THE AUTOMOBILE

SIGILLVM · VNIVERSITATIS · CALIFORNIENSIS
FIAT LVX
MDCCCLXVIII
EX LIBRIS
[illegible]

The AUTOMOBILE

A Journal of Automobile Progress
and
Construction

PUBLISHED WEEKLY

VOLUME XXXII
January 4, 1915 to June 24, 1915

The Class Journal Company
231-241 West 39th Street
NEW YORK CITY

The AUTOMOBILE

VOL. XXXII NEW YORK—JANUARY 4, 1915, TO JUNE 24, 1915—CHICAGO NOS. 1-25

Index to Volume XXXII

ACCESSORIES

Air Compressor, Gardner.......... 523
Air-pressure Regulator, American Lock.......... 523
Ammeter, unbreakable, Benford.......... 610
Battery Charger, Lincoln.......... 995
Battery, Vesta.......... 185
Bearing Bronze Cored.......... 394
Beartone Pump, Horn and Fan.......... 744
Carbureter Air Heater, Fort Wayne.......... 393
Carbureter, Brad-Kent.......... 699
Carbureter, Browne.......... 30
Carbureter, Economic.......... 482
Carbureter, M. F.......... 29
Carbureter, Parkin.......... 30
Carbureter, Rayfield.......... 30
Carbureter, Schebler, Extended Venturi in.......... 541
Carbureters for 1915.......... 238
Carbureter, Shakespeare.......... 30
Carbureter, Stokes.......... 523
Carbureter, Stromberg.......... 30
Carbureter, Thermostatic, Controlled, J. B.......... 699
Carbureter, Vacuum.......... 290
Carbureter, Zenith.......... 30
Carbureter, Zenith for Eight.......... 198
Carburetion Improver, Universal.......... 523
Catalog and Pamphlet Review.......... 524
Catalogs Received.......... 304
Chicago Speedway Finished.......... 1045
Chicago-to-Seattle Relay Run.......... 1051
Clock, Stewart Self-winding.......... 30
Clock, Waltham Truck.......... 30
Crankshaft Bearings, Fitting.......... 350
Die-casting, Doehler.......... 185
Direction Indicator, Warner.......... 610
Door Lock, Push-button.......... 303
Dyneto for Fords.......... 1036
Electric Cars.......... 112
Fan and Horn Combined, Marvel.......... 438
Fender, Telescope.......... 185
Ford Axle Strengthener.......... 524
Furnace Temperatures, New Method of Gauging and Checking.......... 394
Garage Air Compressor, Utility.......... 393
Garage, Portable, Fonts.......... 482
Gasoline Preheater, R. D. C.......... 524
Gaso-Tonic for Fuel.......... 1036
Gearset, Brown-Lipe.......... 290
Gearset Lock, Commercial.......... 610
Generator, Bosch.......... 29
Generator, Dyneto.......... 29
Genemotor, General Electric.......... 28
Generator, Fisher.......... 814
Generator, Hartford.......... 29
Generator, Kemco.......... 28
Generator, Leece-Neville.......... 29
Generator, Northeast.......... 29
Generator, Westinghouse.......... 28
Goodrich Tire Caliper.......... 699
Graphite Lubrication, Dixon.......... 350
Grease Cup, Klickit Ratchet.......... 744
Grease, Dixon.......... 185
Grease Gun, Bell.......... 349
Grease Gun, Zwald.......... 482
Grinder, Portable, Boxhill & Bruel.......... 304
Hinge, Detachable Concealed.......... 349
Horn Button and Dimmer, Kent.......... 610
Horn, Heinze Magneto, for Fords.......... 814
Horn, Twist-of-Wrist.......... 304
Ignition Automobile Lock, Atlantic.......... 438
Ignition, Remy for 12's.......... 1123
Inner-tube Construction, American.......... 567
Jack, Eureka.......... 394
Lamp, Portable Hand, Stewart-Skinner.......... 814
Lantern, Safety Hand, Federal.......... 815
Lighting, Aplco.......... 28
Lighting, Bright Ray Ford.......... 185
Lighting Generator, Jackson Ford.......... 29
Lighting Outfit, Heinricks.......... 438
Lock, Ford Autolock.......... 304
Magneto, Bosch No. 4.......... 29
Magneto Coupling, Eisemann Flexible.......... 335
Magneto, Eisemann for Sixes.......... 467
Magnetos for 1915.......... 150
Magneto, Splitdorf Cunningham.......... 30
National Electric Fittings.......... 905
Oxygen Generator, Oxyphon.......... 482
Pato Products.......... 815
Peerless Portable Power, United Mfg. Co.......... 699
Piston Ring, Smith.......... 744
Piston Ring, Wright.......... 904
Platinum, R & H.......... 995
Pliers, Weed Chain.......... 524
Primer, Self-feeding, Universal.......... 482
Pump, DeLaunty.......... 184
Pump, Hartford Single-cylinder.......... 31
Pump, Kellogg.......... 184
Pump, Manzel Motor-Driven.......... 31
Pumps, Mayo.......... 31
Pump, Sanford Single-cylinder.......... 31
Pumps, Tire, for 1915.......... 330
Quadrant, Pierce.......... 185
Radiator, Ford.......... 655
Radiator, Superior Ford.......... 814
Rattle, Eliminating, New Era.......... 524
Rectifier, Westinghouse.......... 904
Rim, Stanweld.......... 31
Schebler Carbureter, Extended Venturi in.......... 541
Searchlight, Solar.......... 185
Screwdriver, Pocket, Hess.......... 905
Shield for Wet Weather, J. N. Smith Co.......... 694
Shock Absorber, Adco.......... 905
Shock Absorber, Calpaw.......... 185
Shock Absorber, Flaum.......... 656
Shock Absorber, Ford, Oxygen Gen. Co.......... 699
Shock Absorber, Gem.......... 185
Shock Absorber, J. M.......... 904
Shock Absorber, Neco.......... 303
Shock Absorber, Noval.......... 814
Shock Absorber, Right.......... 905
Shock Absorber, Triple-action.......... 30
Signal Direction, Potterto.......... 744
So-Sha-Belle.......... 185
Spark Plug, Benton.......... 904
Spark Plug, Champion.......... 31
Spark Plug, Ford.......... 655
Speedometer, Corbin, with High Speed Hand.......... 1036
Speedometer, Standard.......... 30
Speedometer, Van Sicklen.......... 30
Springs, Self-Lubricating, Detroit Steel Products Co.......... 995
Starter, Brown-Lipe.......... 290
Starter, Genemotor for Fords.......... 742
Starting and Lighting for 1915.......... 144, 201
Starting, Aplco.......... 28
Starting, Bosch.......... 29
Starting, Dyneto.......... 29
Starting Gear, Brown-Lipe.......... 29
Starting, Gray & Davis.......... 28
Starting, Hartford.......... 29
Starting, Kemco.......... 28
Starting, Leece-Neville.......... 29
Starting, Northeast.......... 29
Starting, Westinghouse.......... 28
Starting, Westinghouse Ford.......... 184
Steering Steady, Savidge.......... 438
Stockroom Shelving.......... 349
Switch Lock, Conn.......... 744
Switch, Safety, Hartmann.......... 815
Thermostatic Controller for Water Circulation.......... 303
Timer, Remy 8 Cyl.......... 655
Tire Chain Attaching Tool, Alcemo.......... 610
Tire Chain Protector, Bodenstein.......... 610
Tire, Dayton Pneumatic.......... 31
Tire Gauge, Pop Off, American.......... 904
Tire Grip, Utility.......... 905
Tire, Mansfield.......... 482
Tire Pump, Bell.......... 349
Tire Pump, J-M Engine.......... 655
Tire Pumps for 1915.......... [illegible]
Tire-removing Tool, Stewart.......... 567
Top Fasteners.......... 393
Tops and Upholstery, Springfield Harness.......... 482
Tube Spanner Kit, Walden.......... 656
Towing Line and Car Lock, B & B.......... 610
Tread, Day Sectional.......... 185
Treads, D-M Anti-Skid Traction.......... 31
Tread, Woodworth.......... 905
Valve, Manual Air, Stewart.......... 815
Vibrator, Master, Sendar.......... 482
Vise, Griffiths & Co.......... 290
Vulcanizer, Brown.......... 31
Vulcanizer, Corbett & De Coursey.......... 290
Vulcanizer, Positive Steam Tube.......... 303
Vulcanizer, Shaler Roadside.......... 31
Washing Apparatus, Fuller Brush.......... 350
Washing Brush, Peerless.......... 438
Weed Chain Pliers.......... 524
Welding, Imperial Outfit.......... 304
Westinghouse Ford System.......... 184
Wheel, Parker Steel.......... 31
Wheel, Spring, Chicago.......... 185
Wheel, Wire, G. R. C.......... 568
Windshield for Fords, Diamond.......... 1036
Windshield, Vanguard.......... 904
Windshield Ventilator, Ford.......... 393
Wire Wheel, G. R. C.......... 568

ASSOCIATIONS AND CLUBS

A. A. A., Wilson Heads.......... 908
Associated Garages of America Formed.......... 254
Automobile Dealers' Assn. Elects.......... 388
Automobile Trade Credit Assn. Re-elects Directors.......... 345
California Club Severs Connection with A. A. A.......... 521
Elgin National Road Race Assn. Elects Officers.......... 435
Export Club of Detroit.......... 251
Good Samaritan Help League of Motorists.......... 432
Indiana Automobile Manufacturers' Assn. Elects.......... 345
Internal Gear Drive Assn. Formed.......... 776
International Motor Contest Assn. Formed.......... 607
Jitney Assn., International.......... 919
Jitney Convention in Texas June 14.......... 953
Jitney National Assn. Formed.......... 850
Jitney Union in Minneapolis.......... 963
Jobbers Form National Assn.......... 960
M. & A. M. Elect Four Directors.......... 45
Michigan Garagemen Organize.......... 959
Motor Contest Dealers' Assn. Re-elects Officers.......... 345
N. A. C. C., Clifton Heads for 1916.......... 1048
N. A. C. C. Holds Banquet.......... 44
N. A. C. C., March Car Shipments 16,316 Carloads.......... 646
N. A. C. C. Meeting, Wagon Men Favor I Tread.......... 1045
N. A. C. C. Selects Show and Truck Convention Dates.......... 471
N. A. C. C. Service Convention in Detroit.......... 1092
N. A. C. C. Trying to Standardize Treads.......... 519
National Garage Assn. Holds Convention.......... 607
New York Automobile Trade Assn. Re-elects Officers.......... 959
Pacific Racing Assn. Organized.......... 607
S. A. E.
  Boat Field Reviewed by Met. Sec.......... 601
  Booster Meeting for Detroit.......... 1045
  Brush Advocates Scientific Chassis.......... 802
  Chicago Section.......... 911

Cornell Student Branch Opened........... 648
Cruise Big Success..............................1103
Detroit, Chain and Miscellaneous Standards Meet 733
Detroit Section in New......................... 953
Detroit Standards Simplifies Car Design... 745
Detroit Standards to Report April 22........ 687
Dunham Chairman 823
Gas-Electric Committee Reports............. 401
Governor Night at N. Y. Sec.................. 910
Governors for Motor Vehicles................. 942
Indiana Sec. Discusses Eight................. 404
Indiana Thinks 8 a Fixture.................... 385
Lake Trip Starts...................................1037
N. Y. Engineers Discuss Service............ 772
New York to Shift Headquarters............. 784
Session on Georgian Bay......................1088
Standards Committee 400
Standards Work Under New Rules.......... 616
Summer Program Versatile.................... 953
Summer Trip to Georgian Bay................ 460
Truck, $1,000, Subject at Met. Meeting.... 251
Van Dervoort President........................ 33
Winter Session Produces Six New Standards 83
Zimmerschied Chairman of Standards Committee 339
Safety First Society, National............... 432
Speedway Men Confer.......................... 256
Technical Literature, to Classify............. 956
Truck Club Discusses Recording Instruments. 308
Truck Convention, 200 Delegates for........ 775
Truck Makers to Decide on Standard Service Policy 841
United Garage Assn. Formed—Haradon President 473
U. S. T. C. Discusses Price-Cutting.......... 777

CAR DESCRIPTIONS

Brush 303
Buick 6 for 1916.................................1068
Cornelian 128
Davis Eight 183
Dorris Six, 1915................................... 636
Empire, 1916 680
Ford with Electric Headlights................ 579
Foreign Cars at Importers' Show............ 18
Herff Brooks 4.................................... 508
Hollier Eight 887
Hudson, 1916 1023
Hupmobile, 1916 982
Imperial, 1916 1076
Kearns 770
Knox Tractor, Hydraulic Brakes on......... 416
Locomobile, 1916 1072
Marion Six, 1916................................. 860
Mitchell, 1916 1120
Monarch Eight 492
National Twelve and Six 940
New Car Models Seen at Palace Show...... 1
Oakland, 1916 948
Oakland, 1916 1036
Olds Eight and Four.............................. 987
Overland Four, 1916.............................. 978
Packard 12-Cylinder............................. 942
Pathfinder Twelve and Six for 1916........1064
Standard Steel Car............................... 728
Stanley Steamer 506
Stewart Six, 1915................................. 550
Westcott, 1915 634

COMMERCIAL VEHICLES

Ambulances, American, in Field............. 266
American Trucks to Front, Taking.......... 224
Army Reserve, Trucks for...................... 167
Army Truck Bill Is Passed..................... 213
Australian Government Buys Up All Trucks.. 167
Australia, Want Light Trucks in............. 782
Berlin, Busses Stopped in...................... 471
Brockway Description 640
Cars and Trucks Under War Conditions...... 801
Case's New 3-Wheeled Tractor............... 741
Commerce Jitney Bus on 1,500 Pound Chassis 769
Directory of Truck Makers..................... 62
Electric Commercials, 12 New................ 128
France, Saving Trucks at Front in........... 51
Gobron Armored Car Does 60 M.P.H....... 709
Gramm Truck, New Model...................... 214
Great Southern One-Man Pay-Enter Bus...... 641
Hall 3½-Tonner 768
International 1,500-Pound Truck............ 172
Knox Tractor, Hydraulic Brakes on.......... 416
Jeffery Reversible Army Truck................ 423
Lippard-Stewart, Description 640
London Buses, 1,200 Commandeered........ 45
London Omnibuses Carry 734,000,000 in 1913. 471
Mack, Two New Worm-Drive Trucks......... 172
Packard, 6 Worm Drive Trucks............... 94
Paris Buses, Better Bodies on................. 369
Railway Inspection Car with Continental Motor 813
Roland Stepless Bus with Electric Transmission 159
Saving Trucks at Front in France............ 51
Specification, 91 Electric Truck Chassis for 1915 130
zeman Jitney Bus Makes Appearance...... 786
ck Chassis for 1915 More Flexible......... 60
ck Makers to Decide on Standard Service Policy 841
S. Army Appropriation Bill, $50,000 for Armored Cars in 45
nna Motor Buses................................. 157
Waverley Electric Truck for Industrial Work 467
White Power-Hoisting Coal Body............ 423

CONTESTS

Arizona Grand Prix, $5,000 Purse Guaranteed..1096
Bosch Offers $1,900 for Race Prizes........ 216
Briggs-Detroiter Builds 4-Cylinder Racing Car. 962
Briscoe Racing Cars, Three.................... 872
Buick, 1915, Averages 21.75 M.P.H......... 43
Burman Breaks A. A. A. 5 to 50-Mile Records for 1-Mile Dirt Tracks.......................... 44
Burman Defeats Cooper and Disbrow........ 649
Cadillac's Frisco-Los Angeles Run in 12:10...1097
Chicago A. C. Wins Interclub Event.........1096
Chicago Auto Club to Handle Speedway Race. 938
Chicago Race Sanctioned........................ 256
Chicago-Seattle Record Established.........1141
Chicago Speedway Purse $50,000............ 298
Chicago Speedway, Work Begun on.......... 780
Chicago, Sunbeams for.......................... 872
Chicago, Two Sunbeams for................... 607
Cincinnati Speedway Formed.................. 695
Columbus, Maxwell Wins at.................... 918
Columbus May Build Speedway.............. 962
Desert Races May Combine.................... 781
Des Moines to Build Speedway..............1052
Detroit Electric on 1,500 Mile Run.........1008
Detroit Speedway Assured..................... 476
Detroit Speedway, Whelan Heads........... 521
Dreadnaught Tire's Transcontinental Test.... 759
Duesenbergs Win Glendale Road Race....... 298
Elgin Entry Blanks Out......................... 872
Exposition Entries Near 30 Mark............. 298
Exposition $50,000 Race Planned............ 561
Exposition Races, 31 Entries for............. 346
Franklins Average 32.1 M.P.G. in Fuel Test... 820
Franklins, Six, Average 32.55 M.P.G........1052
Galesburg, Duesenbergs Star at..............1096
Galesburg Plans Completed.................... 828
Glendale Road Race, Duesenbergs Win...... 298
Grand Prize, Resta Wins.................398, 448
Hamline, 200-Mile Event at................... 962
Indianapolis, Chassis Keeps Pace with Motor 883
Indianapolis, Coatalen and Resta for........ 256
Indianapolis, Cornelian Is Smallest Entry..... 388
Indianapolis, 41 Entries for Time Trials...... 818
Indianapolis, Grissom's Prize of $1,000...... 435
Indianapolis, Marmon Suggests Stock Cars for 1,000-Mile Race................................ 649
Indianapolis, Mercedes, with De Palma Driving, Wins 969
Indianapolis, 1,000-Mile Race for $100,000 Planned 513
Indianapolis, Practice 90 M.P.H. in......... 909
Indianapolis Race in Retrospect..............1016
Indianapolis Setting for the 500-Mile Race .. 879
Indianapolis Speedway, Myers General Mgr ..1096
Indianapolis, Stutz and Peugeot Drivers for.. 872
Indianapolis, Three Porter-Knights.......... 256
Indianapolis, 22 Entries for................... 738
Indiana Speedway Is True to A. A. A....... 649
Insurance for Drivers...........................1140
Insurance Fund for Race Drivers............. 999
International Motor Contest Assn. Formed.. 607
Los Angeles, Board Track for.................1143
Maxwell Builds Seven Racing Cars........... 388
Maxwell Finishes 10-Day Test................1051
Maxwell Wins at Columbus.................... 918
Moross and Sloan Outlaws....................1052
Newark, Chevrolet Stars at.................... 828
Newark Track, Stutz Stars at.................1008
Oklahoma, Burman Wins in Peugeot 790
Oklahoma City Race, Overland Wins........ 738
Oklahoma Winner Had Many Handicaps...... 780
Oldfield, Lee, Has 10-Cylinder Racer......... 48
Oldfield Wars on Outlaws.....................1096
Omaha, 16 Entries for..........................1141
Owen Magnetic Averages 34.1 M.P.H. for 1,935 Miles 1096
Pacific Racing Assn. Organized.............. 607
Pittsburg's 2-Mile Track.......................1141
Point Loma Race, Cooper in Stutz Wins.... 93
Porter Car Drivers Announced................ 607
Portland, Romano Stars at..................... 872
Rajah Offers $100 Race Prize 346
Rayfield Offers $1,000 Prize for Chicago....1052
Saxon Averages 37 M.P.G. for 4,665 Miles...1009
Saxon Travels 4,642 Miles in 30 Days 819
Seattle, Romano Wins at.......................1096
Sheepshead Bay Construction Rushed.......1067
Sheepshead Bay Track Description.......... 664
Sheepshead, $50,000 in Prizes for..........1008
Sheepshead Race Oct. 9........................ 908
Sheepshead, 350-Mile Race for..............1052
Sheepshead Track, Working on.............. 738
Sioux City Has 12 Entries.....................1141
Speedway Assn. of America Planned........ 998
St. Paul's Two Speedways..................... 694
Stutz Transcontinental Record 911
Stutz Transcontinental Tested by A. A. A... 954
Stutz Wins Point Loma.......................... 94
Stutz Wins Tucson............................... 94
Tacoma, Annunciators for..................... 872
Tacoma Entries................................... 781
Tacoma Entries Number 12.................... 962
Tacoma Speedway Nears Completion........ 828
Tacoma Speedway, 100 M.P.H. on..........1008
Tacoma Speedway to Be Planked............ 607
Toledo to Have 2.25-Mile Speedway 476
Tucson, Oldfield and Clarkson Win at........ 561
Tucson, Stutz Wins at........................... 94
Twin City Speedway Plans..................... 962
Twin City Speedway Work Started........... 828
Vanderbilt and Grand Prix 19 Entries........ 256
Vanderbilt, Resta's Generalship Won........ 512
Vanderbilt, Resta Wins......................... 446
Vanderbilt, Weed Prize for.................... 94
Venice, Oldfield Wins........................... 521
Venice, Only 30 Stops in....................... 561
Venice Race, 19 Entries for................... 476
Waterloo to Have Speedway...................1052
Wheeler to Head Twin City Speedway Co.... 738
Wilson Truck on 30-Day Test Run...........1052

EDITORIALS

Annealing 774
Automobiles Solve the Problem.............. 907
Bad Breaks Spell Death........................ 732
Bearings, Common Sense About............. 863
Bodies Better...................................... 250
Board Speedways 1041
Carburetion 250
Chicago Section, ?.............................. 382
Chassis Construction 817
Chicago Show 210
City Accidents 732
Defined Service 426
Die Castings 686
Distributers vs. Dealers....................... 338
Driving a High-Speed Motor.................. 554
Efficiency Imperative 600
Engineering Character 33
Engineering Foundation 210
Farmer 338
Farmer, Reforming the......................... 382
Fuels Cheaper 166
High Speed Motor................................ 686
Industrial Relations 210
Initiative 166
Iowa as a Car Buyer............................ 514
Jitney 382
Jitney Endurance 642
Jitney Necessary 600
Lamp Bulb Standards........................... 514
Markets in Both Hemispheres................. 470
Metallurgy, Humanized 642
Michigan Law 907
Modernize High-Priced Car.................... 997
Motors, 1916 817
New England Motorists Increase 10%........ 426
New Racing Problems........................... 951
New Speed Factors.............................. 951
New York's Speedway........................... 686
Prosperity Amidst Adversity 554
Real Prosperity 774
Recognition 32
Registration 1,754,570 554
Research 426
Rubber Embargo 82
S. A. E. Efficiency.............................. 642
Service 338
Show, Boston 470
South American Etiquette 1041
Speed, Foretaste 907
Springs Coming, Better........................ 514
The Bottom 1041
Thermal Efficiency 166
Things That Count.............................. 774
Three-Hundred-Cubic-Inch Results 997
Tire Prices 292
Tires in Storage 600
Truck Convention 86
Twelve, Enter the................................ 951
Under Par 82
Vibration 292

ENGINEERING DIGEST

Busses in Vienna................................. 157
Castor Oil Facts.................................1083
Drop-Forging Art Held Back by Too Many Specifications 1083
Edison Electric Bus for York, Eng............ 720
Formula, Power, Used for Taxation in Different Countries 160
F. N. Lubricating System...................... 159
Lubricating System for F. N. Motors........ 159
Ploughs, Motor, Wider Manufacture of...... 812
Pump, Valveless, with Tubular Piston for Liquid or Air..................................... 720
Rust, Chemical Principles in Protection of Iron Against.................................... 812
Single and Dual Sparks in T-Motors and L-Motors 1083
Sizes Required of Wheels and Tires in Heavy Traffic 1083
Starter, Foot Pressure for Light Car 721
Switzerland, How War Affected Automobilism 721
Taxation Power Formulas Used in Different Countries 160
Van Marchthal's System for Division Disks in Gear Cutting 236

LEGAL AND LEGISLATIVE

Abbott Creditors Receive 2% Dividend....... 519
Adamson Bill Up Before Congress........... 170
American Ball Bearing vs. E. B. Finch....... 213
Apple Sues for Patent Infringement......... 92
Assault May Be Committed with Auto....... 474
Austin Injunction Modified..................... 737
Austin Wins Two-Speed Axle Suit 92
Badger Brass Sues for Infringement......... 212
Baker Patent Is Void............................ 433
Baltimore Bars Headlight Glare..............1095

Barber Cage-Valve Suit Settled.............. 518
Boston Garagemen Fight Fire Restrictions... 694
Cadillac Files Appeal on Austin Two-Speed Axle Decision 688
Cadillac Wins Wheel Suit Appeal.......... 518
California Bill, 40 Cents Per H. P. in......... 604
California Taxes 40 Cents Per H. P........... 913
California, 35 Cents Per H. P. in............ 778
Carnegie Engineering Promoters Held for Mail Fraud 869
Century Tire Bankrupt......................... 475
Century Tire Plant Sold....................... 954
Champion-Frontier Suit Ended............... 776
Cheaper Freight for Return Tanks........... 504
Chicago Proposing Restrictions of Size and Weight for Trucks......................... 690
Chicago Tests Truck Fenders.................. 45
Chicago Wants Wheel Tax Back 867
Cleveland Police and Offending Autos Start Anew May 1................................. 819
Colby Assets to Be Sold May 26.............. 915
Colby Plant Sold for $32,800.................1050
Columbus Assets Sold to Supply Parts....... 915
Columbus Buggy Co., to Auction Part of..... 826
Compensation Act, Double Recovery in.....1050
Compensation Commission Eliminated....... 559
Compensation Law Amendment Passed....... 385
Connecticut Boosts Truck Fees............... 825
Crescent Bond Issue Attacked................1087
Crescent Plant Sale Confirmed............... 915
Curtain Holder Inventor, $20,000 Verdict..... 213
Delaware Makes Change in Auto Law......... 384
Delaware, to Raise Speed Limit in 213
Detroit Adopts Traffic Signal................. 533
Detroit Bankrupts, Four, Receive Dividends.. 432
Detroit Bankrupts Pay Dividends 343
Detroit Body Assets Bring $170,000. 1006
Detroit Body Bid $170,000.................... 955
Detroit Body Voluntary Bankrupt............. 778
Detroit License Office Closed.................1051
Divine Tire Files Petition...................... 343
Driver Must Give Signal to Stop.............. 474
Detroit Violators Warned by Tag 824
Employees, May Discharge for Belonging to Union 212
Employer of Driver Responsible.............. 867
Family Head Responsible for Accidents....... 501
Fiat-Isotta Suit Is Settled...................... 43
Florida State Tax, to Abolish..................1051
Florida Tax Validity Upheld...................1009
Garage Equipment vs. Charles Welland Co... 212
Gibson Wins Breach of Contract Suit......... 925
Great Smith Investors Get $15,000............1094
Griswold vs. Partin & Graper, Plaintiff Gets $15,000 Judgment.............................. 296
Guarantee Suit Won............................1051
Hanlon Shield, N. A. C. C. Members Enjoined from Using...............................1042
Hess-Bright Ball Bearing Victory Confirmed.. 474
Hess-Bright, U. S. Supreme Court Denies Petition for Rehearing in...................... 688
Hewitt Bill Would Double N. Y. Fees......... 384
Illinois, Bills Had in............................ 964
Indiana Bill, Debate Over Cars in............ 213
Insurance Companies Responsible for Safety of Policies 959
Iowa, New Plates Every Three Years in...... 778
Jitney, Common Carriers in Georgia..........1053
Jitney Fees in Los Angeles Reduced 50%...... 693
Jitney, Fort Worth, $2,500 Bond in...........1053
Jitney in Washington, New Ruling on....... 963
Jitney, Louisville, Reprieve for.............. 829
Jitney Owners in N. Y. Must Have Chauffeur's License................................ 829
Jitney, Pennsylvania Cities Can Regulate....1053
Jitney, Pennsylvania Railway Can Operate.... 830
Jitney, Providence Regulations 829
Jitneys Exempt from Pennsylvania Control... 963
Jitneys Lose in Springfield, Mo...............1053
Jitneys Regulated in New York............... 963
Jitneys Win in Savannah 1053
Jitney Tax in California $10 Per Seat. 830
Jitney, Washington Jitneurs Abandon Fight..1053
J-M Shock Absorber Does Not Infringe..... 42
Kardo Axle Suit Dismissed.................... 688
Kardo Suit, Orders Reopening of............. 432
Kardo vs. Reo.................................. 255
Keeton Motor Car Co. Purchases Business from Winternitz 432
Killing by Reckless Driving Is Manslaughter. 501
Klaxon, Removes Competitor's Horn from Show 44
Klaxon vs. Heinze, Temporary Injunction in. 255
Krit Parts, Puritan Machine Buys............ 604
Krit, Uninterrupted Service for............... 340
Laws for Seven States Drafted............... 170
Lindsay Auto Parts Co. vs. Winton Motor Carriage Co. 213
Lozier, $1,000,000 for New Company Promised 294
Lozier Plattsburg Plant Auction.............. 915
Maryland Law Is Held Valid.................. 44
Massachusetts Jitney Bill Defeated.......... 874
Massachusetts Legislature Favors Motorists.. 647
McGregor vs. Weiland Co..................... 255
McIntyre Files Petition........................ 913
McIntyre, Trustee for.......................... 957
Michigan Garage Lien Bill Is Law........... 825
Michigan Taxes H. P. and Weight............ 912
Michigan, Tax on H. P. and Weight......... 518
Michigan to Tax Weight $0.35 Per 100 213
Minneapolis Speeders to Lose Cars One Year 623
Motokart in Receiver's Hands................ 432
Motsinger, Asks Receiver for................. 913
Metz Wins Cushion Tire Suit................. 43
Nebraska Has New Automobile Law.......... 737
Nebraska Registrations Pour in—Sales Boom 782
New Jersey Auto Reciprocity Bill Defeated.. 45
New Jersey, New Traffic Laws for............ 868
New Jersey Registrations Transferable........ 559
New York May Tax Trucks More.............. 775
New York One-Inspection Bill Passes 690
New York Auto Bond Bill Up Again 213
New York City, Jitney Bill Fails.............. 785
New York Dealers Win Test on License Tags 957
New York Fines Go to State.................. 167
New York Fire Marshall Office Abolished.... 216
New York City Jitney Wins Suit............. 785
New York Motorists Protest on Bills......... 518
Ohio Halves Dealers' License Fees........... 778
Ohio Taxation, New 1001
Ohio Vehicles Must Carry Lights, All........ 385
Ontario Car License Fees Revised............ 45
Ontario Favors License Reciprocity with U. S. 625
Owego Co. Files Petition....................... 43
Owner Not Responsible for Chauffeur on His Own Errands 840
Patent Cases, Can Reopen.................... 737
Pennsylvania Bill to Double License Fees..... 690
Pennsylvania Fees May Be Raised 50%...... 825
Pennsylvania License Raise Defeated 913
Pedestrian Partly Responsible for Accidents, Says Wisconsin Court 647
Partin-Palmer May Reorganize............... 255
Patentee Cannot Fix Retail Sales Price....... 559
Patent Owner Must Prove Actual Damages... 90
Pennsylvania Amendment Cuts License Raise. 868
Pennsylvania Has Systematic Registration.... 161
Pilgrim Organizer Charged with Fraud....... 821
Pope Not Insolvent 957
Pope's Westfield Plant to Sell................1133
Prest-O-Lite, Two More Decisions for........ 296
Providence Jitney Ordinance Passed......... 963
Pugh vs. Winton............................... 92
Pullman Receiver Dismissed..................1098
R-C-H, Third Dividend of 10% for Creditors. 518

REGISTRATION
  California, May fees $2,418,000 1095
  California, 7,686 in April.................... 606
  California, 131,323 957
  Canada, 61,599 Owners in 1914.............. 234
  Illinois, 133,140 341
  Indiana, Over 75,000 957
  Iowa, 50,000 964
  Iowa Doubles in 2 Years..................... 341
  Maryland, 24,400 Register in................1137
  Kentucky, 1914 increase, 64%............... 341
  Massachusetts, Ford Leads in................ 845
  Massachusetts, May Reach 95,000.......... 643
  Michigan, 37,990 licenses in 2 mos.......... 633
  Michigan, 90,000 1095
  Minnesota, 73,500 1095
  New Jersey, Collects $787,083 fees.......... 191
  New Jersey, 68,780 1095
  New York, 50,000 Cars Ahead of 1914... 909
  New York, 169,966 in 1914.................. 251
  New York, January, $564,010................ 293
  New York, 159,215 844
  Ohio, 120,500 Cars and Trucks............. 844
  Ohio, 1 Car per 39 people.................. 623
  Ohio, 144,750 and 1,400 dealers............1095
  Ontario, over 28,000........................1095
  Ontario, 34,000 869
  Oregon, 17,500 961
  United States, has 1,754,570 cars.......... 525
  Washington Derives $37,500 from New Law 1137
  Wisconsin, has 66,745 cars..................1095
Re-Sale Prices, Cannot Fix.................... 737
Rhode Island, $500 Bond Per Sent in........ 785
Rhode Island, Can Stay 10 Days in.......... 825
Rite vs. Briggs-Seabury, Answer in........... 255
Rumely to Be Reorganized....................1006
Safety First Recommendations...............1051
Savannah, $10 Per Seat in.................... 786
Seat Spring Patent Upheld in Detroit...... 212
Seven States Amendment..................... 343
S. G. V. Assets to Be Sold May 27.......... 864
S. G. V. Plant Being Sold in Separate Lots..1049
S. G. V. Plant Sold for $55,600..............1086
S. G. V. Will Be Continued..................1132
Stripper, Interstate Commerce Commission Decides R. R. Co.'s Car Charge: $2.15 per 100 Pounds 643
Stripper Wins Freight Car Shortage Case... 643
Smith Files Voluntary Petition............... 297
Sparks-Withington Wins Horn Suit.......... 343
Speedwell Creditors May Get 10%............ 605
Sta-Rite Parts, Todd Buys.................... 865
St. Louis Rotary Traffic System in Force..... 249
Stromberg Patents Sustained.................1098
Stromberg vs. Zenith, Latter Wins on Present Model................................. 296
Tire Core Patent Invalid...................... 43
Traffic Rules to Be Nationalized..............1009
Trolley President Loses Fight to Run Jitney. 874
Truck Limitations, Hearing Held on......... 559
Truck Size, Would Limit, Fit Governors 296
Truck Weight Restriction, N. A. C. C. Fights. 559
Twombly Corporation, Receiver for.......... 297
Twombly, Stelle Trustee for 649
Universal Rim Co. Claims Infringement of Three Patents................................ 43
U. S. L. & H. Co. of N. Y. Now. 1043
U. S. L. Committee Extends Time on Payment of Assessments...................... 867
U. S. L. Receiver, President Smith Appointed. 387
U. S. L. Reorganization Plan................. 645
U. S. L. to Sell Assets and Reorganize in July 604
Walpole Dividend 25%........................1093
Walpole Plant Sold for $780,000............. 519
Warren Creditors Receive Final Dividend.... 604
Washington's New Law in Force June 10.... 959
Weed Wins in Patent Suit.................... 952
Wheel Tax Declared Invalid.................. 778
Wisconsin, Twenty-five Miles Legal in.......1051
Zenith Damages in Carbureter Suit, Master to Pass on................................. 343

MISCELLANEOUS

A. A. A. Garage.............................. 328
Ambulance, one-man for injured car.......... 755
Ambulances, American, in Field.............. 266
Australian Trade, American-made Chassis Lead. 816
Auto-Lite Doubles Factory Facilities.......... 639
Baggage Problem, Solving the................ 306
Belgian Car Factories Intact.................. 99
Blue Book, 6th Volume Added................ 596
Body, Cabriolet Coupe, ¾.................... 494
Body Designs at National Show.............. 217
Body, Jackson Sleeping....................... 941
Boillot Too Daring For French General...... 47
Cabriolet Coupe, a ¾........................ 494
Canadian Armored Battery Nearly Complete.. 45
Deaths From Autos on New York Streets.... 733
Eisemann's Train-Dispatcher System........ 580
Electric Car Registrations Increasing....... 127
Electric Touring Field Enlarged.............. 299
Export, April $8,045,222.....................1136
Export, Argentina.............................1087
Export, December........................293, 342
Exports, February, $4,807,812...........604 736
Exports, January.........................428, 515
Exports, March, 3,767 Motor Vehicles....777, 914
Export, Michigan's 1914, $7,890,250......... 295
Export, 1914, $28,000,000.................... 42
Export, 1914................................. 242
Export, November, Trucks Lead in........... 168
Export, November, $2,879,177............... 90
Flint, Second City of Industry............... 569
Ford Indianapolis Assembly Plant........... 535
French Army Authorities Make Census of Touring Cars............................. 59
French Auto Travel, Restrictions on Private.. 308
French Factories, American Speed Up....... 450
French Factories Want Workmen............ 46
French Highways Widened to Facilitate Army Motor Transports......................... 191
French Mount 75 mm. Gun on 30 H. P. Chassis 305
French Plants, War Rushes..................1013
Garage of A. C. A............................. 328
Imports, New South Wales, $2,893,830 in 1914. 531
Inclosed Cars of 1915 Made in U. S. A...... 311
Iowa, 50,000 Cars in 1915................... 490
Jackson Sleeping Car Body................... 941
Jitney Movement, Human Element Determines Success of................................ 665
Maxwell Newcastle Plant..................... 316
New England Gains 48,063 Cars in 2 Years.. 395
New South Wales Imports $2,893,830 in 1914. 531
Omaha—Distributors for the Grain Belt.... 355
Pan-American Road Congress September 6.. 560
Railroad Engineers Run Buses............... 963
Registration, Electric Car.................... 127
Reo Chassis for University of Michigan.... 840
Reo Highway Offer Is Accepted.............. 156
S. A. E. Headquarters Well Laid Out......1031
Saving Trucks at Front in France........... 51
Sheldon Plant, Welfare Work Gains........ 685
Spares Problem, Solving the. 316
Swedish Army, Volunteer Auto Corps for.... 599
Tungsten—The Hardener. 351
United Kingdom, 341,250 Motor Vehicles for. 678
United States Has 1,754,570 Cars........... 525
War, Cars and Trucks Behind the Lines.... 546
War Trucks Arrive in France................ 226
War Truck Does 60 Miles Per Hour......... 709
War, Wake in the............................ 481
Women, Auto Course for..................... 685
Yellowstone Park Opened to Tourists........ 775

ROSTRUM

Aeroplane Design Used for Racers.......... 627
Aligning Reamer for Tuning Crankshaft.... 672
American Used Tee Motors...................1035
Ammeter to Old Wires, Can Connect........ 852
Anti-Freezing Mixture........................ 275
Apple Used Timed Dynamo in 1909......... 851
Atwater-Kent System to Install............. 719
Autocar 1906 Timing......................... 411
Automobile Engine in Motor Boat........... 543
Axle, Dead, Requires Chain Drive..........1055
Balancing Pistons and Connecting-Rods..... 274
Ball Bearing, Installing Center 192
Batteries, Dry, Should Be Used............. 673
Battery, Charging From 125-volt Dynamo... 457
Battery Ignition vs. High-Tension Magneto.. 808
Battery Information on Care, Storage 671
Battery, Liquid Spills from Storage......... 545
Battery Needs Recharging or Overhauling.....586
Battery Should Float on Line............... 717
Battery Should Last 2 Years................ 629
Battery, Unused, Should Have Care......... 716
Bearings, Adjustment of Main...............1034
Bearings, Method of Adjusting.............. 458
Berth on Ford................................ 893
Blow-Outs, Remedy for.......................1080
Body, Touring Car, Ideal..................... 34
Bows, Experimenting for Resistance on.....1033
Bosch Coil, Current Circuits in............. 321
Brake, Motor as............................. 850
Braking With Safety........................ 731
Brush Balance Gear, Reducing.............. 457
Brush Regulation, 3rd, Explanation of...... 372
Buick Quit Racing in 1910................... 498
Bushings on Spring Seats, Lubricate........1125
Cadillac, Ammeter Connection on 1914...... 372

Camshaft, Better to Fit New........ 763
Cams on Ford, Steeper on, Give More Speed. 986
Cantilever, Comparative Weight of........ 499
Cantilever Spring, Origin of........1034
Carbon Caused By Loose Ring........ 717
Carbon Probably Causes the Trouble........ 410
Carbon Remover, Camphor Not a........ 807
Carbon Remover, Continuous........ 162
Carbon Remover, Liquid, Harmless........ 497
Carbureter Fuel Nozzle Incorrect........ 670
Carbureter Needs Adjustment in Summer....1125
Castile Soap for Mohair Tops........ 327
Chadwick Has 3-Inch Valves........ 498
Chains, How to Preserve........ 234
Chalmers Wiring Scheme, 1913........ 894
Chandler Has 3.375-Inch Bore........ 235
Chandler, 6-Passenger Special Design........ 852
Chemicals in Fuel Injure Motor........ 277
Chevrolet Cars Geared 4 to 1........ 459
Chevrolet Financial Status........ 894
Chloride of Zinc Used as Aluminum Flux....1033
Clutch Drags, Dry Disc........ 808
Clutch, Slipping, Disk Trouble........ 988
Clutch Trouble Overcome By Adjustment.... 370
Commutator, High Mica Trouble........1078
Compression, Dead Gas Does Not Affect.... 163
Connecting Rod Singularity Explained........ 627
Cord Tires Use Continuous Cords........ 852
Cranking By Hand a Lost Art........ 496
Crankshaft, Two Throw, Disturbs Balance....1081
Cyclecar, Makes Wind Wagon from........ 24
Cyclecar Rims, Oversize for........ 806
Cylinder Shapes, Advantages of Various........ 232
Cylinders in Kerosene, Soak........ 162
Detroiter Motor Is L-Head Block........ 194
Differential Gears for Front Drive........ 459
Differential, Spiral Gear in M. & S........ 233
Dodge Bros. Car, First Year for........ 219
Eberman Pumps, Cannot Find Maker of........ 806
Eight, First American V-........ 163
E. M. F. Piston, New Pins for........ 497
E. M. F. Used Continental Demountable Rims. 808
Energy Is Measured in Foot Pounds........ 370
Engine Indicator Impossible on Automobile.. 458
Fan Dynamometer Is Fairly Accurate........1035
Fiat Racers, Wants Sizes of........ 629
Firing Time of 45-Degree Eight........ 762
Ford Abandoned Six for Four........ 588
Ford Beech........ 892
Ford Engine Suitable for Light Boat........1081
Ford Hard to Start When Warm........ 496
Ford Headlights, Wiring........ 325
Ford Motor Runs First, Why?........ 164
Ford, Why Uses Vibrator........ 23
Formula for Liquid Flow Through Jet........ 673
Franklin Holds Economy Record........ 809
Franklin, Motor Speeds of........ 195
Frost Wheel Drive Lessens Skid........ 763
Fuel, Preventing Necessary........ 986
Fuel Tested at Indianapolis Speedway........ 850
Garage for 2 Cars and Driver........ 499
Gasoline Line Apparently Clogged........ 628
Gasoline Mixed With Water for Washing... 411
Gasoline Tank, How to Sink a........ 672
Gearbox Probably Out of Line........ 589
Gear, Gear and Spur, Difference in........ 326
Gear Mesh Improper, Causes Noise........ 988
Gear Ratios of 8 Cars........ 807
Gear Ratios of Various Cars........ 892
Gears, Bad Adjustment Causes Noise........ 852
Gear, Slips Out of........ 626
Generator, Installing a........ 542
Graphite Grease Is Good Spring Lubricant.... 761
Headlight Lamp Out of Focus........1127
Henderson Changed Electric Wiring........ 412
Horsepower, A. L. A. M. and S. A. E. Formula
  the Same........ 545
Horsepower, Brake, Determining........ 373
Horsepower By Formula........ 807
Horsepower Calculation, Instruction in........ 807
Horsepower, Displacement and Rivets........ 275
Horsepower Formula for 2-Cycle........ 806
Horsepower Formulas Give Different Sizes... 544
Horsepower of 2 Motors........ 277
Hot An Apparatus Would Stop Trouble........ 628
Hupmobile, Differential Adjustment on........ 542
Ignition, Dual Explained........ 497
Ignition, High-Tension Principles of........ 410
Ignition, Systems of Electric Defined........ 589
Instruction Tubes Furnished at Factory........ 413
Knight Motor Lining........ 987
Knock, Cannot Locate........ 499
Knock Caused By Side Play........ 716
Knock, Finds When Running Idle........ 588
Lamp Construction, to Determine........ 165
Lamps, Electric Connections for Gas........ 545
Lap Piston Rings, How to........ 325
Light Narrow-Tread Car, Building........ 195
Little From Wiring Diagram........ 761
Lozier, Questions on 1911........ 164
Magneto and Plug Points, Relation of........ 717
Magneto Cannot Charge Storage Battery........ 159
Magneto Can Run Auto Clockwise........ 551
Magneto for 6 Cannot Be Used for Four........ 988
Magneto, High-Tension, Principles........ 233
Magneto Ignition, Wants to Install........ 542
Magneto Is Mis-Timed........ 719
Magneto Needs Overhauling........1125
Magneto Rotation, Changing Direction of........ 809
Magneto, Timing a High-Tension........ 276
Magnets Probably Have Become Demagnetized.1033
Magnet Weak, Cause Miss........ 23
Magnet, Weak, How to Tell........ 23
M. & S. Differential, Spiral Gear in........ 233
Maxwell Co. Making Parts........ 628
Maxwell Electric System Outlined........1078
Meshing Drive Pinion and Crown Gear........ 274
Metric Measurements, Would Like........ 195
Metric System, Criticises Suggestions for........ 626
Misses Fire at Low Speeds........ 544
Mitchell 1912 Six Overhauled........ 497
Mitchell Transmission Made in Racine........ 542
Mixture Constant Not Always Best........ 456
Moline Starter Installed........1034
Moon Co. Makes Own Bodies........1079
Motorcycle Engine Build for Stationary Work. 718
Motor, High vs. Low........ 23
Motor Knocks on Hard Pull........ 627
Motor, Mystery, Motorboat Type........ 496
Motor, Mystery, Is Racine Made........ 497
Motor, Neat, Believes in........ 162
Motor, Racing, Calculating Compression on.... 986
Motor, Single-Cylinder, Mysterious........ 326
Motor Starts Hard, Why?........ 165
Motor, Valve-In-Head and Rotary-Valve........ 894
Motor Will Not Throttle Down........ 761
Mulford's Lozier a 4-cyl........ 989
Nickel Plate, Wants to Remove........ 194
Needle Adjustment Is Too Fine........ 716
North East Cut Out Location........ 807
Ohio Law for Licensing Chauffeurs........ 673
Ohio Model 1912, Parts for........ 717
Oil Causes Spark Plug Trouble........ 163
Oil, Crankcase for Gearbox........ 232
Oil Gauge Probably at Fault........ 586
Oil Reaches Combustion Space........ 195
Oil Strainer Probably Dirt Covered........ 893
Oldham Coupling Noise, Preventing........1124
Olds and Buick Motors, Construction of........ 164
Overheating Causes........ 324
Overheating, Defective Hose Causes........1079
Overland Cylinder, Guides Pressed Into........ 545
Overland Piston Pin Bearing Repairing........ 194
Overland 69, Increasing Stroke on........ 274
Ownership Guarantee, Car Should Carry........ 670
Oxygen Gas for Welding, Producing It........ 325
Packard Patented Offset Wristpin........1080
Painting, Directions for........ 22
Peugeot, Warner Gears Fitted to........ 852
Pierce Arrow, Why Does Not Race........ 852
Pierce, Auxiliary Spring on 1908........ 458
Pin Loose Causes Knock in Chalmers 36........ 372
Piston Displacement, Calculating........ 327
Piston Displacement Figure Corrected........ 587
Piston in Cylinder, Fit of........ 499
Piston Rings Lapping Requires Experience.... 626
Piston Slap, Wants to Eliminate........ 542
Piston, Wants to Lighten 8-pound........ 411
Platinum Points Vary in Composition........ 986
Platinum Test on........ 673
Plugs, Series, Use for 2 Sparks........ 459
Pope-Hartford Lubrication........1125
Pope-Hartford Oiling System of 1913........ 850
Porter-Knight Develops 122 H. P........1035
Power, Highest Speed Not Greatest........ 892
Power, Lack of, Poor Adjustment........ 22
Pressure, Back, Effects on Exhaust........ 325
Pressure Feed, Inadvisable to Install........ 893
Pumpshaft Too Light for Starter Mounting.... 763
Racing, Long Stroke Used for........ 413
Radiator Cleaning, Washing Soda for........ 194
Radiator Efficiency, Laboratory Tests........ 589
Radiators Not Designed by Formulae........1124
Rambler, Magneto Can Be Fixed To........1125
Rattle Comes from Idle Pinion........ 673
Reamer Aligning, for Truing Crankshaft........ 672
Reamer, Reboring Ford Cylinders with........ 806
Reflectors, Resilverizing for Lamps........ 588
Regal Motor, Speed of at Car Rates........ 851
Reliners Not for New Tires........ 456
Remy Current Regulation, 2 Methods of........ 853
Reo Differential, Repairing 1911........ 458
Resilverizing Reflectors for Lamps........ 588
Rings, Loose, Cause Spark Trouble........ 235
Rings, Tight, Prevent Carbon Trouble........ 542
Robe Attachment for Driver........ 164
Rust, Graphite Paints Prevent Rim........ 373
S. A. E. Ratings of 6's and 8's........ 498
Savage Car Not Manufactured........ 980
Saxon Car Smokes........ 894
Schebler Carbureter Should Give Satisfaction. 413
Screw Loose, Causes Knock, Set........ 544
Seamless Steel Tubing for Shaft Repair........1033
Short-Circuit Makes Miss........ 165
Shuntfield Seams to Be Open........ 806
Singing Noise on Down Grade........ 458
Skidding, Front Wheel Drive to Avert........ 629
Sleds Have Narrow Tread, Why........ 410
Sleds, Treads Narrow, Why They Are........ 274
Slip Covers for Seats, Cleaning........ 544
Spark Advanced Too Far........ 235
Spark Plug Position Important........ 628
Spark Retarded in Overhauling Motors........ 233
Sparks, Two From Single Magneto........ 324
Speedometer Light, to Wire for........ 22
Speedometer, Tire Diameter Affects........1079
Spiral Gear in M. & S. Differential........ 233
Spokes Guaranteed for Three Years........ 851
Spring, Cantilever, ¾ and Semi-elliptic........ 235
Spring Wheels, Information on........ 325
Stake Trap for Autos........1032
Starter Art, Textbooks Not Up to........ 893
Starter Motor as Generator, Using........ 587
Starting Ignition, Dry Cells on........ 543
Starter Stalled Through Poor Final Contact.. 586
Starting on Velie, 7 Volts Needed........ 893
Starting, Suggests Cause of Trouble in........ 718
Steam Car, Reasons for........ 457
Steel Alloys, Value of........ 195
Stevens-Duryea, Carbureter and Oiling of........ 276
Stevens and a 1911 Model........ 372
Stewart Vacuum System, to Install........ 545
Stewart-Warner Vacuum Tank Mounting........ 24
Stromberg Type B Adjustment........ 761
Stutz Racer Is Semi-Stock........ 277
Tap Drills, S. A. E. Sizes........ 233
Thermo-Syphon Cooling, Use of........ 325
Thermo-Syphon, Theory of........ 545
Thomas 1910 Information........ 760
Thomas, Parts for Old........ 588
Thomas Receivership in 1912........ 192
Timing for 2-Cylinder Motor Opposed........ 987
Timing of Fours and Sixes........ 24
Timing Maxwell Mercury Model........1125
Timing Most Efficient, No........1032
Timing When Flywheel Is Unmarked........ 761
Timken Jackshaft, Details on........ 763
Tire, Not Advisable to Reduce........ 23
Tire Pressure Same Throughout Tire........1035
Tires, Clincher and Q. D. Same Size........1124
Tires Oversized Often Most Economical........ 545
Top Dressing Wanted........1081
Top, Mohair, Mending a........ 275
Torch, Acetylene, Home Made, Fails........ 762
Torch, Backfire on Acetylene Welding........ 853
Torque, Meaning of........ 277
Trials, External, Believe in........ 542
Tube and Rod Strength Compared........ 275
Tube Bends, Wants to Make Short........ 413
Two and 4-Cycle, Difference Between........ 413
Valves on Ford, Grinding........ 234
Vibration at High Relative Speeds........ 851
Viscosity Bears Relation to Constancy........ [illegible]
Warren Cars, Repair Parts for........ 629
Warren 1911 Parts Wanted........1033
Welding, Oxygen Gas for, Producing........ 325
Western Electrical Laboratories, Wants Information on........ 989
Wheelbase Long, Consumes Less Power........ 589
Wheelbase of Racers Shorter........1033
Wheel from Floating Axle, Removing........ 760
Wheels Misaligned Will Affect Steering........1081
Wheels Pitched, Canted or Dished........ 588
White, Eight-Cylinder Motor for........ 894
Windlass, Spanish........ 806
Worn Parts Must Be Replaced........ 627
Wristpin Seized in Bushing, Why........ 277

SHOWS

Berlin's Motor Show Building........ 900
Body Designs at National Show........ 212
Boston 1916 Show March 4-11........1047
Boston Show at 2 P. M........ 433
Boston Sales Larger Than 1914........ 520
Boston, 329 Cars and Trucks at........ 442
Boston to Have Truck Show........ 824
Brooklyn........ 466
Chicago Show Closed........ 175
Cleveland, 72 Exhibits at........ 171
Columbus, Two Shows for........1009
Denver, Electrics Sell Well at........ 95
Des Moines, $1,000,000 Sales at Show........ 433
Detroit, Business Good at........ 216
Detroit, New Trucks at........ 172
Detroit, Over 64 Car Makers for........ 95
Exposition a Mecca for Cars........ 954
Exposition, Automobile Exhibits Occupy 80,000
  sq. ft........ 860
Exposition, Small Attendance........ 781
Importers' Salon, 40 Cars at........ 18
Indianapolis, 300 Cars Sold at........ 520
Lehigh Valley's First Show........ 425
Lehigh Valley Sells 133 Cars........ 520
Milwaukee, Dealers Active at........ 95
Milwaukee Show, 42,000 at........ 171
Milwaukee's Progressive Show a Success........ 738
Minneapolis, Northwest Farmers Offer Big Car
  Market........ 270
New York, New Car Models Seen at Show........ 1
New York Show Results........ 96
Panama Pacific Exposition, Makers Show Little
  Interest in........ 738
Spokane Holds First Show........ 962
Tacoma, Farmers Buy at........ 433

TECHNICAL

A. C. A. Tests Tireseal and Multiple Rings.. 110
Axle, Russel Internal Gear Drive........ 313
Axle, Sheldon Worm Gear........ 946
Balance and Vibration of Engines........ 261
Ball Bearings in Theory and Practice... 846, 896
Ball Bearing, Manufacture Methods........ 701
Battery Systems Improved in Detail........ 284
Body, Metal, Quantity Production Favors, H.
  J. Hayes........ 37
Brake Lining, 20,000,000 Feet of........ 509
Brakes, Three Broad Classes of........ 437
British Lamp Standards Report........ 489
Brown-Lipe Gearset and Starter Unit........ 900
Brush Advocates Scientific Chassis........ 802
Cadillac Test on Eights with Dynamometer
  Equipment........ 659
Camshaft, Chain, Bound to Come........ 712
Capacity of 8-Cyl. Motors in Cubic Inches.... 263
Carbureter, Schebler, with Extended Venturi.. 541
Carbureters for 1915........ 238
Carbureter, Zenith for Eights........ 190
Carter Fuel Feed System........1066
Chains, Silent, Drives on Increase........ 314
Chassis Design, Scientific, by Brush........ 802
Connecting Rod, Harding........ 906
Couplings, Flexible Leather Shaft, Replace
  Metallic Type........ 272
Cylinders, How Many........ 888
Denver Trophy for Coke Burning Bus........ 754
Design Could Be Improved, Davis Thinks.... 658
Differential, Walter........ 996

Drill, Power Feed, Double Economy.......... 465
Drill Press, Quick Speed Changes.......... 422
Duesenberg, Double Oiling System in.......... 272
Duryea Takes Exception to Oil Recommendation.......... 756
Efficiency, Measuring Automobile.......... 374
Engine Balance and Vibration..........261, 310
Engineering Analyses..........5, 56, 103
Headlight Supports Bent to Throw Glare on Road.......... 625
Excess Heat Cuts Oil Film.......... 546
Flame Propagation Spark, Advance Should Be Function of.......... 408
Flywheel for Ford Plant Large.......... 505
Ford's Huge Flywheel.......... 505
Front Wheel Drive Design.......... 683
Fuel Feed System, Carter Talk..........1066
Gasoline, Another Synthetic.......... 344
Gasoline, Boiling Point, Standard for.......... 507
Gasoline from Wet Gas.......... 344
Gasoline Mixtures, Experiments Show Action of 510
Gearless Differential Clutch for Fords.......... 420
Gearset Problem, Eliminating.......... 540
Gear, Spiral Bevel, Making the.......... 357
Goodyear Tire Fabric Must Stand Test.......... 996
Hardening Bevel Wheel by Special Machine... 461
Harding Connecting-Rod Under Tension.......... 906
Heat-Treating, Recording Instruments for.......... 460
Igniter, Atwater Kent, Is Interchangeable with Magneto.......... 553
Ignition, Remy for 12's..........1123
Indianapolis Races, Valve-in-Head Motor Supreme.......... 926
Indianapolis, Setting for the 500 Mile Race... 879
Knox Tractor.......... 416
Lamp Standards, British Report.......... 489
Lighting, 6-Volt Single-Wire Leads.......... 674
Magneto vs. Battery Coil.......... 20
Magneto Coupling, Eisemann, Flexible.......... 335
Magnetos for 1915.......... 150
Magnets, Recharging Magneto.......... 414
Marmon Demonstrates Effect of Congestion on Fuel Economy.......... 691
Marmon Starts 75 Times on High.......... 829
Maxwell Racing Car Description.......... 528
Measuring Automobile Efficiency.......... 374
Metric Standards of Measurements, Favors.......... 365
Milling and Boring Efficiency in Dodge Plant. 377
Motor, Able.......... 594
Motor, Buda 8.......... 106
Motor, Capacity of 8-Cylinder in Cubic Inches. 265
Motor, Continental Light Six..........1130
Motor, Curtiss 8-Cylinder Aeroplane.......... 632
Motor, Dorris Six.......... 636
Motor, 8-Cylinder, Paper by H. C. Chatain at S. A. E. Meeting.......... 87
Motor, Europe's High-Efficiency.....660, 710, 752
Motor, Ferro Eight.......... 9
Motor, Herrmann 8.......... 758
Motor, Herschell-Spillman 8-Cylinder.......... 80
Motor, Indianapolis, Valve-in-Head Supreme. 926
Motor, Knight Original Racing.......... 291
Motor, Moline Knight.......... 272
Motor, Northway 8.......... 106
Motor, Schebler 12-Cylinder.......... 532
Motor Speeds and Gear Ratios..........1030
Motor Speeds, New Unit to Avoid High and Low..........1082
Motor Spirit Process, Improvements Devised for.......... 533
Motor, Sturtevant Aeroplane 8.......... 469
Motor, Twelve-Cylinder, History of.......... 500
Motor, Walker.......... 128
Motor, White 8.......... 747
Motor, Wisconsin, Two Fours.......... 550
Oakland, Marvel-Equipped Makes 23.7 M.P.G. 254
Oil Changes for temperature and Wear.......... 549
Oiling, Splash, for Eights.......... 468
Oiling, Splash, for Step Piston Motor.......... 947
Oiling System, Double, in Duesenberg.......... 272
Packard Rear Axle, Twin Machines for.......... 684
Painting, Pickling Process.......... 278
Pipe Bends, Machine Makes Intricate.......... 552
Piston Ring Directory, Giving Sizes.......... 313
Piston Ring, Multiple, Tests by A. C. A.......... 110
Piston Ring Problems..........364, 624
Pistons, Light, Make Smooth Motor.......... 362
Pneumatic Control Valveless Car Runs on Acetylene.......... 822
Porter-Knight Speed Creations.......... 790
Premier Mounting of Stewart Vacuum.......... 725
Propeller Shaft Layout Correct.......... 379
Ratios, Motor Speeds and Gear..........1030
Recharging Magneto Magnets.......... 414
Rittmann Vaporizes Petroleum in Still.......... 555
Radiator on Dashboard Best for Trucks.......... 669
Radiator, Huff Defends Front.......... 714
Radiator Position, Burrows Favors Front.......... 756
Radiator, Younger Thinks Front Position Best. 714
Rock Holds Any Motor in 32 Positions.......... 420
Rotary Valve Makes Slow Progress.......... 595
Rubber from Crude Oil, Synthetic.......... 515
S. A. E. Cruise Big Success..........1103
Schebler Carbureter with Extended Venture.. 541
Schebler 12-Cylinder Motor.......... 532
Spark Advance Should Be Function of Flame Propagation.......... 408
Spiral Bevel Gear, Making the.......... 357
Spring, Compensated Cantilever Eliminates Roll.......... 186
Spring Manufacture, Science in.......... 835
Spring System Improvement, Discussions on. 502, 593, 630, 676, 722, 810, 901
Spring Systems, Improvement of, 26, 196, 280, 321, 361, 462, 594, 764, 854, 900
Starter, Brown-Lipe.......... 290
Starting and Lighting for 1915..........144, 200
Starter, Genemotor for Ford.......... 742
Steel, Its Pathology..........611, 660, 706, 796
Straining of Gasoline.......... 365
Stutz Transcontinental Tested by A. C. A.... 954
Sunbeams for Indianapolis.......... 679
Tire, Cord, Its Origin, by Palmer..........1020
Tire Efficiency, Resilience No True Gauge of 1037
Tire Efficiency, Resilience Rejected as a Measure of, by S. A. E. Standards Committee. 1040
Tire Equipment Based on Car Weight, C. B. Whittelsey.......... 38
Tires, British to Standardize 11 Sizes.......... 365
Tires Oversize Increase Comfort and Reduce Expense.......... 625
Tire-cal, A. C. A. Tests.......... 110
Tire Test in England on Cord Tires.......... 234
Truck, 1915 Electric Chassis Specifications. 140
Tungsten—The Hardener.......... 557
Universal Joint Losses Small.......... 678
Valve, Overhead Cheaper to Manufacture.... 715
Valve, Rotary, Makes Slow Progress.......... 595
Valves, Overhead, in Theory and Practice.... 618
Vanderbilt Cup Racer Rebuilt.......... 862
Vibration and Balance of Engines.......... 261
Victor Tire Mileage Test.......... 916
Warner Gear Making Machinery..........1129
Wheel, English Pressed Steel Truck.......... 621
Wheels for Commercial Vehicles.......... 189

TRADE NEWS

Abbott, Consolidated Car Co. Buys.......... 40
Adams Reorganization Scheme Completed.......... 91
Aermore Horn Prices Reduced.......... 26
Ajax Tire Winner Makes 21,985 Miles.......... 692
Akron Co. Taxes on Tire Manufacture.......... 556
Allen Heads Yale & Towne.......... 521
Allis-Chalmers Directors Re-elected.......... 867
Allis-Chalmers Truck a Caterpillar Type.......... 960
Alter, New 4.......... 344
Aluminum Alloy for Pistons.......... 601
American Forging & Socket Co. Formed.......... 958
American La France Report.......... 385
American Piston Ring Closes Large Contracts 1067
American Steel Foundries Enter Field.......... 341
Anderson Hupp Sales Manager.......... 822
Anderson Joins Sales Force of Fisk.......... 819
Apperson 1916..........1134
Argentine, Taxicabs in.......... 958
Army Trucks, No Need to Test.......... 429
Arndts Joins Western Spring & Axle Co.......... 959
Atlanta to New York City by Jitney.......... 920
Atlas Co. Enters Chicago Taxicab Field with One-Half Rates.......... 646
Atwater Kent, 100% Increase in Business.......... 872
Auburn, 1916..........1042
Auction, to Sell Cars at.......... 344
Australian Trade Recovering—Trucks Scarce. 339
Autocar Elects Officers.......... 345
Autocar Reduces Chassis Price $200.......... 138
Autocar Sales Increase 40%..........1097
Auto Parts Reduces Prices on Accessories to Jobbers.......... 867
Baily-Klapp Eight Announced.......... 344
Baker R. & L. W. Merger..........1044
Baker Reduces Prices on Three Models.......... 636
Ball Bearings, Receiving from Germany.......... 428
Bearing Embargo, German.......... 747
Beartone Horn Reduced to $5.......... 646
Bell Plant Starts Producing..........1130
Benford Rights Sold to Hercules Inst. Co.... 779
Benzol Price Up.......... 962
Benzol, Steel Companies to Manufacture.... 471
Benzol, Woodward Iron Co.'s Plant.......... 691
Bessemer War Truck Order.......... 717
Blair Truck to Be Developed.......... 428
Bollstrom 4-Wheel Drive Chassis.......... 998
Bosch for Jeffery and Marmon..........1098
Bassett Co. Increases Capacity..........1143
Bowling Green 1,000-Truck Order.......... 605
Bradfield to Head King's New Department of Sales.......... 820
Brazilian Rubber Duty in Abeyance.......... 959
Brewster-Knight at $4,000.......... 691
Briscoe Adds 3 for 1916..........1092
Briscoe for 4 in Same Chassis..........1092
Briscoe Leases Cutting Plant.......... 252
Briscoe 1916 Motor..........1133
Brown-Lipe-Chapin Business Increases.......... 340
Buffalo Companies Increase Working Force... 340
Buick Discontinues N. E. Branch.......... 292
Buick Experiment Station at Chattanooga.... 504
Buick 1916.......... 998
Buick Output Sold—42,000 Cars.......... 558
Buick Plans 400 Cars Daily..........1096
Buick Plant, 800 Dealers Visit..........1097
Buick, 75,000 Cars for 1915..........1143
Buick Ships 1,952 Cars in Week.......... 472
Burd Gets Packard Contract.......... 955
Burd Increases Capital $150,000..........1050
Busby Dies.......... 733
Cadillac, 150 Men in Convention.......... 254
Cadillac Ships 8,386 Eights.......... 872
Cadillac Ships 2,506 Eights in May..........1006
California, Southern, $35,000,000 for Cars in 1915..........1142
Canadian Rubber to Issue 10,000 Shares Pfd. 516
Canada Underwriters Pleased.......... 869
Cartercar Plant to Be Closed.......... 776
Case 1914 Sales $14,395,384.......... 602
Case, 101 Cars for Russia.......... 958
Chalmers District Managers in Quarterly Session..........1024
Chalmers Heads Detroit A. C.......... 956
Chalmers Managers Meet..........1052
Chalmers Service Plan..........1052
Chandler's May Shipments 1,282..........1086
Champion Extends Time Limit of Profit Sharing Plan..........1006
Champion Ignition, to Add..........1050
Champion Inaugurates Profit Sharing Plan.... 557
Champion Plug Salesmen Hold Convention... 216
Chandler, New Roadster for 6-Passenger..... 651
Chandler, New 7-Passenger.......... 725
Chase Truck Refuses War Orders.......... 512
Chevrolet Buys Second Tarrytown Plant..... 556
Chevrolet Canadian Plant..........1132
Chevrolet Makes Record Shipment..........1043
Chevrolet 1916..........1003
Chicago to Have ½-Rate Taxicabs.......... 603
Chili, Motors Needed for Buses..........1001
Chili Shipments Are Rough..........1047
Clero Hand-Operated Horn Reduced to $3.50.. 605
Cleveland Plants Busy on War Orders.......... 295
Columbia Tire in New Plant.......... 952
Compensation, Thorn Bill for Advance Payment Passed.......... 605
Co-operative Grocery Delivery..........1132
Consolidated Car Co. Expands.......... 435
Continental Motor Adds 90,000 Square Feet. 915
Continental Motor to Increase Plant.......... 216
Continental Tire Factory Burned..........1050
Cooper Heads Maxwell Sales.......... 828
Couple Gear Officers.......... 171
Croxton Plant Sold for $25,500.......... 339
Dallas Company Estimates Yearly Loss at $500,000.......... 693
Daniels Company to Build Eights in Reading.1042
Davis 1916..........1002
Davis Record Order on Eights.......... 823
Deeds Leaves N. C. R.......... 690
De Kalb Car on Street..........1133
Delion Tire & Rubber Co. Opens Plant.......... 429
Detroit Factories, Skilled Mechanics in Demand for.......... 713
Detroit Factories, Spring Brings Flood of Car Orders to.......... 620
Detroit Piston Ring Co. in New Home..........1051
Detroit, Prosperity Wave Hits Parts and Accessory Makers in.......... 751
Detroit Steel Products Adds $750,000.......... 644
Detroit Wants More Accessory Plants.......... 646
Detroit Ward Leonard New Name.......... 387
Detroit-Wyandotte Elects.......... 345
Dietz Remembers Employees in Will.......... 845
Dodge Drive-Away Day..........1097
Dodge Runabout..........1134
Dorris Brings Out 7-Passenger Six.......... 386
Dort Co. Incorporates for $500,000.......... 40
Dort's Convention at Flint.......... 388
Dudley Tool Co. May Build Electrics.......... 558
Dunham Leaves Chalmers—Hinckley Promoted.......... 734
Dunn Overland Vice-President.......... 908
Duplex Enters Foreign Fields.......... 605
Dyneto System for Fords.......... 913
Eagle—New Electric Car..........1042
Eccleston Retires—Jarrard Now Handles Apperson Sales..........1094
Edison to Build Benzol Plant.......... 251
Eisemann's Business Gain 300% in 1914....1048
Elections of 1915 Officers, Adams Bros., L. P-C, Grant, Badger Brass, American Metal Wheel.......... 255
Electrics Increasing in England.......... 427
Electric Storage Battery Earns $848,628...... 556
Elwood Joins Marmon Sales Force.......... 823
England Offers Opportunities to Makers.......... 251
England, 1 and 2-Ton Trucks Popular in.... 578
Erskine to Head Studebaker.......... 999
Estey Dies.......... 471
European Trade After the War.......... 211
Export Bureau Established.......... 956
Export Club of Detroit.......... 251
Falcon Truck in Field.......... 953
Farmack Enters Field.......... 912
Farmers of Southwest Could Buy 94,000 Cars at $1,000 Each.......... 406
Favary Tire Incorporates in Canada.......... 958
Fedders' Radiator Factory Addition..........1050
Federal Commission Hearings Bring Out Weaknesses in Export Trade..........1046
Federal Rubber Capital Increased $1,000,000.. 215
Federal Rubber Running Overtime..........1050
Federal Truck Business Increases 20%.......... 517
Federal Truck Capital Increased to $500,000 1004
Federal Truck Cuts Price.......... 251
Fiat Building Trucks for Italian Government. 561
Fiat Four and Six Rivera M.......... 998
Fickling Enamel Process Saves Time.......... 236
Fisher Buys Universal Plant..........1086
Firestone Adds Tire for Electrics.......... 693
Fisk Adds $500,000 Preferred Stock.......... 341
Fisk Additions.......... 916
Fisk Profits Gain Over $100,000 in 1914..... 776
Fisk 1914 Profits Increase $336,204.......... 254
Fisk Reduces Prices on Tires.......... 41
Five Hundred Dollar Elco 30 Enters Field... 431
Fletcher Heads Remy Electric Co.......... 474
Forbes Monarch V.-P.......... 953
Ford Buys More Detroit Land.......... 646
Ford, Canadian, Raises Pay—Cuts Hours.... 735
Ford Farm Tractor for $200.......... 845
Ford, 40,888 in May..........1085
Ford Has Built 819,922 Cars..........1044
Ford Plant in Dallas, Begin Assembling in... 429
Fords Number 74,906 in Past Four Months.... 38
Ford Plant in Milwaukee.......... 872
Ford Production May Reach 325,000.......... 741
Ford Reduces Prices on Parts..........1007
Ford to Build 47,813 Cars Per Month to Aug. 1.......... 870
Ford's $48,000,000 Dividend..........1044
Ford's New Canadian Plant..........1087

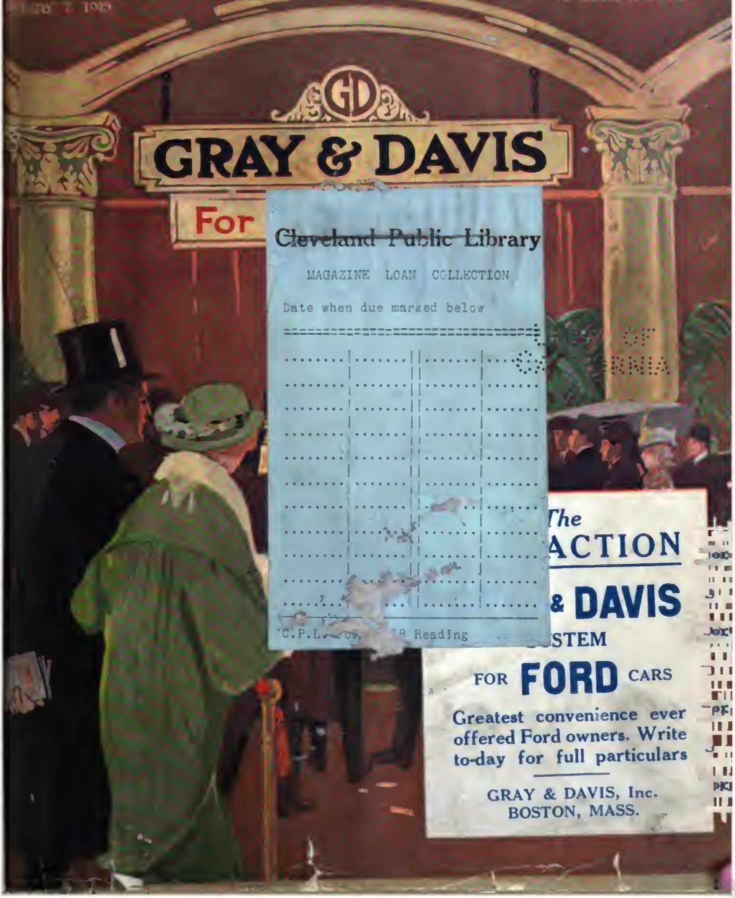
Ford's Tractor Plant 1137
Ford to Pay Over $15,000,000 in Rebates to Car Buyers 776
Four-Wheel-Drive Car Designs 1002
Four Wheel-Drive Gets 130 Truck War Order 344
Franklin Dividend Common 10% 1138
Franklin Elects Officers 293
Franklin ½-Year Business 64% Better Than 1914 1086
Franklin Production for 1915, 3,500 293
Franklin Sales for Six Months Ending Dec. 167
Fuel Processes Discovered, Two, by Dr. Rittman 427
Galbraith Gets Appointment 819
Garford Truck 1½-Ton 741
Garford Truck Starts Work 472
Gasoline Cheaper, Process for 648
Gasoline Famine, Warns of—To Use Alcohol 427
Gasoline 14 Cents in Denver 826
Gasoline Prices Down in Milwaukee 427
Gasoline Prices, Lack of in Texas 961
Gasoline Price War in West 1091
Gasoline Raised, 1 Cent in New Jersey 952
Gasoline Reduced in New York 167
Gasoline, S. O. Price Dropped 1 Cent 1048
Gasoline Substitute Called Charbo-Oil 952
Gasoline Substitute Called Natalite 1094
Gasoline, West Reduces Prices 1141
Gasolock Sales Co. Organized 1098
General Electric 1914 Profits $8,970,963 776
General Motors Notes to Be Taken Up 602
General Motors Sells 20% More Cars 516
General Motors Truck Holds Convention 254
General Rubber Issues $9,000,000 5% Debentures 1093
Germany Cuts Private Cars 50% 428
Golden, Belknap & Swartz Show 15% Increase 959
Goodrich Factory Addition to Cost $500,000 734
Goodrich, Fisk and Republic Reduce Prices 253
Goodrich Making Millimeter Solid Tires 94
Goodrich 1914 Net Sales $41,764,008 386
Goodrich 1914 Profits $5,440,000 254
Goodrich Output 50% Over 1914 1092
Goodrich Plans Addition of $1,000,000 870
Goodrich Reduces Preferred $2,000,000 472
Goodyear $400,000 Addition 1133
Goodyear Increases Capital to $25,000,000 1051
Goodyear Managers Meet in St. Louis 1086
Goodyear Sales Conferences to Be Held on Coast 866
Goodyear to Take Over Motz Sales Feb. 1 90
Government Awards Truck Contracts 1087
Government Wants Truck Estimates 295
Gramm-Bernstein Refuses Truck Orders 428
Gramm War Order of 2,000 3-4 Trucks 344
Grant Clover-Leaf Roadster 1042
Grant Motor Elects Officers 345
Gray & Davis 1914 Sales $4,000,000 294
Hauch Leaves Marmon 252
Handley, Banquet for 575
Hans Equipment to Be Reorganized 561
Hans, National Gauge and Equipment Replaces 645
Hartford Auto Parts Co., Chamberlain President of 345
Hayes Annual Banquet 865
Hayes Wheel Production 1,500,000 644
Haynes Makes Promotions 1135
Haynes 1916 Announcement 822
Haynes 1916, Two New Sixes 1002
Heising Moon Chief Engineer 293
Henry Leaves Peugeot 449
Hercules Touring Car and Roadster on Market 778
Herff-Brooks Small Four at $765 387
Hermann 8 for Light Cars 648
Hess-Bright to Increase Plant 819
Hill Joins Pilot 252
Holdaway Smooth-Tread Enters Field 823
Hood Rubber Common Increase $1,000,000 40
Hoover Steel Ball Doubles Plant 955
Houk Buys American Spoke Co. Plant 601
[illegible] Builds 2½-Ton Gasoline Electric Truck 822
[illegible] Truck Organization Completed 428
Hudson Sales for Five Months $7,500,000 91
Humphrey Chalmers Vice-President 864
Humphrey Joins Chalmers 777
Hupp Dealers Discuss Business on Lake Trip 1053
Hupp Turns Down 900 Orders 865
Hyde Joins Simms Co. 823
Illinois Farmers, Statistics Sell Cars to 621
Independent Motors Increases Capital $60,000 1004
Indianapolis Spring Opening in Full Swing 476
Industrial Unrest Investigated 212
Ingot, 4-Cylinder, Enters Field 605
Insurance, Auto, Rates Reduced 339
Inter-State Adds Roadster 741
Iowa Farmers Will Spend $2,500,000 on Cars in 1915 424
Iowa, 50,000 Cars for in 1915 490
Italian Car Builders, War Hurts, Says Lancia 211
Italy to Take Over Plants 953
Italy, War Halts Trade in 1004
Jackson Co. to Build Sixes 1049
Jackson Cushion to Add 959
Jeffery Gets French War Order 252
Jeffery Has 750 Truck Orders 517
Jeffery, Lewin and Meriheina Saved 864
Jeffery Reduces 4-Cylinder $300 646
Jitney Bus Field, Developments 563
Jitney Developments in Ohio 874
Jitney Development—Street Railways Fight 607
Jitney Express Line 829
Jitney, Frisco Men and City Authorities in Complete Accord 873
Jitney Insurance Company in Milwaukee 829
Jitney, Jacksonville Trolley Co. Installs Autos 650
Jitney, McLaughlin-Buick Builds 830
Jitney Movement Reaches Eastern States 434
Jitney, Pacific Coast Jitneers Discouraged 963
Jitney, Pay as You-Enter in Baltimore 650
Jitney Public Utility in Illinois 1053
Jitneys, Reduce Trolley Revenue $2,000 Daily 786
Jitney, San Francisco, $2.23 Per Day Cost 651
Jitneys Carry 45,000 in Kansas City 346
Jitney, Tennessee Defines as Common Carriers 739
Jitney, Washington Recognizes 963
Johns-Manville Convention at Detroit 388
Jones Six Appears in Wichita 299
Kansas City, Great Distributing Center 336
Kansas Farmers Could Buy 94,000 Cars at $1,000 Each 406
Kansas Farmers, $200,000,000 Car Sales Boom 1062
Keegan Manager of Briggs & Stratton 824
Keeton Continues 4-Cylinder Model 43
Kelly-Springfield Gets War Order 214
Kelly-Springfield Profits Gain $939,194 294
Kelly-Springfield Tire on 24-Hour Schedule 1045
Kelly-Springfield to Share Profits Over $1,000,000 827
Kelly Springfield Truck Elects Officers 911
Kelly Takes Over C. H. Fuller Business 953
Kentucky Wagon Elects Officers 345
Kentucky Wagon to Build Hercules Cars 602
King Dealers Drive Away 90 Eight-Cylinder Cars 1097
King Ships 45 Eights a Day 822
King, Ward Heads 1087
Klaxonet Sells for $4 475
Kline to Resume 644
Knox Motors Associates 1132
Krit Companies, Sansdale in Charge 43
Krit to Reorganize 295
Lancia Imports Not Halted by War 1094
Laurier with Norwalk Tire 1001
Lauth-Juergens, English Firm Gets 1044
Leece-Neville Buys Factory 957
Leonard, H. Ward, Dead 383
Lesser Killed 1095
Lewin Here for Car Agencies 341
Lewin Takes American Car Agencies for London 827
Lewin Takes London Dodge 475
Lewis Brings Out Eight at $985 299
Lewis Consolidated Car President 474
Lewis 1916 Car 912
Lima Light Car for $500 648
Lippard-Stewart Reduces Prices 1043
Locomobiles Adopt Multiple Disk Clutch for 1916 952
Lonnia to Make New 4-Cylinder Car at $980 1001
Lozier, $5,000,000 Capital for 518
Lozier, Harry, Re-enters Car Building Field 1045
Lozier Plattsburg Sold 1006
Lozier, to Bring Out New 431
L-P-C Cars May Be Equipped with Vulcan Gearshift 648
Macauley on Packard Board of Directors 999
Madison Motor Co. to Build 4 and 8 602
Madison Motors' New Appointments 779
Madison Runabout 1002
Mansfield Tire Expands 871
Manganese, War Sends Up Price 354
Marmon 1916 1002
Massnick-Phipps Gets Wahl Plant 516
Master Carbureter Buys Air Compressor Plant 777
Maxwell's Daily Output Averages 250 958
Maxwell Tarrytown and Detroit Plants to Be Sold 429
Maxwell Preferred Placed on 7 Per Cent Basis 864
Maxwell Test Shows High Efficiency 868
McAfee Process, Gulf Co. to Test 603
McCord Plant, Optimism at 958
McCulla in Paris 954
McCulla Back from Europe 1134
Mead Goes to Cheltenham Agency 821
Mercer Adds 24,000 Sq. Ft. 1044
Michigan Castings Declares 200% Dividend 688
Milwaukee Dealer Assn. 648
Minneapolis Farmers Offer Big Car Market 270
Minneapolis, 485 Carloads in and 576 Go Out 1095
Missouri's New Insurance Rates 868
Mitchell Election 252
Mitchell 8 for 1916 1042
Mitchell 1916 998
Monarch Buys 5,000 Advance Pumps 1051
Monarch Reorganized 911
Money Orders Exchange With S. A. 516
Monahan Gen. Mgr. of Marion Co. 4
Monitor 8-Cyl. Car 214
Monitor to Concentrate on 4-Cylinder 779
Monitor to Continue 959
Moon's Jan. Business Gains 28.24% 340
Moon's May Business 33.1% Gain 1049
Moore a Newcomer 1042
Moreland Truck Parts Bought in East 1006
Morton Receives $270,000 Truck Order 605
Morton's Second Order—116 Trucks 428
Morton Truck War Order 300 386
Motor, Ross 8-Cylinder 92
Murray Heads Splitdorf on Detroit 784
National Carbon's Income $2,215,880 340
National 4 Newport Model 741
National Used Car Report 1096
National Used Car Report Pocket Edition 1117
New Departure Plant, Engineers Visit 91
New England Will Spend $58,500,000 for Cars and Accessories 439
New Era Engineering Co. Incorporated 824
New Era 1916 1043
New Haven Territory, $4,116,000 Sales Predicted for 425
New Process Gear Addition 917
Non-Fluid Oil Prices Reduced 171
New York, 3,500 Cars for Central 424
Norwalk Plant Sale on April 24 735
Nyberg Plant to Be Reopened—New Car 519
N. Y. Perfection Spring Service Branch 1052
Oakes Secretary of Indianapolis Chamber of Commerce 575
Oakland, 1916 908
Oakland's New G. M., Warner 1132
Ohio Automobile Plants Busy 956
Ohio Electric Car Co., Barbour Pres. of 345
Ordnance Officers to Buy Trucks 295
Orr Modern M. C. Co. to Manufacture Dual Gear 1006
Overland Action on Extra Dividend in April 516
Overland Advertising Mgr., Pierce 1138
Overland Breaks Its Single Shipment Record 1050
Overland Daily Output to Be 600 734
Overland Dinner at Chicago 216
Overland Electrifies Enameling Ovens 689
Overland's 1916 Shipment 12,000 1135
Overland's Extra 5% Dividend on Common Stock 688
Overland Orders Increase 1,300 601
Overland Plant Rushed to Capacity 340
Overland Ships 302 Cars in 1 Day 472
Overland Statement 5 Mos. Ended Nov. 30, 1914 340
Overland Surplus for 6 Mos. $2,853,864 644
Owen Joins Forces With [illegible] 516
Packard's April Sales $3,047,811 865
Packard, Six Worm Drive Trucks 94
Packard 12's, $2,600 and $2,950 1042
Page Takes Mitchell-Haupt Now Hudson Agent 864
Paige-Detroit's Monthly Dividend Now 10% 1062
Paige Sales Gain Nearly 70% 516
Paige Six at $1,095 1003
Paige Stockholders Get $17,500 Monthly Dividend 864
Paige to Double Production 912
Pampell Heads Lyons-Atlas 734
Partin Cars to Be Continued 644
Paterson Cuts Price $100 1098
Pathfinder Automobile Co. New 960
Pennsylvania Farmers Own 15,000 Cars 341
Pennsylvania Rubber Elects Officers 388
Pennsylvania Tire Guaranteed Up to 6,000 Miles 1051
Pennsylvania Tube Prices Reduced 691
Perrin Joins Continental 316
Petroleum Exports for 1914 343
Pierce-Arrow to Concentrate on Sixes for 1916 952
Pilliod 8 Sleeve-Valve Motor 344
Pittsburgh Model Engine Co. Has High Speed Six 763
Pontiac Building Chassis for Trade 565
Pontiac Builds Chassis for Trade 561
Pope Parts, New Building for 1094
Pope Plant Bought by Pratt & Whitney 40
Pope Plant Offer $67,000 91
Pope's West Works Sold 216
Porter to Use High-Speed Knight 214
Princess Enlarges Plant—1916 Car Ready 871
Pullman, Fox Pres. of 734
Pullman Ships 150 Cars a Week 958
Puritan Machine Buys Crescent 871
Puritan Takes Monitor Shock Preventers 871
Racine Rubber Profits $570,000 215
Railroad Protests Truck Competition 1098
Raybest Organization Meets in Convention 226
Reading, May Build Eight in 968
Reddig King Chief Mechanical Engineer 641
Regal Eight at $1,250, Four, $650 67
Regal 1916 1134
Regal Orders 1,000 Four-Cyl. Motors 344
Remy Ignition System for 12's 1098
Remy Preferred All Redeemed 1005
Remy to Move Plant to Detroit 44
Reo Co. to Enlarge Factory 960
Reo Dividend 12½% 1092
Reo Gets Truck Export Contract 951
Reo 1916 966
Reo Profits in 1914, $2,519,187 40
Reo Truck Assets, $1,028,312 167
Republic Gets Orders for 300 Trucks 428
Republic Rubber May Issue $2,500,000 Preferred 215
Republic Rubber Officers Re-elected 252
Republic Rubber's $3,000,000 Issued Approved 252
Republic Truck Capital Increased $200,000 215
Republic Truck Declares 100% Dividend 294
Republic Truck's $50,000 Bldg. 1086
Rice Waverley Pres. 953
Richardson to Represent Studebaker in S. A. 957
Rittman Fuel Processes Discovered 427
Rittman, Plant for 691
Rittman Process Expands 1005
Rittman Process to Form Co. 471
Robertson Joins Houk 1141
Rolls-Royce Profits Decrease $71,500 294
Rubber Control Committee Appointed 343
Rubber Exports Permitted to U. S. 91
Rubber, 4,859,200 Pounds Imported in Feb. 428
Rubber Goods Earnings $2,193,220 644
Rubber Imports, 4,876,900 Pounds 41
Rubber Makers in Quandary 42
Rubber Shipments Coming 215
Rubber Shipments on the Way 168
Rubber Substitute, Dr. Noble Discovers 1141
Rural Delivery, 105 Autos for 1137
Russia Buys American Cars 1004
San Diego R. R. Interests Stop Jitney Development 755
Savidge Steering Device Makes Record 1006
Saxon Makes Record Shipment of 115 Cars 415
Saxon Triples May Shipments 1086
Sayer Visits U. S. Plants 937
Schebler's New Engineering Building 752
Schwallach Joins Grossman 1091

Schwalbach Leaves Bearings Co. 823
Service Gear & Machine Co. Buys Parts.... 387
Sheldon, Increase of 43% for 958
Shipments for 1914 Equal 138,250 Carloads.. 298
Shipment of Automobiles in April, 17,084 Carloads 870
Simpson Hupp Manufacturing Mgr 865
Singleton-Tripp Co. Now 1049
Slade to Judge Exhibits.................... 819
Smith Chalmers Sales Mgr. 999
Smith Succeeds Thompson As Maxwell Works Mgr. 822
Somerville Brings Out Starter 823
South America, Dollar Exchange Inflated.. 956
South American Exports, Advances Made in. 911
South American Markets Advertising Opens.. 866
Southwest Sales Gain 64.2% in 3 Mos....... 576
South American Conditions, To Confer...... 734
Spark Plug, Carson to Make, With New Alloy 957
Sparton Horn for $4........................ 519
Sparton Horn on 1916 Packard.............1004
Speedwell Assets Purchased by Puritan Machine 647
Speedwell Plant Sold 871
Sphinx M. C. Co. to Be Reorganized........ 168
Springfield Plants on Overtime.............1006
Stalnaker Pathfinder V-P.................. 999
Standard Steel Car 8 and 6................ 558
Stearns Building 5-Story Plant 1087
Stearns 5-Ton Knight Truck................ 952
Stearns Production Gains 55%............. 823
Steel, Tool, Record Demand for............ 849
Steinmetz Transmission to Cheapen Electric. 558
Sternberg Truck War Order 252
Stevens-Duryea Plant Sold for $1,000,000....1049
Stevens-Duryea Plants Purchased by Westinghouse 916
Stevens-Duryea Quits Manufacturing 94
Stewart-Warner Earns 10% on Common..... 386
Stewart-Warner Stock Is Listed 169
St. Louis Jitneys to Put Up Rates 786
Strouse Car for $325 297
Studebaker Breaks All Records 865
Studebaker Common Pay Initial Dividend of 5% 819
Studebaker Discounting Notes 776
Studebaker Earnings Amount to $4,000,000.. 294
Studebakers Enter Export Assn.............. 912
Studebaker Expands in L. I. City...........1072
Studebaker Gains 100% in East 1053
Studebaker Profits Gain 150.6%............ 430
Studebaker Re-elects Retiring Directors..... 648
Studebaker 1916 Cars 1112
Studebaker, 10,282 in 8 Weeks 956
Studebaker's 1915 Cars Sold by May 1...... 558
Studebaker's Annual Convention 1133
Taylor, F. W., Dies 599
Ten Broeck Tire to Resume Feb. 1........... 169
Texas Refiners Boost Gasoline Prices....... 826
Texas, Trade Increasing in 578
Texas Wants Light Motor Trucks........... 867
Thompson Joins Hudson 779
Timken Buys Metal Products Plant 474
Timken Plants to Be Enlarged 779
Timken to Add Cold Drawing Steel Plant...1086
Tire Prices, Firestone Reduces Solid Tires 10% 472
Tire Prices, Gaulois Reduced............... 430
Tire Prices Reduced 297, 387
Tire Prices Reduced, Diamond and Lee...... 341
Tire Service, Free Emergency 1052
Tire Warranty, British, of 10,000 Miles on Solid 916
Torbensen Gear Buys Cleveland Plant......1044
Transmission, To Cheapen Electric.......... 558
Tripp Singleton V-P 959
Trolley Pres. Petitions to Substitute Jitneys for Cars 829
Troy Wagon $500,000 Trailer War Order.... 517
Troy Wagon War Order 295
Truck Orders, More 1004
Trucks Leave for War Zone 252
Turk Inter-State Design 823
Twombly Taxicabs, To Build 500........... 43
United Trucks Appear at Grand Rapids...... 381
Used Car Report, Boston Dealers Accept.. 827
Used Car Report for Salesmen.............. 912
Used Car Report Is Nationalized........... 560
Used Car Report National, Name Changed.. 957
Used Car Report, To Nationalize........... 95
U. S. L. Plan Well Received............... 958
U. S. Rubber Elects Directors.............. 516
U. S. Rubber Officers Elected 556
U. S. Rubber Output Gains 30%..........1086
U. S. Rubber's Net Profits, $9,776,873...... 472
U. S. Should Protect American Trade-Marks. 735
U. S. Tire Branch Mgrs. Meet at Detroit.. 345
Vacuum Oil Earns $2,075,644 in 1914........ 644
Vail Rutenber General Manager............ 354
Van Speedometer for Chevrolet, Hupp and Jeffery 957
Van Speedometer on 1916 King 866
Velie Six $530 Cheaper....................1086
Venezuela, American Automobile Sales Growing 956
Vulcan Insurance Lowers $1,500 Car Rates.. 560
Wadsworth to Mfg. Bodies 1003
Waldron Goes to Cadillac.................. 339
Ward Leonard Patents Magnetic Regulation .171
Ware Truck Order 605
Wayne Tank Adds..........................1143
Weber Maxwell Assistant Mgr. 779
Weidley Motor Co. Organized.............. 430
Westinghouse to Buy Stevens Duryea Plant 819
White Men Get Wage Increase.............1133
Wichita Falls British Truck Order 953
Willys-Knight Under $1,200................. 864
Willys Sells Gramm and Garford Interests... 169
Winton Co. Now 1086
Wisconsin, Dairy Wealth Will Buy 20,000 Cars in 1915 in............................ 623
Wuchter and Werner Form Tire Co.........1132
Xenia Rubber Buys Springfield Tire......... 954
Yale & Towne Adds $500,000 Capital........ 81
Yale & Towne's 1914 Earnings, $663,898. 556
York Men Organize to Build $700 Bell Car... 913
Zephyr Carbureter Patents Bought.........1086

THE CLASS JOURNAL COMPANY
231-241 West 39th Street
NEW YORK CITY

The AUTOMOBILE

10 CENTS A COPY



~~Cleveland Public Library~~

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. [illegible] 8 Reading

The [illegible] ACTION

[illegible] & DAVIS

[illegible] STEM

FOR **FORD** CARS

Greatest convenience ever offered Ford owners. Write to-day for full particulars

GRAY & DAVIS, Inc.
BOSTON, MASS.

THERE is no question about which is the best brake lining for this is a point which has been proved time and again by engineering tests. Don't take our word for it, but write at once for the signed reports of these tests.

STANDARD WOVEN FABRIC CO.
FRAMINGHAM, MASSACHUSETTS

BOSTON—F. Shirley Boyd, 903 Boylston St.
PHILADELPHIA—N. A. Petry Co., Inc., 1427 Vine St.
CHICAGO—F. E. Sparks, 1430 Michigan Blvd.
SAN FRANCISCO—Fred Ward & Son, Inc., Cor. First & Howard Sts.

Vol. XXXII New York—Thursday, January 7, 1915—Chicago No. 1

The AUTOMOBILE

TL.1
F1
v.32

New Car Models Seen at the Palace Show

Body Designs Show New Trends—Large Exhibit of Small Cars—Mercer, Chalmers, Owen and Dort Display New Models — Many Electric Starters

UNIV. OF

NEW YORK CITY, Jan. 4—Continuing the practice inaugurated a year ago the four-floor show at Grand Central Palace once more exhibits progress of the automobile industry to the public of New York City and to the visitors interested in the industry, from all over the United States and Europe. With 317 exhibitors of cars, accessories and motorcycles, this show, in spite of a year in which it is generally acknowledged that the business conditions of the country have not been so good as desired, stands as the highest evidence of a year of prosperity and an optimistic lookout for the automobile industry.

221 Gasoline Cars—15 Electrics

The statistics of the show tell us that there are 221 gasoline passenger cars on the floor, 105 of these are sixes, ninety-six are poppet-valve fours, ten are sleeve-valve fours, eight are eights, two are crescent-valve sixes and one is a sleeve-valve six.

Touring bodies are far in the lead, being shown on 123 chassis. Roadsters are forty-eight in number and forty-five are with miscellaneous inclosed types of bodies. Of the closed types the limousine is in the lead with eighteen.

There are fifteen electric exhibits, nine of which are broughams and three roadsters. Besides these there is an example of a limousine, a cabriolet and a coupé.

Many makers are exhibiting the engineering and design features of their cars by employing a stripped chassis for the purpose. There are twenty-six sixes, twenty fours, four four-cylinder sleeve-valve motors and one eight. This is a larger number of stripped chassis than ever before exhibited.

The setting for the show is one that provides a suitable background for the variously colored cars. The interior of the Palace is arranged to represent a Persian palace with a decorative scheme in white, gold and crimson. This season, while the cheaper cars are of a dark color as a rule, those in the intermediate and higher price classes have a greater individuality. Royal blue, Brewster green, various yellows and reds are more strongly in evidence than they were a year ago.

As usual many manufacturers awaited the show time to make important announcements regarding the new models, reductions in prices, additions of new body types and departures from previous practices in their stock lines. Beside these, concerns that had announced cars shortly before the show exhibited these models, in several instances for the first time.

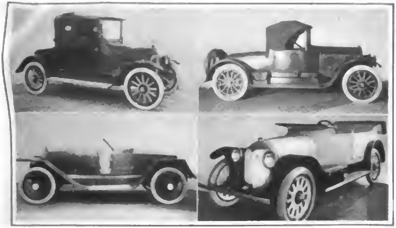
Six Have New Cars

The cars, which had not previously been announced, but which were announced and shown at the exposition are the Mercers, Lexington, Dort, Malcolm, Jackson and Remington. The last named, an eight, was one of the surprises of the show. In addition to these cars, which were shown for the first time at the exhibition of which details have previously been mentioned, are the new Chevrolet $490, the Chalmers overhead six, which is one of the show features, and the Briggs-Detroiter eight.

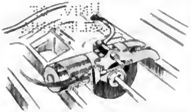
In addition to these, there are several others who show cars which incorporate several changes. The National is one of these, having made a number of alterations, which really constitute the inauguration of a new model. Paige and Auburn have reduced prices. Paige has reduced the price on model 36, a four-cylinder 1914 model, from $1,195 to $1,075.

The Kissel 6-42 which was announced not long ago also had its price given at the show. This car sells with a one-compartment two-door body at $1,650. It is a new design with a 126-inch wheelbase having a block-cast, L-head, 3.625 by 5.5 motor, cone clutch, three-speed gearset and 36 by 4.5 tires. It is unique in that it is supplied with a detachable sedan top at the inclusive price of $2,000. This was one of the examples of an all-year-round car which can be converted from an open to a closed design by simply adding

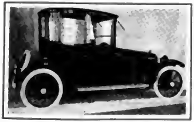
719369



Some of the new body designs at the show. Upper left—Jeffery coupelet. Upper right—Fiat smooth-sided streamline roadster with top. Lower left—Cole Cabriol roadster. Lower right—Pathfinder streamline touring car



Reo mounts the starter at the front of the gearbox. It drives the engine through worm gearing and the clutch must be engaged when cranking as the starter drive is behind the clutch. The starting switch is mounted directly on the side of the motor casing and is operated by pedal which also meshes the gears



New Scripps-Booth coupe, giving an idea of inclosed small car possibilities

the detachable sedan top, which fits over the single compartment body. This is a stock job entirely and when used as a touring car presents the appearance of an up-to-date, divided-front-seat design. When used as a sedan only close inspection would reveal the fact that the top is detachable.

New Body Designs

New broughams are shown by Locomobile and Oakland. The Locomobile is a special Brewster built job for show purposes only and is not listed as a stock price. The Oakland is a new development that will be kept as a standard job. It is characterized as an open-front brougham and sells at $2,500.

Peerless shows a roadster, which has something new in the way of roadster seating, in that they are so arranged that the driver sits slightly ahead of the other two passengers on the transverse seat similar to the arrangement generally adopted in coupes and other inclosed cars. Back of the advanced seat of the driver is a package compartment.

The divided front seat is rapidly gaining and at the show is seen on several stock bodies for the first time. Among these are Kissel, Winton, Cole, National, Pathfinder, Premier and Westcott. The aisle between the front seats is sufficiently large to permit an adult to pass from the tonneau to the front compartment.

Double Cowl Gains

A feature, which has hitherto been a characteristic of custom-made and imported bodies, is the double cowl. It is now seen on such bodies as White, McFarlan and Lewis. The double cowl varies all the way from a fully developed polished cowl-board extending back to the tonneau to a small suggestion of a cowl made by forming the back of the front seat to taper off into an extension. The five-passenger Stearns has only a suggestion of the double cowl, formed by the moulded back of the front seats.

The Moon company has altered the body styles both in the seven-passenger touring and the roadster. In the roadster the appearance has been altered considerably by the use of a car deck with a small door accessible from the [illegible] through which the luggage can be placed in the compartment beneath the deck.

The R. M. Owen magnetic transmission car is shown in its completed form. The car uses an improved [illegible] valve-in-the-head motor in which the principal change is in the method of driving the overhead camshaft. The drive is now taken from the front end of the motor to the center on a horizontal shaft in the crankcase in the same manner as the crankshaft. From this point it is taken vertically upward by spiral gears. The crankshaft has been stiffened to eliminate vibrating within the range of practical motor speeds. The car is now equipped with vacuum-gravity gasoline feed. The Zenith carburetor bolts directly to an extended portion of the intake manifold which is integral with the block cylinder casting. The price, $3,750, is for either three-passenger or roadster. The motor is a six with 3.75 by 5.5 cylinders. The aluminum housing for the electrical system of transmission is bolted to the crankcase.

Boat-Line Bodies

Westcott had some new bodies which show a tendency towards the adoption of the boat-lines. Three touring cars have sheered lines along the top of the body which, in connection with divided front seats, give the bodies a launch-like appearance.

Another concern which shows distinctive bodies is the Lewis. They are copies of the Sunbeam bodies produced in England. A sedan, which is in a deep canary yellow with red doors and trimmings, is one of the conspicuous exhibits at the Palace.

Maxwell has added a cabriolet, which should make a desirable low priced physician's car. It is roomy and with the top down makes a roadster design with all the advantages of the straight roadster type. The seat is 43 inches wide and 22 inches deep. Ample leg room is provided, as the front of the dash to the heel-board measures 30 inches. Plenty of head room is also provided, the height from the top of the cushion to the inside of the top being 40 inches. The doors are 18 inches wide. Entrance can be had from either side and for convenience there is a rear deck compartment measuring 34 by 40 inches inside with a 10 by 32-inch door in the top.

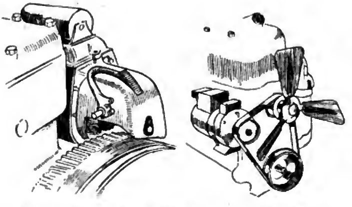
Small Car Progress

Scripps-Booth shows a closed job that is a revelation as what can be on a small car chassis. It is a coupe with a capacity for three passengers, and staggered seats. The driver sits in advance of the passenger on his right and the third passenger sits on a seat which folds back under the cowl. The car is well illuminated on the interior with four lights. There is one beneath the cowl which throws light on the pedals and control instruments and another on the instrument board which [illegible] the [illegible] lamp. Besides these there are two dome lights in the [illegible] corners.

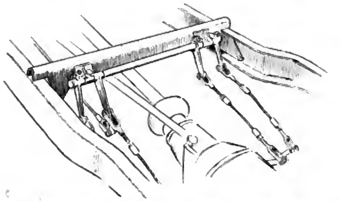
Metz shows the new touring car [illegible] just started. It [illegible]

Three types of cantilever rear spring. That at the top is used on the Case, the center one by the [illegible] and that at the bottom [illegible] found on the new Dort

Left—Intake side of block motor used on the six cylinder [illegible] the motor showing the exhaust manifold bolted on [illegible] overhead valves. Right—Exhaust side of new Saxon [illegible]. Note distributor mounting



Left—Mounting of Delco starter on Cartercar. Right—Belt drive of Bosch-Rushmore generator and fan on Regal



Short brake cables on new Reo six. Note the method of supporting the brake mechanism on the U-shaped cross-member

teristics of Metz design except that the dimensions throughout are greater to take care of the larger body. This marks the debut of this Waltham concern in the touring-car field.

Trumbull is another of the new small fours that has a closed body, which is an open-front coupé with wire wheels, and is one of the few closed cars on a narrow tread, 44 inches.

Twombly shows a new two-passenger roadster at $660. It is mounted on the standard Twombly chassis. The car is unique for its six-point spring suspension gained by continuous cantilevers on each side.

Gadabout exhibits a runabout with a basket body, on a four-cylinder chassis with a 2.5 by 3.5 power plant having L split-head cylinders. It uses the gearless clutch differential in the hub of the wheels. The body is of reed on a hardwood frame. It sells for $400 with electric lighting.

Electric Systems Accessory Feature

Starting and lighting equipment is the most interesting feature of the accessory division. Some new makes and many new models are on exhibition. On the whole the new machines are better looking, lighter, more efficient and have better material and workmanship in them. Improvements have also been made in the voltage regulation. The development in motor-generator design is notable. Gray & Davis, Westinghouse, Leece-Neville, Chicago Electric Specialty Co., are among the makers showing this type of machine for the first time. New models of generators and motors are shown by Gray & Davis, Aplco, Westinghouse, Bosch, Leece-Neville, and Kemco. The latter concern now has a full line of starting and lighting units, a universal system for old cars and a smaller model of this system for Fords. The Hartford Suspension Company is also showing a special Ford system which is unique in that it is a high-speed, two-unit type. The motor runs 8,000 to 10,000 revolutions per minute. This feature gives lightness, the complete system weighing in the neighborhood of 50 pounds.

New Carbureters

Several new carbureters have been brought out since the last show. These include a new Rayfield G, a Zenith O, Stromberg H and K, all of which have been described in THE AUTOMOBILE. In addition several brand new carbureters are on display. There is a floatless carbureter, known as the M. F. It is light, compact and simple. The Shakespeare is a springless model in which the flow of air and gasoline are controlled by a single floating disk valve. The Parkin carbureter made by the Light Mfg. & Foundry Co. uses a throttle-controlled fuel flow. It also has no springs and but one air inlet. Two new carbureters are shown by the Hamilton Kerosene carbureter company, one is a new kerosene model using a double float chamber and the other is a gasoline carbureter with many jets.

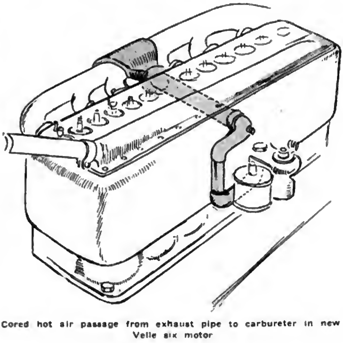
Another carbureter is the Browne which automatically proportions the amount of air to the flow of gasoline by a vacuum-controlled valve.

Refinements and lower prices are noted in the shock absorber field and the speedometer makers show some new combinations, although no radical departures. An interesting accessory shown by the Stewart-Warner company is a self-winding electric clock which runs a year on the energy of one dry cell.

Some new spark plugs are shown but in the main there has been little change. Motor-driven tire pumps are on the increase, the single and two-cylinder pumps being the most numerous.

Monihan General Manager of Marion Co.

INDIANAPOLIS, IND., Jan. 6—J. G. Monihan, recently connected with the Cole company, has been appointed general manager of the newly organized Marion Motor Co., which, together with the Imperial Automobile Co., are the two selling organizations that will market the product of the Mutual Motor Co. recently headed by J. I. Handley. The Marion Motor Co. has paid in capital of $100,000 and will market the entire new line of Marion cars which will consist of four- and six-cylinder models at popular prices. These models will be exhibited in Chicago during the Coliseum show. It is expected that the Mutual company will take possession of its new manufacturing plant February 1 and in the meantime the production of the new models is being pushed ahead.



Cored hot air passage from exhaust pipe to carbureter in new Velie six motor

Engineering Analyses

Foreign Engineer Applies First Principles to the Car Designs at Palace Show—Compares Sixes and Eights—Machined Combustion Chambers—Prefers Overhead Camshafts—Says Europe Leads in Light Construction

By A. Ludlow Clayden

Member Institute of Automobile Engineers of Great Britain

THE enormous home market which the large and prosperous population of America provides for the American motor car maker has the most protound influence upon the whole trade, because it means that the American car is made to suit the average taste of thousands, whereas the European car can be designed to suit the idiosyncracies of a small section of a smaller population. There is one particular instance of the effect of this difference which may be taken as typical of the whole, and this is that the American public demand an all high-gear car, while the European buyer does not.

Why is this?

The question is not difficult to answer being merely that the European car is commonly driven by a chauffeur or by a mechanical enthusiast who takes an immense pride in his skill of handling. Here in America, where the motor car is bought for its usefulness much as a man purchases an umbrella or a pair of shoes, the average demand must naturally be for the utmost possible simplicity of handling and the type of user who loves mechanisms for the sake of playing with them is in the minority. It has been left for the manufacturers of this country to prove, by their ever increasing trade with Europe, that there are many people there to whom the American proposition appeals, but it is the opinion of the writer that there will always be differences in the average taste of the consumers on opposite sides of the Atlantic. It is this point that he wished to make clear before proceeding to a detailed consideration, and criticism of American design as it appears to him today.

When Power Was King

The first demand of motorists in the early days was for more power, and this demand kept up for many years. Then, as power was given at the cost of increased weight, expense and noise, came the demand for greater refinement and for cheaper vehicles, but, let it be marked, for cheaper vehicles that would also be more satisfactory in use. This called for striving to get smoothness of operation, eliminating excessive vibration, and for simplification of design so as to lower manufacturing cost. The ultimate effect of these demands has been different in Europe and America, for the development of the light high-speed, four-cylinder motor, which is very smooth and quiet, has been Europe's care, while America has tackled the problem by producing inexpensive sixes.

To make the typical European four-cylinder chassis is now almost as cheap as to make the American light six, quantity for quantity, but the development of the former called for an exaggerated carefulness of workmanship and even much hand fitting, while the six obtained something the same effect at the cost of improved machining facilities. The American, having big quantities to consider, could not have undertaken the kind of work which the European makers did from 1909 to 1912, while the European, not having the quantities, could not have followed the American plan. This means that one cannot very well make direct comparison between the American typical car and the typical European.

Speaking quite broadly their tendency is to grow more and more alike, and this trend doubtless will be obvious for many years to come; but there must always be some differences in the buyers' requirements just as there are still quite big differences in the automobile taste of the French, the Germans, the British and the Italians.

Unprecedented American Progress

Taking the American car as an engineering product, and without any reference to the practice of other countries, it has improved almost out of recognition since the summer of 1911, which is equivalent to saying that the most prodigious strides have been made since 1912, because it was the 1912 models that were going through the shops in the summer of 1911. The most impressive change is in the general tidying up of the chassis, the aggolomeration of once separate parts into symmetrical wholes. In this Italy led the whole world; in fact, Italy has sometimes gone too far, and France and England were close seconds. Today America can show some chassis which almost outdo the Italian, and many which are equal in neatness to the most advanced British practice.

Favors Block Cylinders

On first principles this neatness of outline is to be commended because of two machines which do the same work that with fewer parts is almost always the better, though fewness of individual parts does not necessarily mean greater simplicity. For instance, the block-cast cylinder, with six bores

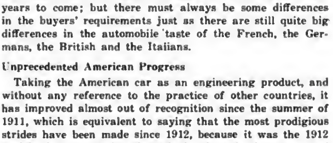


Fig. 1—Left—Piston drilled to reduce weight and to prevent smoking. Fig. 2—Right—Illustrating the use of a ring of steel tube to protect gasket and also to form a spigot

---

EDITOR'S NOTE—A. Ludlow Clayden began as a motorist in 1899 and as a motor engineer in 1903. He so gained a wide experience of European conditions and of the types of automobiles arising therefrom. In 1911 he made a first visit to America and attended the summer meeting of the Society of Automobile Engineers at Dayton, O., and visited many of the best known manufacturing plants in the United States. This visit, short though it was, gave him an insight into the great difference between the conditions of automobile service here and in Europe so that, while no doubt still possessing some European bias, he does not share the opinion expressed by some Europeans; namely that a difference in practice is necessarily to the advantage of the Old World.

and a collection of internal passages for gas or water, is vastly more complicated than six plain cylinders with straggling external pipe work: because it requires much more elaborate plant to produce it. But experience shows that expenditure of much money upon and in the foundry enables a better article to be made. The block cylinder has cost incredible sums to bring it to its present state of perfection, and it has been developed because it made a better, and not because it made a cheaper job. The fact that it *is* cheaper now that we know how to do it is merely a fortunate side issue.

Again, the self-starter makes a better car, but it unquestionably makes a more expensive one; the spiral bevel is dearer but better; the pressed steel axle is not so cheap as the built-up type—and so one could go on. The point is that the American maker has, in the past 3 years, done all sorts of things to make the ideal of cheapness more difficult, and it is therefore all the more to the credit of the purely manufacturing end that cheapness has been none the less obtainable.

Next Is Weight

Indications are not wanting that the next big effort will be made towards reduction of weight, not only in America but in Europe, and it would be very hard to say what effect this striving may have upon the design of the chassis. Perhaps the eight-cylinder is evidence of an impending change in which weight considerations take a part, perhaps it is not; for it is yet early to judge; but it is a fundamental fact that to obtain any new quality in a machine generally calls for profound changes.

Sixes Lead

However, leaving speculations of this sort on one side, the present show is emphatically a six show, and as such is unique in the annals of motoring. That the length of the six-cylinder motor is a little inconvenient is shown in some cases by a tendency to crowd the dashboard and its fittings too close to the end of the block; so much so, sometimes, that there would be grave difficulty in removing the cylinders for scraping, and the general provision of more leg room for the driver and his companion passenger shows that room has been lacking. Also the car with a fairly short wheelbase is more handleable than a longer vehicle, so that anything that can help to keep down the length of the motor is desirable if it does not entail sacrifice of other qualities.

Cost of Sixes and Eights

It is claimed that the eight is as cheap, or cheaper, to build than the six of equal power, and it is possible that this may be true in the long run, but it is certainly not true generally, because far greater changes are needed in machine shop and works equipment to change over from a six to an eight than from a four to a six. Thus the writer is loth to believe in a sudden boom in eights for next year.

It had become imperative to produce something better in performance than the average four of 2 or 3 years ago, and the six was the natural outcome. It is not now by any means imperative to make anything better than the average six so far as smoothness in operation and quietness go. Hence suddenly to drop a type of chassis which engineers are just commencing to get a grip of, and to turn to something new, simply because of its novelty, would be very bad business. If a concern has made only fours it can turn to the development of the eight much more readily than could a manufacturer who already had valuable experience in the construction of sixes. Let it not be forgotten that some years ago there was a pronounced trend towards cars of gigantic size and weight, and that those firms that persisted in their own ideals and went on turning out a sound medium-sized, medium-priced car have reaped the reward due to their consistency.

On the other hand; if it is wise to retain types that have taken the public fancy as the moderate-priced six has done, it is not wise to retain models too long without alteration in detail. There are several examples in the show of chassis which have undergone no redesign for years, but have merely had addition after addition in the matter of fittings and attachments. Such cars may be cheap, but their intricacy cannot but give trouble to their owners and desperate anxiety to the dealers who have to see to their road service. Taking the self-starter as an example one sees many instances where this forms a truly integral part of the motor, but this is usually on new cars of new design throughout. In amalgamating fresh parts with older designs some engineers have been more successful than others, but there are plenty of fine chassis of which the accessibility and the appearance are ruined utterly by a litter of attachments alongside the cylinders.

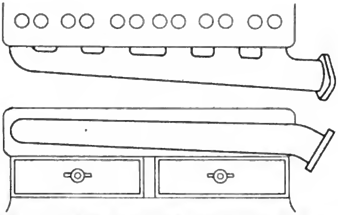


Fig. 3—Top and side views of good exhaust manifold giving clean run for burnt gas

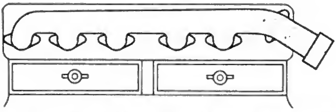


Fig. 4—Common type of exhaust manifold wherein gas has to turn two corners and is thereby baffled

Accessibility

It is very easy to argue that accessibility is of small importance in these days when cars give so very little trouble, but while this viewpoint may be right enough, it is far too often made the excuse for slovenly engineering design. A quick walk round the Grand Central Palace is proof positive that it is just as easy to incorporate the starter, the tire pump, the water pump and the magneto or distributor so that all are individually accessible, as it is to pile them in a heap so that all the lot has to come down to give proper access to any one.

Also it appears bad practice to fit attachments of this order in such positions that they spoil the accessibility of the valves, because it is certain that valves must one day be ground in, and when that day arrives the job will be quicker and cheaper if the valve springs and the tappets are easy to get at.

Detachable Cylinder Heads

What appears to be an excellent tendency from the owner's point of view is the increase in the number of cars with detachable cylinder heads. Probably their presence on many sixes is due just as much to the greater ease in handling and machining the split casting as to any desire to assist the persons who will have the job of cleaning out the combustion chambers. When detachable heads are used, however, might

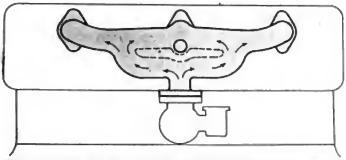


Fig. 5—Intake for six in which distance from carbureter to valve is equal for all valves

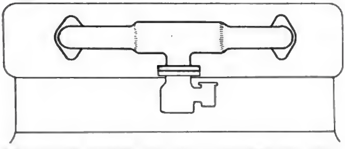


Fig. 6—T-pipe manifold with central waterjacket most used in Europe for sixes

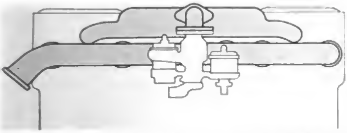


Fig. 7—Intake manifold situated where it is well warmed by exhaust, so assisting power and economy

it not be advisable on all but the very cheapest cars, to provide valve caps in addition; so that valve trouble would not necessitate removal of the head? To detach the head is easy enough in the garage, but it is no job for the roadside, and the cost of the valve caps would be so small that they could easily be given without hurting the manufacturer.

Machined Combustion Chambers

Another point in favor of the detachable head is that it enables the whole of the combustion space to be machined, and so allows of certainty that each combustion space has the same volume exactly. It is an incontestable fact that the Knight engine is far less susceptible to carbon than the ordinary poppet-valve motor, and it has never been settled to what extent this is due to the hemispherical shape of the combustion space and to what extent to the smoothness of all internal surfaces. Also it is claimed that a motor with all-machined cylinders will run more slowly when idle than the ordinary kind. In Europe there have never been enough cars with all-machined heads to enable any of these questions to be answered, but it should soon be possible to settle them in America.

Small Head Gaskets

Yet another idea appertaining to the detachable head is that there seems small reason for doing as a few firms have done and making the jacket cover a separate part: having divided the cylinder block in one horizontal plane, surely that should suffice. The design of one engine also shows that it is possible so to design a detachable head that only plain circular gaskets of two or three sizes are needed to effect the junction, and as these are less costly and more easy to obtain anywhere, their use is to be commended in preference to the single all-over gasket most commonly employed. The writer has only had experience of detachable head cylinders on cars in which the mean effective pressure was very low, and does not know whether high pressures and temperatures have ever resulted in blowing trouble. If this should have been the case he would like tentatively to put forward the suggestion that the provision of a spigot by dropping in a shallow ring of steel tube would overcome any tendency to leakage while being quite cheap. Fig. 2 shows the idea, which is not, of course, new, as it has been used often enough on other parts to protect and to locate gaskets. There are, of course, detail difficulties in applying the idea to cylinder work, but they should not be impossible to overcome.

Overhead Camshaft Preferred

At almost every automobile show in Europe any time in the past 10 years there has been a fair sprinkling of overhead-valve motors, and here in America the same probably is true. In the present show there are a few very interesting examples. Of the two types of overhead construction, that with the camshaft in the usual place within the crank case and long operating rods has never made much headway, principally because, despite all possible precautions, it is difficult to keep quiet. With the overhead camshaft the construction is generally reckoned as more costly than the usual practice and there have been many troubles with the drive for the camshaft, despite the fact that it looks the simplest thing on paper. Thus in one of the most striking designs of the overhead type in the show the writer observed a most neatly arranged vertical shaft drive with skew gearing of fairly small dimensions. If this is utterly satisfactory it will be a splendid testimonial to the material employed. Of course the touring car engine does not have to stand up to racing stresses, but it is significant that the use of a long train of spur gears for the racing Peugeot camshaft drive was decided upon after the trial and failure of skew and bevel gearing. Some of the first attempts made with gears of these types showed that the thrust set up had been sufficient to heat up the teeth to a point where they bent readily. This means that the power required for camshaft driving is more than is supposed.

Eliminate Valve Cages

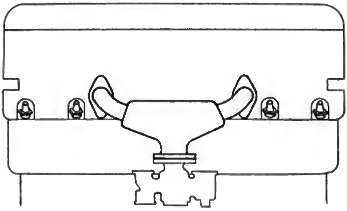
Then again there has been much trouble with valve cages, so that there is much to be said in favor of those designs in which the valves seat directly in a detachable head, for in such a case there can be no difficulty in ensuring proper cooling for the seatings.

Yet another trouble with overhead construction for touring car engines is that the greater its length the greater is the durability of a valve spring, and overhead valves are usually short in the stem so as to keep down the height of the motor.

Still, from the accessibility viewpoint as well as on account of the unquestionable advantages of the symmetrical combustion space, the valve-in-head motor is well worth keeping on with, and the enterprise of the sponsors of new endeavors in this direction is commendable.

Europe Leads in Lightness

It seems that this is a year of general tuning up, so that the brake horsepower of the average American motor has increased a good deal, despite the decrease in average rated power. This is shown by the large valves and gas passages now being employed, and in the lightness of reciprocating parts. With respect to the latter there is still possibility of advance, since the average piston and the average connecting rod are heavier than European experience shows that they need be, even supposing that quantity production is considered. This means that the 1915 motor will have a higher mean effective pressure than its predecessor, and the 1916 probably higher still.



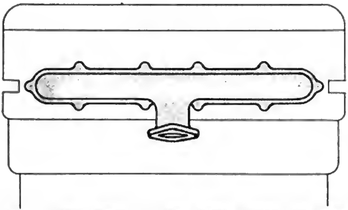


Fig. 8—Another design of Y-pipe intake manifold with bigger waterjacket

Fig. 9—Cover plate to cored passages for intake on I-head motor

Now, all troubles with high power-for-volume motors are due to high pressure, corresponding high temperature and high stresses due to reciprocating parts. Valves are one of the first parts to give trouble, by burning, and no doubt Tungsten steel is going to help. For crankshafts and connecting rods lighter weight and higher stresses call for stronger steel, and THE AUTOMOBILE announced last week that these parts were, on the average, of higher tensile material. The use of such steels means more costly machining as well as a bigger bill for raw material, so that the tuning-up process is going to cost money. That this money is not being grudged is a most healthy sign, and it means that in the happy future, to which we are all looking forward, the American manufacturer will be readier than ever to grasp the enormous foreign trade that will of necessity arise.

More Speed, More Oil

Turning to another detail of motor construction, namely, lubrication, it is to be noticed that pressure-fed oil is being supplied directly to the bearings on a majority of the better class new designs. One must not always reckon from wide averages in this as in other things, because trends are really shown by new work only. Taking an average from all cars one includes many old patterns which pull down the figures, wherefore it is true that fully forced systems of oiling are very greatly on the increase. This is the effect of bigger bearing loads engendered by higher speeds.

For the eight, with its compound lower ends on connecting rods, forced oiling is probably essential, and on all engines its presence spells greater durability for the bearings, but it is usually more difficult to get oil economy than with the splash system. Conversation with one or two exhibitors suggested that European experience in this respect was being borne out here. One fitting which has been part of the Rolls Royce for many years is a throttle for varying the pressure of oil according to the position of the gas throttle, and it has always been a source of wonder that so excellent and common sense an idea has not had general adoption. It is to be found on at least one American motor now—an eight—and engineers who have trouble with heavy oil consumption might do well to try it.

Clean Oil Filters

However, apart from such refinements, something yet remains to be done to facilitate the cleaning out of oil filters, and to assist the cooling of the oil in circulation. It is the fact that only a very few drivers will ever take the trouble to clean a filter, but is it to be wondered at when the nature of the task of removing that filter is considered? It is possible to make a filter so that it can be extracted without dirtying more than the hands, and without crawling beneath the car. If the oil pump is in the most efficient place—which is actually beneath the oil level and inside the base, then by casting a vertical chamber on the side of the crank case base the filter can be located over the pump and made to withdraw upwards on the removal of a single thumb nut. In such a car the chances of the filter being cleaned are hundreds per cent. greater than where the *position* even of the filter, may be a matter for search. Rising engine efficiency with rising bearing pressures makes the cleanliness of oil of increasing importance and, as people cannot be trusted to filter oil as it goes in, the effectiveness of the internal filter becomes vital.

Cut Down Oil

No doubt, too, the rise in motor r.p.m. will lead to the complete and final abandonment of the plunger pump in favor of the gear pattern. The appearance of scraper rings at the foot of many pistons shows that the need for keeping oil from excess in the cylinders is being attempted, but the writer has not found an example of the simplest way of scraping the cylinder, namely, the drilling of as great a number of half-inch holes in the piston skirt as it will support. This method has been used in England on racing cars as well as on touring vehicles, with the greatest success, and has the dual advantage of overcoming smoking while reducing reciprocating weight instead of increasing it as does the scraper ring.

It seems that there are sometimes troubles here due to piston slap at low speeds, and it is difficult to see why this should be so unless American tolerances on bores and pistons are very large. Certainly one of the best ways to reduce slap is to cut down piston weight, to increase the weight by making a very long piston is really trying to make a right out of two wrongs.

Wrist Pin Bushings

As to piston pin fixings, in Europe the bushed connecting rod with the pin fixed in the piston is universal, but the American method of reversing this seems to have many advantages. On one engine here the piston is bushed and the rod also, the pin being free to move in whichever it likes, and prevented from sideways motion by slipping a thin piston ring over the ends. This seems a very good idea, and is certainly one to be watched. Probably the securing ring is not necessary as it should suffice to make the pin a trifle short and to drop in a bit of bronze at each end. This was once done with success in England, but the pin was then a tight fit in the piston and not meant to move in it.

Favors Four Bearings

As to the number and proportions of crankshaft bearings it seems that four of good size are the rule on sixes. The writer has previously expressed a preference for seven bearings, but the study of the six in so many different kinds and sizes shows that the advantages all told should rest with the four-bearing construction. In discussing a contribution of the writer's to the S. A. E. talk on the ideal car last summer, Howard E. Coffin said that vibrations in sixes were due more to torsional oscillations in the shaft than to bending stresses or lack of adequate bearing support. With this view agreement is difficult to one who has studied rotary balance, because the Norton machine makes amply evident the big reactions at the bearings due to the bending distortion of a crank when run light, and without piston masses to aggravate the effect.

Also, it has been found that periodic vibrations in sixes could be cured, or at least raised above the practical range, by increasing the stiffness of the crank case. Now, when the length of the motor is important—and short length reduces torsional deformations in a shaft—it is much easier to give rigid support to the shaft by means of four big bearings than by seven little ones. It is, of course, cheaper, too, so the American practice as it stands today seems right.

Problems of Manifolding

Probably the widest differences in idea on the sixes are shown in the designs used for manifolds. For exhaust gas the best effect is usually obtainable from a separate pipe of which the section increases from front to rear and which stands clear of the block. The integral type calls for a great increase in cooling water and so means weight, while it is impossible to clean it out inside so as to give the gases a clear run. Seen in the horizontal plane the pipe is certainly best when straight, for it is easier to cast, easier to clean, easier to machine, freer in action and better to look at. It is usually only possible to use a straight pipe like this when the intake is through cored passages in the cylinder, but since it is imperative to keep the intake warm, if carburetion is to be satisfactory, there is everything in favor of the type embodying cored intakes.

Simple Ones Best

Usually it is possible to simplify the casting and to give the incoming gas a path of equal length to each cylinder, if there are two sets of cores in a six block. This means two flanges outside the casting and a branched pipe to the block from the carbureter. In the show there are all sorts of freak designs and in many cases external pipes of such length that considerable condensation must take place within them, greatly interfering with even carburetion; of course the greatest things are always claimed for them, but the writer has seen them nearly all in Europe and has watched nearly every six builder come back to the simpler job.

From the viewpoint of warming the gas thoroughly before it enters the cylinders, from the point of view of carbureter accessibility and from that of valve accessibility also, it is best to put the carbureter on the side of the block opposite to the valves and this is therefore quite rightly the general practice.

(To be Continued)

Overhead Valves Make Ferro Eight Accessible

AN eight-cylinder motor with valves in the head has been brought out by the Ferro Machine & Foundry Co., Cleveland, O.; and it is exhibited at the Biltmore Hotel, New York City. This is the first time this construction has been used in a commercial eight-cylinder motor. Many other interesting features are also noticable in this machine which is built in two models rated at 45 and 60 horsepower. The former has a 3 by 3.5 bore and stroke and the latter 3.25 by 4.

Except for the difference in size the two engines are identical. Both cylinder blocks and the top half of the crankcase are cast in one piece, the valves being in a detachable head. The rocker mechanism is completely inclosed in caps which are bolted to the heads.

Extreme accessibility has been obtained in this motor by the valve-in-head construction which allows the exhaust pipe to be carried on the outside of the cylinder blocks. The intake manifold also incorporates the water outlet from the cylinders and in this way one pipe is made to do the work of two. The thermo-syphon system is used. Further simplification has been obtained by driving the generator and two-bladed fan by a single 2-inch belt. The starting motor drives through the flywheel. The timer distributer may be any standard make.

Many details of this motor are new. For instance, the cover which incloses the valves is bolted tight so that it is noise-proof and dust-proof and retains the oil. It gives the impression that it is an integral part of the cylinder castings. These coverplates are held by three studs. The valves are operated by pressed steel rocker arms, which are an innovation. These are roughly of channel shape. Another feature is in the pivoting of these rocker arms. Instead of using a pin, a ball-and-socket joint construction is employed. The ball is formed on the end of a stud which is bolted to the valve cover plate and the socket is pressed into the rocker. The studs just mentioned are hollow and are equipped with ball-closed oil holes. Thus the ball joints can be easily oiled through these holes. The studs are adjustable so that the proper clearance between the ends of the rocker arm and the valve stem and push rod can be maintained. The cylinder head is held by eight bolts, four on each side.

A single camshaft with sixteen cams is used. It is driven by a pair of large helical gears direct from the crankshaft. By the use of a cam for each valve, the necessity for the use of valve levers is eliminated. Roller cam followers are used. It is stated that with the sixteen cam construction this motor is as easy to time as a four and no difficulty should be experienced by repairmen.

The outlet water connection is at the center of the casting on the outside. Exhaust pipes are on the outside of the castings, there being three outlets from each cylinder, individual outlets from the end ones and one outlet for the center cylinders. Pistons are fitted with three rings, two near the top to hold the compression and a larger ring around the wrist pin which has a double function: to retain the wrist pin and to prevent from scoring the cylinders and to hold compression. Connecting-rods are of the forked type, there being one bearing for two connecting-rods. The crankshaft and camshaft are carried on three main bearings of phosphor bronze.

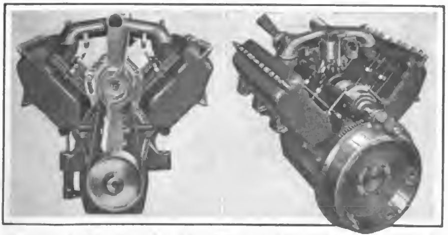
Lubrication is by a force-feed system, there being a gear pump at the front of the motor on the left side which draws oil from the bottom of the crankcase and forces it through four oil leads to the main bearings, whence the oil is distributed from the connecting-rod bearings to drilled leads in the crankshaft. Two insure an even distribution of oil to the four connecting-rod bearings. Four main leads are used. The two leads run to the two end bearings, whence oil is carried to the adjacent connecting-rod bearings. The other two leads go to the center main bearing, where one lead distributes oil to the second cylinder connecting-rod bearing and the other to the connecting-rod bearing of the third cylinder.

A feature of the generator mounting is the use of an aluminum housing which carries the generator and which allows for belt adjustment. This housing is pivoted at one side and is held by a bolt running in a set on the other side. By loosening this bolt and moving the hole housing the tension of the belt may be changed. Any standard make of generator may be installed and likewise any length of motor may be used. Dimensions:

	60 hp.	45 hp.
Compression volume in per cent. of piston displacement..	31	31
Diameter and length of crankshaft bearings:		
Front	1.75 by 2.75	1 9-16 by 2 5-16
Center	1.75 by 2.5	1 9-16 by 2
Rear	1.75 by 3.25	1 9-16 by 3
Crank pin bearing.	1.75 by 2.25	1 9-16 by 2
Valve diameter ...	1 9-32	1 11-32
Lift	1-4 inch	

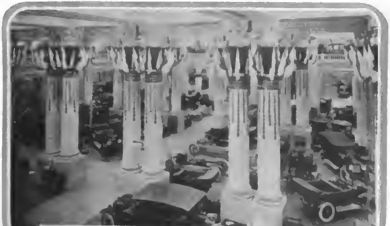
The firing order is as follows:

Right 1, left 1, right 3, left 3, right 4, left 4, right 2 and left 2. Connecting rod length is twice that of the stroke.

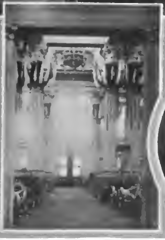


Left—Front of Ferro eight motor. Right—Rear, showing mounting of electric system, distributer and carbureter with combined water outlet and intake manifold for simplicity and waterjacketing. Note inclosed overhead valves, permitting outside exhaust

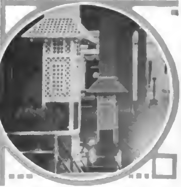
New York Show as a Persian Garden



A partial view of the first floor of the Grand Central Palace, showing the arrangement of the cars on display



A glance down the main aisle of the first floor, showing decoration scheme. The dominant colors are white, gold and crimson and the theme is a Persian garden



A glimpse of the California garden decorations at the entrance of the first floor. Lattice work, palms, etc., enhance the beauty of the stairway

Above—Some of the electric cars at the show. There are fifteen cars in all, nine broughams, three roadsters, one coupé, one cabriolet and one limousine

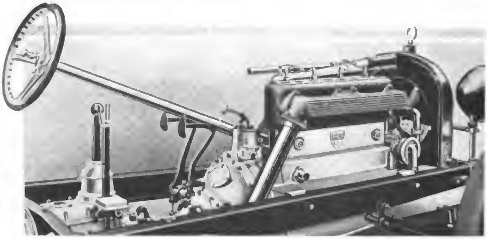
Right—One of the aisles on the second floor. Note how the theme of the decoration scheme is continued by the garlanding of the pillars

Below — Looking across the center aisle on the main floor, giving a partial view of Cadillac, Paige, Locomobile and Packard exhibits, with Oakland, Jeffery and Franklin in the background

Eleven New Chassis Seen at Show

In Addition to the Many New Bodies Eight Concerns Show Models for First Time—Remington Brings List of Eight-Cylinder Cars to Four

ELEVEN concerns awaited the opening of the show in New York before announcing their new chassis models. Some of these are models that have been expected for the past few weeks but are exhibited now for the first time. Others, however, are showing cars of which no details have heretofore been known. The latter include Mercer, Premier, Malcolm, Remington, Dort, Lexington, Jackson and National. Those cars of which details have been known but which are seen at the New York show for the first time are Chalmers, Chevrolet and Detroiter.



Mercer four-cylinder L-head block power plant, showing left drive and center control. Note steering rake

Mercer Announces New Series

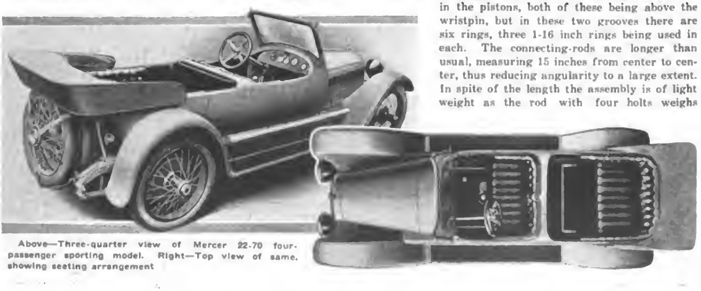
Mercer waited until the show to announce its new series of models. The new Mercers are entirely different from those of previous seasons with the exception that the policy of building medium-weight high-speed four-cylinder cars is continued. The low lines and high speed for which Mercer has always been noted are also features of the new model, for in the touring car the side line of the body is only 45 inches from the ground and the speed is guaranteed to be 1 mile in 45 seconds or 80 miles an hour.

Four cars, a six-passenger touring, four-passenger sporting, both listed at $3,000, a runabout at $2,900 and a raceabout at $2,750 make up the line. These are all mounted on the same chassis with the exception that the wheelbase of the touring and sporting models is 130 inches while the raceabout and runabout have 115 inches.

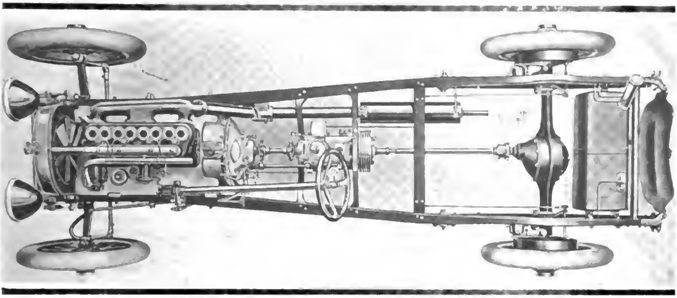
The new motor is of Chief Engineer Delling's design throughout as, in fact, is the entire new chassis. The power plant is a four-cylinder 3.75 by 6.75 L-head block with a piston displacement of 298.2 cubic inches. This gives an S. A. E. rating of 22 horsepower and the maker's rating is 70 horsepower at 1,800 revolutions per minute. The combination of these two horsepower ratings has given rise to the model name of the series which is known as 22-70.

New Mercer features are in evidence throughout the chassis. The valves are on the right side and are inclosed by an aluminum cover plate held in place by two thumbscrews. In connection with the block motor this cover plate gives an effect of simplicity to the exterior. This is heightened by the carbureter being attached directly to the cylinder casting which carries the intake manifold integrally. The magneto and water pump are set at the front of the motor and are driven from a cross-shaft. This arrangement keeps the sides of the motor smooth and clean. A web is cast between the arms of the crankcase, extending out to the frame on each side of the motor, forming a shelf which serves the purpose of a dirt seal, obviating the necessity for a mud pan.

Multiple piston rings are used. There are only two grooves in the pistons, both of these being above the wristpin, but in these two grooves there are six rings, three 1-16 inch rings being used in each. The connecting-rods are longer than usual, measuring 15 inches from center to center, thus reducing angularity to a large extent. In spite of the length the assembly is of light weight as the rod with four bolts weighs



Above—Three-quarter view of Mercer 22-70 four-passenger sporting model. Right—Top view of same, showing seating arrangement



Plan view of Mercer 22-70 chassis, showing arrangement of magneto and pump drive by means of cross shaft at front of motor. The U-S-L starting and lighting system is used. Note service brake on propeller shaft behind gearbox

but 4 pounds and 1 ounce. The crankshaft is 2.125 inches in diameter and both the main and connecting-rod bearings are of bronze lined with babbitt.

The camshaft is driven by a 2-inch Coventry chain attached to the crankshaft and to a single camshaft gear. On the crankshaft sprocket is the worm gear which drives the magneto and water pump cross-shaft. Since the magneto is on one side and the water pump on the other a balanced drive is given on the cross-shaft.

As would be expected from a motor designed for high speeds the valves are exceptionally large, having a diameter of 2.25 inches. The valve stems are threaded at the end for carrying the spring retainers and the material is tungsten steel. By the use of the threaded valve stems the tension on the valve spring can be regulated by inserting a screw-driver in the slot on the head of the valve and turning to the required adjustment. If it is desired to change a valve spring or to remove a valve it is possible to remove all the tension from the spring by turning the valve until the spring retainer is lowered sufficiently to take the strain off the spring. The push-rods and push-rod adjusting screws are good examples of how care has been taken in manufacture to keep the weight as low as possible. These are hollow. The lower ends of the push-rods are fitted with rollers which ride directly on the cams.

Five-Bearing Hollow Camshaft

The camshaft is carried on five bearings. It is of hollow section and is carried in a continuous oil bath.

Lubrication is by a high pressure system. The oil is forced to all bearing surfaces under pressure varying from 10 to 20 pounds at slow speeds to 50 and 60 pounds at high speeds. The leads are all self-contained, there being no external oil pipes in any portion of the motor. The pump carries the oil directly to the camshaft and crankshaft bearings through leads drilled through the webbing in the crankcase casting.

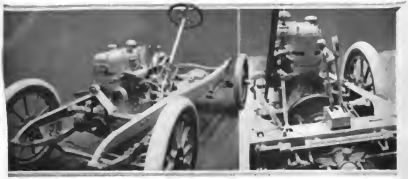
Ignition is by single Bosch high-tension system and the balance of the electrical equipment is made up by a U-S-L starting and lighting installation. This operates at 12 volts and while worked out to the special requirements of the Mercer car does not differ materially from the general U-S-L system. The apparatus consists of a motor-generator which takes the place of the flywheel. The storage battery is of 100 ampere hour capacity. The clutch is contained within the starting and generator housing on the sporting and runabout models. On the raceabout it is embodied in the flywheel as no starting and lighting system is supplied. The clutches for all bodies, however, are the same, being a dry-plate disk type.

The gearset provides four speeds and has a distinctive locking device which does not permit the gears to be shifted unless the clutch is disengaged.

The rear axle is floating. The springs are semi-elliptic all around, being 2.5 by 38 in front and on the touring and sporting models 2.75 by 58 on the rear. On the runabout and the raceabout the rear springs are 2.5 by 52. The rear springs are underslung and are located directly underneath the side rail. The drive is of the Hotchkiss type, both thrust and torque being taken through the rear springs.

A channel section frame is used with an arch over the rear axle. The front axle is an inverted Elliott design. The brake for service use is on the propeller shaft while the emergency brakes are on 16-inch drums attached to the rear wheels. Both the shaft and rear wheel brake are internal

Left side of Mercer 22-70 motor. Note clean design, radiator mounting and arrangement of magneto on transverse shaft



Left—Chassis of new L head block cast six-cylinder Chalmers model 35. Note clean design of motor. Right—View of the motor from the rear, showing cross member of frame carrying center gearshift levers

expanding. The wheels are wire on the sporting and raceabout cars and on the touring they are wood with Howard demountable rims. Wire wheels are Rudge-Whitworth.

The cars are sold fully equipped, all models excepting the speedster design being fitted with a one-man top, Jiffy curtains, pump, jack, windshield, speedometer and a full set of tools. On the cars using wire wheels an extra wire wheel is supplied and on those using the wood wheels an extra demountable rim. The tire size is 34 by 4.5 on the cars using the 130-inch wheelbase and 32 by 4 on the cars using the 115-inch wheelbase.

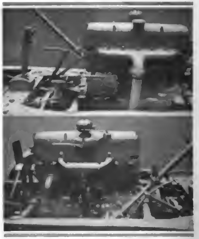
Chalmers Exhibits Overhead Valve Motor

Seen for the first time at the New York show the Chalmers new six, with its overhead camshaft motor, is attracting more than passing attention. This car, selling at $1,400, and having throughout specifications of a sturdy design, is an event in the field of low-priced sixes.

It is in the power plant that the most important features of this new car stand out. The 3.125 by 5-inch cylinders are cast in a block with a unit removable head. While the valves are in the head of the motor the drive is a new system for use in connection with this type of motor. A shaft runs transversely from the crankshaft to the right side of the cylinder block, where it connects through spiral gears with a shaft running vertically upward to drive the camshaft. None of this shafting can be seen on the exterior of the motor, but the vertical shaft is extended above the casing and on this is mounted the distributor for the Atwater Kent ignition system. The use of the overhead camshaft is designed to give a direct action on the valves and to overcome the objection of noise which is apt to develop in long rods and linkage.

The camshaft is driven by steel and bronze gears and carries the cams integral. The inlet valves are nickel steel and the exhaust valves tungsten steel. They are all fully inclosed and are oiled from a hollow camshaft. The cams provide a 5-16-inch lift for the valves.

The carbureter is a Rayfield hot-water jacketed and with the intake air heated by contact with the exhaust manifold. There is a gasoline adjustment on the dash which controls the supply through the nozzle. A special intake manifold priming device is also on the dash, thus giving a hand control of the carbureter functions for both climatic and varying grades of gasoline conditions.



Two views of the new Chalmers six-cylinder motor. The upper shows the exhaust side, giving an idea of the compact, clean design while the lower shows the intake side. Note the short manifold high carbureter mounting and spark plugs set in at the side

The drive is taken by a dry-plate multiple-disk clutch which has alternate Raybestos and steel plates. The gearset provides three speeds and the drive is through an inclosed shaft with a torsion tube bolted to the housing of the gearset. The axle is floating with a pressed steel housing. The rear wheels are carried on Hyatt high-duty roller bearings and the differential on Timken taper rollers. The brakes are on the rear wheel hubs with the service set contracting, being

14.375 inches in diameter and 2.25 face width. The outer emergency brakes are expanding and have a diameter of 14 inches and a face width of 2 inches.

The bodies are sheet metal over a wood frame and are made in five-passenger touring style only. They are on a 120-inch wheelbase and have 34 by 4-inch tires. The equipment is complete with a Gray & Davis two-unit starting and lighting system, one-man Pantasote top, windshield, double bulb headlights, demountable rims with one extra rim, Stewart speedometer, tire carrier, magnetic gasoline gauge, Klaxon horn, license brackets, ignition switch lock, Collins adjustable curtains, tonneau carpet, driving compartment rubber mat, robe and foot rails, pump, jack, full set of tools and tire repair outfit.

Premier Adds T-Head Six

In addition to the Weidely model the Premier company has announced a new model, seen for the first time at the New York show. This is a six with a 4 by 5.5, T-head motor with the cylinders cast in threes. The motor is of Premier manufacture and has a water jacketed intake and multiple exhaust. Carbureter is a Rayfield fed by the Stewart-Warner vacuum system.

Lubrication is by a combined pressure and splash system with the oil carried in the customary reservoir beneath the crankcase and fed by a gear pump to the main bearings from which it flows to the splash troughs. Cooling is by water circulated by a gear-driven centrifugal pump through a V-shaped radiator. Ignition, lighting and starting is taken care of by a combination Remy outfit which operates at 6 volts. The headlights are double bulbs without side lamps. There is a combination tail and license lamp and lights for the instrument board.

New Chalmers model of six-cylinder touring car

The clutch is a disk with dry plates and the gearset provides three speeds. The drive is by shaft to a Timken floating rear axle with helical bevel gears. While the wheelbase is the same for both the touring and roadster models, 132.5 inches, the tires are 34 by 4.5 on the touring model and 35 by 5 on the roadster. The springs are semi-elliptic all around, those in the rear being of exceptional length, 60 inches, with shackled ends. Shock absorbers are provided as standard equipment.

The equipment is complete at the purchase price, $1,985, for both touring and roadster. In addition there is a coupelet for which the price has not as yet been set. The standard color is royal blue and equipment consists of a one-man top, Jiffy curtains, envelope, windshield, foot-rail, robe-rail, Warner speedometer, jack, Kellogg tire pump, trouble light, extra rim and full set of tools. There is a tire carrier on the rear for carrying one or two spare tires.

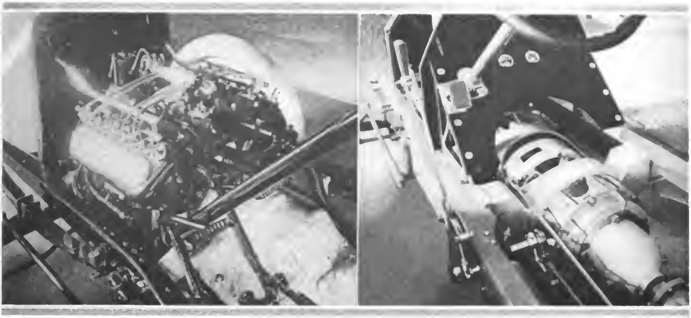
The body is a moulded six-passenger design with a long cowl constructed of sheet metal panels over steel braced oak framework. The hood is a stamping and the fenders are flanged to give additional rigidity. Upholstery is in leather, tufted and lined with curled hair. The seats are divided in front. Wire wheels are sold at $50 extra on the touring car and on the roadster they are optional equipment.

Malcolm Has Small Four

The Malcolm, a product of the Malcolm Motor Co., of Detroit, Mich., and made only in roadster form, is one of the new models to be first seen at the show. This is a light car job throughout, having an L-head block cast motor of 2.875 by 4 dimensions with a two-bearing crankshaft. The crankshaft is exceptionally large, having a diameter of 2.5 inches. The motor is designed for lightness and hence shows very little in the way of exterior fittings. The clean appearance is heightened by the use of thermo syphon cooling, which eliminates the water pump, and by inclosed valve action with thumb screws to hold the cover plates in position.

Ignition is by the Atwater Kent battery system and the carbureter is a Zenith. The price of $625 is exclusive of the electric lighting and starting system, but when this is fitted at $70 additional it is an Allis-Chalmers. The clutch is a cone, and the gearbox contains a three-speed selective gearset. The wheelbase is 100 inches and the tires are 30 by 3. The wheels are wood, and left steering and center control are used. Both the front and rear axles are Weston, the rear axle being semi-floating and a [illegible]

Manifold and valve side of new Dort four-cylinder power plant, showing the center control and with section cut away to show twin exhaust ports



Left—Eight-cylinder motor of the new Briggs-Detroiter. Note carbureter and distributer mounted between cylinder blocks. Also note flexible exhaust manifolds. Right—Electric transmission used on the Owen, which takes the place of clutch, gearbox, etc.

The electrical equipment is the only option offered at an extra price, as all the other equipment is included with the car. A feature is the silk mohair top.

Detroiter Eight Seen at Show

The Detroiter eight, while announced shortly before the show, makes its first appearance at this event. It is equipped with a Perkins eight-cylinder motor with the cylinders cast in fours and arranged in a V in accordance with the scheme so far generally adopted by users of the eight motor. Other than the new motor the car does not vary to any great degree from the previous Detroiter. In fitting the new motor the wheelbase did not have to be altered and the entire remaining specifications of the car remain practically the same. The tires, however, are slightly larger, being 33 by 4 instead of 32 by 3.5.

The new eight motor is a 2.75 by 4.5, with the valves on the left for the left block of four cylinders and on the right for the right cylinders. The two-cylinder blocks bolt to a common crankcase and have their center lines at an angle of 90 degrees to one another. With this arrangement a single crankshaft is used which is similar in design to that of a four-cylinder type. The connecting-rods of opposite cylinders attach to the same bearing, one having a yoke end and the other a rod going between the arms of the yoke.

Only one camshaft is required and the cams for each set of cylinders operate the valves of the opposite cylinder also.

The carbureter is a Rayfield, one instrument being sufficient for the entire eight cylinders. This is mounted between the two blocks of four cylinders and so arranged with the intake manifold that an equal distribution of gases will be fed to both sides of the V. Ignition is by the Atwater Kent system and starting and lighting by the Remy two-unit device.

In revamping the chassis light weight has been sought in the use of drop forgings in place of castings. The gasoline tank is now under the cowl, and while this was used in the four-cylinder models of this season it is still a 1915 departure for the Detroiter company.

The clutch is a cone and the gearset provides three speeds. Both these units are new, as the clutch was a disk in the four-cylinder model. Both the clutch and gearbox are products of the Massnick-Phipps concern. Steering is on the left and is accomplished by a Gemmer gear. Control is in the center. Both the front and rear axles are of Weston-Mott manufacture.

So far the only body supplied is a touring, but both that and a roadster are marketed as regular stock at $1,295. Equipment is complete as generally offered, consisting of a one-man top, speedometer, windshield, pump, jack and a full set of tools. The tires are Goodrich and are non-skid in the rear.

Dort in Two Chassis Sizes

The Dort car manufactured by the Dort Motor Car Co., a new concern which has recently incorporated for $500,000 under the laws of Michigan, and which consists largely of the stockholders of the Durant-Dort Carriage Co., made its first appearance at the New York show.

While practically on one chassis, as far as general design is concerned, the touring and roadster models which make up the line are carried on different wheelbases, have different size motors and different tires. The touring model, which sells for $680 without starter, has a 105-inch wheelbase, 30 by 3.5 tires and a 3.25 by 5 powerplant. The roadster, selling for $495 without starting equipment, has a 92-inch wheelbase, 30 by 3 inch tires and 3 by 4 motor.

Both chassis have the same characteristics in other particulars. The motors are block cast, having four L-head cylinders. The motor itself is a product of the Dort company, which is closely allied with the Chevrolet and other Flint industries. It is designed for light high-speed work, has a two-bearing crankshaft and the distinctive feature of a large diameter for this unit. The crankshaft has a diameter of 1.75 inch and is carried on exceptionally long bearings, the front measuring 3 5-16 inches and the rear 4 1-16 inches. Another distinctive feature of the motor is the twin ejector type of exhaust. With this manifold cylinders 1 and 4 exhaust in one passage and 3 and 2 in another, thus avoiding any chance of dead gases entering the wrong cylinder and at the same time helping to create a vacuum into which it is easy for the motor to exhaust at low pressure.

Ignition is by the Connecticut battery system and the carbureter is a Marvel model H. The lighting and starting system which, when electric, sells for an additional $45, is the Apleo. When this is not supplied an acetylene generator and full set of lamps take its place.

The clutch is a leather-faced cone and the gearbox provides three speeds with a selective arrangement. A feature of the car is that the entire drive from the clutch to the rear wheels is taken through 3.5 per cent. nickel steel as the gears in the gearbox, the 1-inch propeller shaft and the bevel-gear rear axle with its 1.25-inch shafts are all of this material. The spring suspension is a floating cantilever with the drive taken through the torque tube. The manufacture of the rear axle is Walker-Weiss.

The touring body has a five-passenger seating capacity and the standard colors are green and red with black. On the roadster which seats two passengers the colors are black and green. The equipment on the touring car consists of a one-man top, electric horn, generator, windshield, speedometer, license brackets and a full set of tools. The equipment on the roadster is the same with the exception of the windshield.

Remington Announces an Eight

One of the eight-cylinder surprises at the New York show was the Remington, fitted with a Perkins V motor in two blocks of four and selling in touring and roadster forms at $1,495 on a 116-inch wheelbase.

As is customary in the eights, the cylinders are L-head with the valves on the right side of the right block and the left side of the left block. A single crankshaft is used and the two blocks of four cylinders bolt to the common crankcase. The cylinder dimensions of the Remington eight are 3.125 by 4.5. The connecting-rods are the fork and yoke design providing for a crankshaft which does not differ from that of a four-cylinder motor. The valves are operated off a common camshaft and a single carbureter provides for all eight cylinders through a symmetrically designed intake which is arranged to feed both sides of the V and to provide equal distribution of the gas.

Ignition is by a battery system, and lighting and starting by Gray & Davis. The clutch is a disk and the gearbox provides three speeds. The drive is taken through a shaft and bevel floating axle of Salisbury manufacture. The wheels are wire and the tires 34 by 4 inches. Control is in the center, and left or right drive is optional.

The bodies furnished with this car are not radical departures from the moulded forms that have come into fashion during the past two seasons. They are of five and two passenger capacities and their standard color is Brewster green The equipment is inclusive at the quoted price, consisting of one-man top, windshield, speedometer, demountable rims with one extra, license brackets and a full set of tools

Chevrolet Shows New Four

A new car at $490 is the offering of the Chevrolet Co., exhibited for the first time at the show. This car, while smaller than any put out by the Chevrolet company in the previous season, follows very closely along the lines of the other Chevrolet cars. It has a Mason valve-in-head motor with a detachable cover-plate concealing the overhead valve action and at the same time helping to silence the motor. The detachable head is aluminum and can be lifted off readily when it is necessary to inspect the valve mechanism.

The dimensions of the new four which is a block design are 3 5-16 by 4 3-16. The cylinder head is a one-piece casting secured to the cylinder block by bolts making a readily removable assembly. Lubrication is by circulating splash and ignition by a single Simms system with hand control. The carbureter is a Zenith and the starting and lighting system an Auto-Lite 6-volt installation.

A cone clutch delivers the power to a three-speed selective gearset located amidships. Final drive is by bevel gear to a semi-floating rear axle. The tire size is 30 by 3 inches all around and the wheelbase 102 inches. The wheels are wood and the car has left drive with center control.

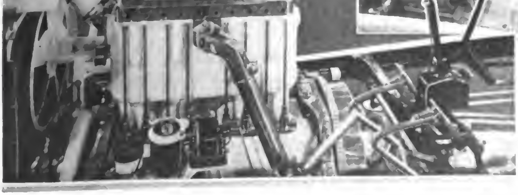
The all-steel body supplied with the new model is a five-passenger touring and it is fully equipped with top, windshield, speedometer, jack, pump and a full set of tools. The purchase price includes the lighting and starting system and a full set of electric lamps.

Lexington Adopts a T-Head

The new Lexington four was first exhibited at the New York show. It is changed in several respects from the four of last season, having gone to the longer stroke type and being one of the few examples of where a concern has shifted from the I-head type of motor to the T-head. The motor is now a Teetor 3.875 by 5.25, with its four cylinders cast in a block. Another point in which a change has been made is in the spring suspension, which is now cantilever instead of three-quarter elliptic. Starting, lighting and ignition is by the Westinghouse combination system and the wheelbase is 115 inches.

The use of vacuum feed on this model has enabled the designers to secure a more accessible arrangement of the carbureter and to shift the gasoline tank from under the

(Continued on page 39)



Above—Intake side of new four-cylinder Inter-State, showing mounting of Bendix gear on flywheel

Left—Exhaust side of same power plant, showing mounting of distributer. Also note detachable valve cover

Forty Cars at Importers' Salon

General view of the salon for imported automobiles on the floor of the grand ballroom at the Hotel Astor

Nine Manufacturers of Cars,. Three Body Builders and Three Tire Makers Exhibit—Two American Car Firms

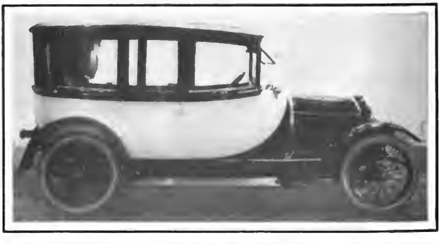
NEW YORK CITY, Jan. 2—With forty examples of foreign and domestic elegance on the spacious floors of the Astor ballroom, the Importers' Salon opened here today. The products of eight foreign manufacturers and two Americans are on exhibition, in addition to the products of several of the representative body makers of England, France, Belgium and the United States. The foreign manufacturers represented are DeDion-Bouton, Peugeot, Isotta-Fraschini, Lancia, Renault Frères, Rolls-Royce, Sheffield-Simplex and Delaunay-Belleville. The body makers represented are Holbrook, Locke and Brewster. In addition to these there are several body manufacturers who have their products incorporated with the exhibits of the manufacturers. Faure, Dunlop and Hardmann tires are also shown.

In spite of disturbed conditions abroad several new models are to be seen in the exhibits at the Salon. DeDion shows six cars, two mounted on 50-horsepower, eight-cylinder chassis, one on a 20-horsepower eight-cylinder, and two with different bodies on a 16-horsepower four-cylinder chassis.

The two touring car bodies are built by Holbrook and are streamline touring models with the double cowl which has been the feature of foreign bodies of elegance during the past year. On the 20-horsepower eight there is a limousine by Healey & Co. On one of the 16-horsepower fours there is a landaulet by Healey and on the other an inside drive body by Holbrook.

DeDion Bodies New

With the exception of the body work the DeDion chassis has had no alteration during the past year. The bodies, however, show the effect of a year's development in moulded design. The touring bodies, following the practice now used by the leading body makers, are in dull oil finish. Town car bodies, such as limousines, landaulets and inside drive cars are keeping the polished surface.



Glass-cabin launch body on the DeDion exhibit, which was one of the body features of the show

Fiat has made no important changes in mechanical design but some of the motor and chassis dimensions are slightly larger to accommodate the longer bodies. The wheelbase has been increased 2 inches on both the 20-30 and the light 30 which are on display. Altogether Fiat is showing six cars. On the 20-30 there is a limousine and a coupé by Fleetwood and on the light 30 a touring, limousine, sedan and a runabout by Brewster. The feature of Fiat exterior is in the use of the moulded radiator which gives an elliptical appearance to the front of the car. The body work on these cars also exhibits a tendency toward the oil finish for all around work and the polished finish for town use. The fitting of the one-man top on cars of higher price is brought out strongly by its use on the bodies exhibited at the Salon.

Peugeot is showing four cars. These are a stripped chassis, a Baby Peugeot, a racing car and a five-passenger touring body. The latter is an example of quiet luxury in this standard type of body. It is from the plant of G. Mossier, Neuilly on Seine, and is one of the striking bodies at the show.

The Isotta exhibit includes two touring cars, both of seven-passenger capacity, a seven-passenger collapsible landaulet, a special high-speed roadster and a stripped chassis. One of the touring cars, which is mounted on a 45-55 chassis, is a striking adaptation of the streamline design. It is black with satin finish. The seven-passenger body on the 12-horsepower chassis has an aisle between the front seats. A special feature on both these cars is the inclosing of every moving part.

Isotta Has Front Wheel Brakes

The Isotta exhibit is of interest in that it is an example of the use of front wheel brakes. On one of the models there is also a brake fitted on the transmission shaft, giving three sets. The special 55 roadster shows a departure from the regular 55 car which is furnished with a touring body in that it is an example of light weight construction throughout. It has the same dimensions as far as the power plant is concerned as the regular 55 but in addition it is fitted with hollow connecting-rods, a hollow driveshaft and lighter frame, giving a greatly reduced weight and rendering possible high speeds. It is classified as a gentlemen's roadster and is a good example of a luxurious speed type. It has a seating capacity of three passengers. The wheelbase is much shorter than that of the regular 55 being 129 inches as compared to 135 on the touring cars mounted on this chassis. The motor is 120 by 160 millimeters or, in inches, 4.2 by 4.6.

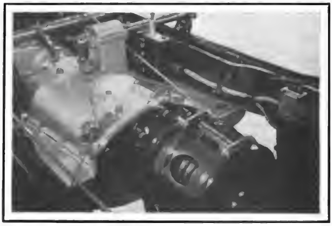
On the 25-35 there is a Vanden Plas collapsible body that is of the design which bears its name but which has been made in this country.

A striking feature of the DeDion exhibit is a boat-line touring car with white body and having black hood and black running gear. No top or windshield is shown on this body and in place of the side lamps there are ventilating cowls which give the appearance of a marine body.

There are nine Lancia cars exhibited. Four of these have Holbrook bodies showing original developments of the limousine, landaulet, coupé and inside drive type. Two are by Hayes and Miller showing a special design of four-passenger car and a runabout and three are by Fleetwood. These are an inside drive sporting type, a limousine and a coupélet. In addition there is a stripped chassis. No mechanical changes are to be noted, the luxurious bodies being the feature. The high spots in Lancia design are the compact block-cast motor and the chain-tightened brake on the propeller shaft.

Rear construction of the Sheffield-Simplex, a newcomer to the salon

Peugeot gearset housing of cast aluminum, showing a neat support of the control linkage



Simplex gearset and transmission brake which has been adopted for this season

Sheffield-Simplex a Newcomer

Sheffield-Simplex is a new arrival to the ranks of Salon exhibitors this season. The 30-5 chassis which is in company with another having a genuine Brussels Vanden Plas body. The Sheffield-Simplex is fitted with the U. S. L. starting and lighting system and has a Lanchester worm drive. The frame is of pressed nickel steel and throughout Sheffield steel is used in the construction work. All the fittings are nickel-plated and the springs are floating cantilevers.

Renault has eight cars at the exhibit. They are on five chassis. Four of these are fours and the other a six. All the bodies on the Renault cars are imported. They represent the works of Kellner and Rothschild of Paris and Vanden Plas of Brussels. The Renault concern is another example where a concern has taken a standard model and cut it down to light weight for use as a special high speed sporting model. The special car is a three-passenger runabout on an 18-30 chassis. It has been lightened by the use of hollow parts, lighter frame sections, etc. The power plant dimensions and the drive units remain the same as on the heavier car.

Mechanically the Rolls-Royce cars remain the same as they have for the past five seasons. There is one chassis, a six, and at the exhibit this is shown dressed in four different body styles. In addition to this there is a stripped chassis which has just arrived from the works of the British manufacturer. The bodies shown are both imported and domestic. Two are the works of Barker & Co., London. These are a

(*Continued on page* 25)

Magneto vs. Battery Coil—From Automobile Drivers' Viewpoint

The Automobile Engineer's Forum

Two Complete Sets of Spark Plugs with Corresponding High-Tension Cables Give Security from Troubles on the Road—Likes Low-Tension Magneto with Separate High-Tension Coil

By Charles S. Manierre

NEW YORK CITY—Editor THE AUTOMOBILE:—You have recently published two very interesting articles on the subject of ignition, one written from the standpoint of the magneto maker and the other from that of those interested in the storage battery. There seems to be room for a third communication, from the standpoint of the man who drives.

Hidden away from observation and needing no attention, having no moving parts, and referred to only casually in instructions sent with cars, probably unknown to many otherwise expert drivers, is the condenser. I take it that no one can read the articles published by you on ignition intelligently who has not some idea of the operation of this adjunct to the ignition system.

The condenser may be briefly described as a series of leaves of tin foil, each separated from the other by parafine paper, and each alternate leaf connected so that by a single wire it is joined to the low-tension current wire on either side of the point where the platinum contacts make and break the circuit.

The object of the device is to receive the rush of current as contact is broken and to hold it in storage, as it were, until contact closes. There is never at any time a highway for the current through the platinum leaves. It takes a brief but definite time for the current, when contact is made, to build up, as the saying is, to a point where a fat spark is obtained.

Dry Cell Type Simplest

Of course the simplest type of ignition system is that with dry cells and a timer and vibrator. The demerit of this system is, I believe, that the contact is broken by the vibrator before the spark has time to build up as it should and that a shower of sparks, all worthless but the first, results from the usual vibrator.

A refinement of the vibrator by means of a fine supplemental wire, using practically no current, gives but a single spark, but the opportunity for building up is still lacking.

The low-tension magneto has the advantage over this system in that, provided the motor is running fast enough to generate a sufficient intensity of current, the contacts yet remain together and are only opened momentarily for the production of a spark. This opening, being mechanical, occurs with great accuracy, and the building up of the spark even at the highest speeds is thoroughly satisfactory. In fact, the faster the motor runs the more generous is the spark.

The difficulty with the system is that it requires a set of dry cells on which the motor is to be run when turning at very low speed, and for starting.

When the electric cranking and lighting systems became general, many of the cars discarded the magneto and advertised that they had the magneto type of ignition, although the current was furnished from the storage battery. This was a fair enough description, for the reason that instead of using a vibrator with the comparatively large supply of current available, they allowed it to run past the contact points in the contact breaker and the building up for spark purposes was similar to that of the magneto, except that the spark is as well built up or better at the low speed of starting and the lowest speed of running as it would be in the best of magnetos.

I think I am correct in saying that it is not uncommon for makers who use the storage battery to supply for emergency purposes a set of dry cells. It would seem probable that these would be repeatedly run out by any very continuous use of them on a circuit which demanded such a semi-continuous current.

For the average man probably any of the systems in use is sufficiently good, particularly if one is within convenient reach of supply and repair shops. With my limited experience, however, if I were expecting to get some distance from expert assistance, I would pin my faith upon a reliable low-tension magneto with its own high-tension coil separate, or possibly one of the newer high-tension magnetos capable of generating a spark to start the car, and with that outfit, a separate set of spark plugs, a dry cell battery and a one spark producing vibrator.

Two complete sets of spark plugs, with corresponding high-tension cables may give a somewhat crowded appearance under the engine head, but on the other hand probably two-thirds or more of the minor breakdowns are due to ignition, and it is frequently as important to be able to switch in an entirely new system of ignition as it is to jack up a wheel and replace a blown out casing with the spare rim and tire ready to run.

My own car is fitted in the above way and there have been instances where I would have been very much inconvenienced if I had not been so provided. Even when time is not valuable, it is much pleasanter to attend to some minor breakdown at home than to hold up a party on the road while the difficulty is taken care of, and not infrequently the mere switching in for a few moments of the other set will take care of the oil or carbon which is causing one of the spark plugs to miss.

Also, in searching for engine troubles, the mere fact that the trouble persists after switching in the other set of plugs gives one the information that the difficulty is in no wise connected with the sparking system.

Two Separate Systems

It has always seemed to me a pity that the motors built today are not provided with means for two entirely separate systems of ignition, one of which should be the dry-cell system, including timer, distributer, spark plugs, etc.

It would be comparatively easy for the private owner to install all of these items on most engines with the single exception of the extra timer, and the aggregate weight of all of the items is not great.

It would seem to be a matter of no great expense to build engines so that such an attachment could be made if desired, and it ought not to be on the same shaft with the regular timer, for the reason that through the loss of the shaft key there might be a shifting of one or the other timer which would not otherwise affect the engine. For example, if the shaft still continued to operate in connection with the oil reservoir and water system, this could be done.

If I were in the market for a new car, the fact that a car provided for two complete ignition systems would have considerable weight with me in making a choice.

Evils of Complication

Admitting fully the inferior performance of the dry cell batteries and vibrator, nevertheless, the extreme simplicity of the system and the ability which it gives the driver to follow out, from one end to the other, the whole ignition circuit to learn what is wrong and probably to be able to remedy it, is a great promoter of confidence and of a feeling that whatever else may happen, the spark will not fail him until he reaches his destination. For effective running and an economical use of gasoline and for many other virtues we may laud the other systems and use them as a regular sparking outfit, but when they get out of order, they are, in some of their parts at least, quite beyond the skill of nearly all drivers, and the mere addition to the system of dry cells only partially remedies the defect. The puzzle presented is complicated by the more refined system being mixed up with the one which is more simple.—CHARLES E. MANIERRE.

Likes High-Tension Magneto With Automatic Control

By C. J. Morrison

Chief Engineer Meyer, Morrison & Co., Inc.

NEW YORK CITY—Editor THE AUTOMOBILE:—The discussion of various questions pertaining to the automobile are very interesting and many are educational. Such discussions cite experiences, tests, chemical formulas, mathematical calculations, etc., and draw conclusions which must be either accepted as true or disproved by some acceptable method. However, there is another class of discussion which simply makes statements or contradicts other statements and offers no proof. Such contributions are of little value and may even be misleading.

Proofs Wanted

The discussion of battery-coil versus high-tension magneto ignition has consisted chiefly of statements unsupported by proofs. If either method has points of superiority, the facts should be known and the only way to make them known is to conduct tests under the supervision of impartial observers. Such a series of tests could be easily made and would be well worth the cost.

In THE AUTOMOBILE for December 17 H. E. Rice makes a number of statements which are contradicted by everyday experience. This fact causes his whole discussion to be doubted. His key statement: "In a well-designed ignition equipment the spark should be uniform throughout the entire speed range of the motor," has never been proved by tests and is not even believed by many engineers. All recent, high-speed runs have been made with magneto ignition which gives the hottest spark at the highest speeds. If this is undesirable, why do not the racing drivers use battery ignition?

Every time my car is cranked, which is always by hand, it disproves the statement that a high-tension magneto will not furnish a sufficiently hot spark for starting at ordinary cranking speeds. As the cylinders are 4 1-4 inches with no provision for compression relief there is little probability that the cranking is faster than ordinary. In fact when the mixture is right it will start on the magneto with a quarter turn, although the car has made 30,000 miles and the only attention to the magneto has been a few drops of oil and an occasional cleaning. My car, in common with all others of the same make, has no provision for furnishing a spark other than a high-tension magneto. Investigations of many cars equipped with self-starters and dual ignition revealed the fact that starting was almost invariably on the magneto and that in many cases the battery connections had been taken off. Why then should battery ignition be compared only with the dual system?

The trouble in starting in cold weather is not with the spark, but in persuading present day gasoline to vaporize. This statement is generally accepted as a fact but the doubtful can easily demonstrate to their own satisfaction. Let one who wishes to demonstrate, determine first in the usual way that the spark is present, throw off the switch and crank a few turns with the throttle in the starting position, then throw on the switch and give a half turn. If the mixture is right, the motor will start, while if it is not right neither magneto nor battery will avail.

Automatic Spark Control

The conclusion that a magneto-equipped car requires a spark control lever and its intelligent handling shows ignorance of common practice. As long ago as 1909 the Franklin discarded the spark control lever and substituted automatic control. Surely, in the face of recent tests, no one will accuse the Franklin of being inefficient.

Let us have some conclusive tests and a solution of the ignition problem. All motorists are interested.—C. J. MORRISON, chief engineer, Meyer, Morrison & Co., Inc.

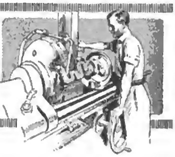
U. S. Leads In Car Exports to South Africa

TOLEDO, O., Jan. 2—Figures furnished by one of the South African distributors of the Willys-Overland Co., showing the growth of imports of American-built cars in that territory, prove interesting. Car imports from England were falling off rapidly in proportion to the development of the automobile movement in English territory long before the declaration of war.

In the race for supremacy, which may be said to have started in 1909, England has fallen far behind the position which she had hitherto occupied. In 1908 the total car imports from the United States were valued at a little more than $5,000. The following year they sprang to $90,073, and for the 4 years 1909-1912 their total value was $1,043,515, or 29 per cent. of the value of cars imported from England for the quadrennial period.

Imports for 1913 from America were $2,623,648 as against $2,119,029 for England, or more than 23 per cent. in excess of England's total.

The Rostrum



This department is for the instruction of the readers and all are at liberty to ask questions. Give full name and address so that we may send you a reply by letter if there is no space in the Rostrum. If you wish to sign a fictitious name, also sign your own.

General Directions for Painting

EDITOR THE AUTOMOBILE:—Although you have probably published several times suggestions for repainting an automobile in an amateur way and still so as to get a good-looking job, I cannot find anything in the books I have, and wish to ask for this information.

I have a small touring car which is now painted dark on the body and cream on the running gear, and I wish to paint it all dark blue or black. The paint on the body is chipped and cracked very badly and will probably all have to come off. Kindly advise how many coats of paint from the metal filler up it will require and what they should be. Also advise what the paint used for striping or blocking off is composed of, and what kind of varnish is used.

Watertown, N. Y. SUBSCRIBER.

—By careful effort you can do a fairly satisfactory job of painting, but you cannot expect to equal the work done by an expert. The materials may be obtained from any paint manufacturer.

First of all, the old paint must be removed, and this is done by applying a paint remover and scraping the old paint off with a putty knife. One gallon will be required.

If it is a wood body, a lead coat or a wood filler must now be applied to fill the small roughnesses in the surface, and if the body is metal a metal primer should be put on. The wood filler and the metal primer may be bought ready mixed, and one quart will be required. The lead coat may be made by adding a small amount of turpentine and boiled oil in equal parts to 1 pound of white lead. The mixture should be of a consistency to flow freely but not too freely.

A lead coat is then applied whether the body be metal or wood, the lead being merely a mixture of white lead, and turpentine and boiled oil in equal parts.

Three coats of color are then applied. The color comes in the form of a paste and is mixed with turpentine to make it flow. Somewhat over a pound will be required.

Next, a little over a pound of color is mixed with an equal amount of clear rubbing varnish, and three coats of this mixture are applied. After each coat dries the color-varnish is rubbed with powdered pumice stone and water.

Then the striping is put on, the job is finished by applying one coat of finishing varnish. About two quarts will be required.

Lack of Power—Poor Adjustment

Editor THE AUTOMOBILE:—1—What suggestion can you offer which will enable me to get more power from my Hupmobile model 20 car?

2—Would it be possible to install a larger motor and use the same transmission, or would it be better to get a new motor and transmission combined?

3—Would reboring the engine give me very much more horsepower?

This car is geared 4.2 to 1, but does not seem to have quite enough power on high.

Washington, Pa. J. M. PRIGG.

—1—It is inadvisable to make any changes in this car. If it is in proper condition it should be powerful enough for you. See that the valves are ground and the push rods properly adjusted, that the pistons, rings and cylinders are not badly worn, that the carbureter and magneto are functioning correctly, and that there are no places where an excess power is consumed in friction.

If the compression is good, then the valves and pistons are tight but if the compression is poor the exhaust valves should first be examined, and any that are pitted or carbonized should be ground. Then with the motor warm, adjust the push rods so that the clearance between valve stem and push rod is .01 inch. Should this not improve the compression, new rings or possibly rebored cylinders and slightly larger pistons will be required.

If the car is slow to pick up when the throttle is opened, it is likely that the trouble is poor carbureter adjustment. Not knowing what make of carbureter you are using, we would advise changing each adjustment a small amount at a time until the best setting is found.

Clean the spark plugs and adjust the gaps to between 1-64 and 1-32 inch. Tighten all electrical connections and then examine the breaker mechanism. The distance between the points when the circuit is broken should be 1-64 inch and the contacting surfaces should be flat so that when they touch they will meet squarely. If these surfaces are not in proper condition they should be smoothed with a fine file such as a nail file, and then adjusted.

If the car still lacks power jack up the wheels one by one and rotate them by hand, noting whether it takes very much effort. Likewise rotate the gearset shafts. This will locate binding brakes, bearings, etc.

2—You might install a larger motor, but it would put a heavy strain on the whole car. The driving strain on the clutch gearset, drive shaft and rear axle would be increased, and the larger weight of the bigger motor would throw more work on the springs and the tires in front. But aside from this it would not be wise to put in a new motor because it would cost more than the car is worth now, and probably more than you could sell the car for even with the new motor in it.

Similar objections apply to the motor and gearset. Of course the new clutch and gearset would be better able to carry the load of the larger motor, but the extra weight of the complete new power plant would be very hard on frame, springs and tires, and the strain on the drive shaft and rear axle would also be great.

3—Reboring the cylinders would give slightly increased power but not enough to make it worth while to go to this expense unless the engine is in exceptionally poor condition.

To Wire for Speedometer Light

Editor THE AUTOMOBILE:—I have a Maxwell model 25, equipped with the Gray & Davis dynamo and motor. I wish to attach two more lamps, a speedometer and trouble lamp, and use a separate switch. Shall I attach to the generator where the lamp wire is attached?

2—What size of bulbs should be used?

3—Will this decrease the efficiency of the present system and over-tax the dynamo and storage battery?

Elyria, O. C. S. B.

—1—These lamps should be wired the same as the horn, that is, tap the wire running from the ammeter to the terminal on the starting motor, and insert two wires running to the frame, one of the lamps and a switch being connected in each of these circuits.

2—A 1.5-candlepower lamp should be used for the speedometer and a 2-candlepower bulb for the trouble lamp.

3—Lamps of this size will not overtax the system or appreciably decrease the efficiency.

To Tell Weak Magnets

Editor, The Automobile:—1—Is there any simple method to determine if the magnets of the Splitdorf model O magneto have become weakened?

2—Can the pistons of an Overland car be grooved and drilled to return excess oil to the crankcase? If so, kindly furnish sketch of same.

Hoping for an early answer, I remain

Leetonia, Ohio. S. J. Prior.

—1—A simple method which gives a rough idea is to take the two pairs of magnets and place them together end to end so that the opposite poles are in contact. The attraction should be sufficient to hold one pair against the other when held in a horizontal position and while the magnets are gently shaken. Weak magnets will be indicated by misfiring at low speed.

2—It is not advisable to drill the pistons but the best remedy is to reduce the oil level in the crankcase. If the car is a model 79, fit small stand pipes under each connecting-rod. These pipes should be about 7-8 inches high so that excess oil will drain back to the reservoir in the bottom of the crankcase.

On the model 69, there are two stand pipes, one for each compartment of the motor. By cutting off about 1-4 inch, the oil level should be reduced enough to prevent over lubrication.

Why Ford Uses Vibrators

Editor The Automobile:—1—Why does a Ford car require vibrators on the coils? As I understand it, alternating current does not require a vibrator and the Ford magneto generates an alternating current.

2—What is the object of the breaker box found on most cars outside of the Ford?

Rixford, Pa. Chas. Evers.

—1—You are right, an alternating current does not require a vibrator but the reason vibrators are used on the Ford coils is so that more than one spark may be produced each time the circuit is closed, the idea being that several sparks in quick succession are better than a single spark, especially when the mixture is poor.

2—The breaker mechanism takes the place of the vibrator. The basic difference between the breaker and the vibrator is that the former breaks the circuit mechanically, some form of a cam separating the breaker points, while in the vibrator the points are separated magnetically, the operation being similar to that used in the electric bell.

Now, the object in breaking the primary circuit suddenly either by using a vibrator or a breaker is to cause a quick stoppage of the current flowing in the primary circuit. Around the primary of the induction coil there is a strong magnetic field proportional in its strength to the amount of current flowing in the primary. This field extends through the windings of the secondary coil, which are directly outside of the primary windings. The voltage generated in the secondary depends on how quickly this primary field rises or falls in strength. Therefore, if the primary circuit is suddenly broken, the field will quickly die down to nothing and the result will be a high-voltage generation in the secondary or high-tension coil, this voltage being high enough to jump the spark gap at the plug. The action, in principle, is the same whether the circuit is broken by means of breaker or a vibrator.

Not Advisable to Reduce Tires

Editor The Automobile:—I want to reduce the size of my tires on a car using 34 by 4.5-inch tires. Is there a smaller size that will fit these rims without alteration?

For instance, how would the 33 by 4-inch tires go on these rims? Also what effect would this reduction of wheelsize have on the speed of the car?

Ft. Fairfield, Me. A. P. G.

—Yes, 33 by 4 tires may be used. It is not advisable to reduce the size of the tires because it will undoubtedly increase the tire cost per mile. Since your present tires are 34 by 4.5 inches, the diameter of the rim is 25 inches (25 + 4.5 + 4.5), and any tire with an inside diameter of this amount will fit your rims. Therefore if you select a tire of 32 inches, it must have a section of 3.5 inches; a tire 33 inches in diameter must have a section 4 inches in diameter in order to have the requisite inside diameter. The reduction in speed is not worth considering, as it would only be the ratio of the two tire diameters, or a mile or two an hour.

High and Low Speed Motors Compared

Editor The Automobile:—Please explain by sketch and description the difference between a high and a low-speed motor? 2—Explain the difference between a T- and an L-head motor?

Yonkers, N. Y. John Kelly.

—1—The difference between the low and high-speed motor can hardly be shown by sketches. The former has a speed of about 1,500 revolutions per minute and the latter a speed well towards 3,000. The high-speed motor has a smaller bore, the reciprocating parts are lighter, the timing is changed to suit the high speed, and the parts are generally in better balance in order to reduce the vibration due to the excessive speed.

2—These motors take their names from the shapes of the respective combustion chambers, the combustion chamber consisting of valve pockets and piston space. In the T-head motor the intake and exhaust valves and valve pockets are on opposite sides and two camshafts are used. In the L-head all the valves are arranged on one side.

Weak Magnets Cause Miss

Editor The Automobile:—Have been having some trouble lately with car. The motor skips when running slowly or pulling hard on high gear if the spark lever is advanced more than half way on the quadrant. As soon as I retard the spark below this point the engine picks up and will pull as well as it ever did. Why is this? It is not the fault of the carbureter, as I have tried all kinds of adjustments and have operated it under every conceivable condition.

Vineland, N. J. R. W. Call.

—If the magneto is correctly timed it is probable that the trouble is due to weak magnets. When the spark lever is advanced all the way the spark actually occurs when the armature is at the edge of the magnetic field instead of being in the position where the strength of the field is greatest. Therefore if the magnets are weak the effect must first be felt at the weakest point in the field, and that may be either

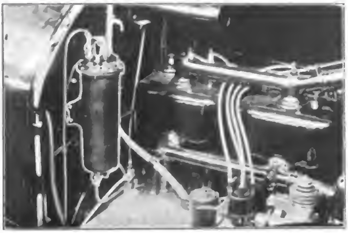


Fig. 1—Mounting of Stewart-Warner vacuum feed tank on dash

a position of great advance or retard, depending on how the magneto is linked up. Recharging the magnets should remove the trouble.

Stewart-Warner Vacuum Tank Mounting

Editor THE AUTOMOBILE:—Will you please illustrate the mounting of the Stewart-Warner vacuum feed system?

Hicksville, N. Y. E. W. W.

—The most usual position of the Stewart-Warner vacuum feed tank is on the front of the dash, although it may be attached at any other convenient place above the carbureter and near the motor.

It will be noted that it is placed high with reference to the carbureter and it is so near it that there is no lack of flow when climbing steep hills.

Timing of Fours and Sixes

Editor THE AUTOMOBILE:—Is there any difference in the timing of four- and six-cylinder motors, and do you believe that the shape of the cylinder head and the position of the valves make any difference?

Atlanta, Ga. JOHN E. WARD.

—The timing for fours and sixes does not vary as it is self-evident that the number of cylinders is an immaterial factor in the valve timing where the volumetric efficiency of each cylinder and the thermal cycle of each is an entirely independent question. Manifold design is, however effected by the number of cylinders and that may have a bearing on the timing. Thus wherever difference in timing for fours and sixes would occur, it would not be because of any theoretical reason but of practical developments.

On the other hand the question of I-head, T-head or L-head shapes may affect the timing because the volumetric efficiencies of these motors would doubtless vary. Nevertheless, the I-heads do not develop any peculiarities in the timing table which would distinguish them from motors of any other shape. But, to cite examples:

Chadwick has the greatest length of inlet opening, 247 degrees, this is from 18 degrees after top center to 85 degrees past lower center. The greatest exhaust opening is on the Auburn, from 71 degrees before bottom center to 15 degrees past top center. These long openings are not usual however, the average as noted being considerably below this.

While the characteristics of the motor affect valve timing to some extent, the personal element of the opinion of the chief engineer is still the deciding factor. It is doubtless true that on the higher speed motor it is necessary to open the exhaust valve sooner in order to permit the gases to drop to atmospheric pressure at the desired time. At the same time, however, motors that are of the typical small-bore, long-stroke high-speed type, running in cars with reductions of 4 to 1 in the rear axle, do not exhibit any marked differences on the whole, from the heavy duty motors running at much lower crankshaft speeds and with final reductions of 3 to 1 or less on direct drive.

Take Buick for an example. This concern is now the only one making the square type of motor with the bore the same as the stroke. The exhaust valve on this model with its 3.75 by 3.75 cylinder and 1 stroke bore ratio, opens at 56 degrees and 19 minutes before lower dead center. The Buda motor with 3.5 by 5.125 cylinders and a 1.45 ratio opens the exhaust valve at 55 degrees before lower center. This motor is used in many cars geared 3 to 1, and the Buick is geared 4 to 1. This does not show any material difference in exhaust practice.

A search of car specifications for a trend for any type of motor is in vain. It is not the motor type, but the motor speed and the best results that have been obtained by trial at different speeds, with different carbureters and ignition systems, that determine the results. Were it not for the inertia of the gases the logical point to open the intake and to close the exhaust would be at upper dead center at the practical beginning of the intake and the ending of the scavenging strokes; yet, there are only two who do this.

There is only one other make that utilizes the upper dead center for the opening of the intake or the closing of the exhaust alone. This is the Briscoe which opens the intake valve on the dead point and closes it at 45 degrees past lower center.

Makes Wind Wagon from Cyclecar

Editor THE AUTOMOBILE:—Fig. 2 shows a wind wagon which I built.

It has an 80-inch wheelbase, 36-inch tread. The frame is made of ash. The wheels are regular cyclecar type, no axles, the springs serving for the same. The engine is a four-horsepower motorcycle type and drives a 40-inch propellor by a 1-inch V-belt. The brakes act in the belt rims on the rear wheels and are of hard wood. About 25 miles per hour can be made, and it has a very quick get-away.

Logansport, Ind. CLAIRE VANCE.

The Ideal Touring Car Body

Editor THE AUTOMOBILE:—Slightly over a year ago—on November 13, 1913, THE AUTOMOBILE published a drawing illustrating my views on the ideal touring car body. Since then they have developed along the lines foreshadowed in the article which accompanied the drawing in question. The result is seen in the design reproduced in Fig. 3.

The general effect is boatlike due in part to the pronounced tumble-in along the top and to the almost horizontal line

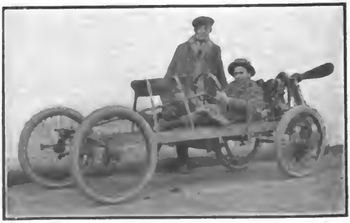


Fig. 2—Cyclecar wind wagon made by subscriber

preserved from radiator to cap stern. The domed fenders are attached to the stub-axles instead of to the frame and they follow the movement of the wheels. This arrangement has been tried both here and abroad but some difficulty has been experienced in making the fastenings secure. With this construction the fenders and wheels are concentric and the clearance between them is reduced to the desired minimum. The front wheels do not project partially outside the mudguards and spray mud over the body-work when turns are made. As the sidelights are placed on the fenders, the road to be followed around the curve is illuminated before the turn is actually made. Filaments can now be obtained strong enough to withstand the shocks to which they would be subjected.

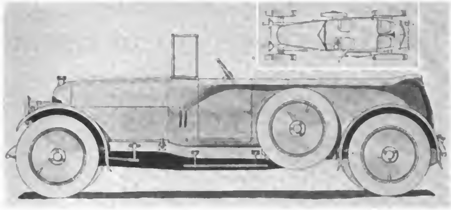


Fig. 3—Ideal car designed by John J. Ide, showing unbroken lines and unusual mounting of the spare tires

Pressed Steel Wheels

Lynton pressed steel detachable disk wheels are used. The chief advantage of this type is the ease of cleaning, the operation being performed thoroughly in 2 minutes for each wheel, a small fraction of the time occupied in cleaning a wire, or even an artillery wheel. While the sides of the pressed steel disk wheels are slightly coned, they do not have the excessive projection which characterizes triple-spoked wire wheels.

There being only two doors the spare wheels are placed diagonally, one on each side, as shown in the plan view. By this arrangement a good distribution of weight is obtained while access to the motor is not rendered difficult—too often the case when a wheel is placed on each side of the hood. The spare wheels are secured by dummy hubs fastened to the body thus doing away with complicated and unsightly carriers and straps. Long running boards have been avoided, a simple step being placed under each door.

Windshield and Radiator Are Pointed

It will be observed that the windshield is pointed, thus harmonizing with the radiator. Vision is not interfered with in the slightest as the junction of the two sections occurs in the center of the dash. Each front seat occupant can adjust his section to suit himself, a feature not to be underrated.

The body sides are very high, 29 inches on the outside. This is rendered possible with only a slightly tapered hood by dropping the frame at the dash. The four individual seats are of the so-called Pullman type introduced by Lamplugh of Paris. Pullman seats, being completely isolated from the sides and back of the body framework, can not only be moved fore and aft but also the angle of inclination of the back can be varied at will. It is needless to dwell upon the great increase in comfort, especially for the driver, possible with this arrangement.

The top, when it is in use folds down into the case and is covered with three detachable panels. Thus is removed perhaps the greatest disfigurement of the modern car. Nothing surely is more ugly than the ordinary folded top with its baggy cover. A compartment is provided behind the rear seats capable of accommodating a large trunk. The rear of the car, therefore, is not spoiled by baggage piled up on a rack.

A few points in regard to the chassis may be worth mentioning. The wheelbase is 12 feet. A six-cylinder Knight slide valve motor of 90 by 150 millimeters (3.5 by 5.9 inches) is employed. A multiple-disk clutch transmits the drive through a four-speed gearbox, direct on high, and a shaft inclosed in a torque tube, to the worm bevel drive rear axle.

The back springs, of the Lanchester cantilever type, 56 inches long, are shackled at the rear below the axle permitting a limited sliding motion.

The long diameter of the filler caps for radiator and gasoline tank is a good feature. Replenishing fuel and water takes much less time than with the puny openings generally used.

New York City. John Jay Ide.

Forty Cars at Importers' Salon

(*Continued from page* 19)

limousine and a cabriolet. The other two are from Fleetwoods plant. These are a brougham and a four-passenger design.

Two American Makers

Simplex, one of the two American manufacturers who are included in the Salon exhibit, the other being Fiat, is showing four bodies on an improved line of two chassis. There is also a polished chassis. The mechanical changes which have taken place in the Simplex line are not in the nature of changes in specifications but in such details as the timing, shorter intake manifold, higher carbureter, flush cowl board and the use of a driveshaft service brake on the shaft drive models. This is mounted just back of the gearset behind the ball-and-socket universal joint. Some of the body builders' products are shown on White, Packard and Moline-Knight chassis, giving an idea of the high luxury and finish possible with American cars.

The bodies on the Simplex are produced by Quinby and Holbrook. Three of the bodies are mounted on the larger chassis known as the 50, on which either shaft or inclosed chain drive is offered as an option. These are a four-passenger inside drive and a limousine by Quinby, a seven-passenger touring car by Holbrook and on the 38 there is a coupé-landaulet by Holbrook. At the Holbrook stand there are two cars. One of these is a Fiat with a town body. The other is a DeDion eight-cylinder having a body of streamline adaptation in grey-green with an oil finish. This car is fitted with a one-man top.

Three Brewster Bodies

Brewster is showing three bodies. These are an inclosed drive with a collapsible top and a brougham on Rolls-Royce chassis, and a brougham on a Delaunay-Belleville six. The combination of inside drive with a collapsible top is a unique construction giving the advantages of a landaulet and a collapsible. The inside drive feature is in line with a general trend towards favoring this style of body which is exhibited at the Salon. The limousine seems to be losing ground.

The Improvement of Spring Systems--IV

Close of the estimates of shocks and movements in springless vehicles needed for comparing the effects of springs and tires and for passing principal requirements in review

By M. C. K.

(Continued from issue of December 31, 1914)

IN accordance with a modern theory of the schoolroom, to the effect that a subject on which errors of reasoning are liable to occur should be presented not magisterially or didactically but with a plain indication of the mental processes by which the results are reached, two ways of figuring shock and retardation in a springless vehicle were worked out in the issue of last week, and there was an avoidable error in both of them. The nature of it was indicated in a parenthesis, but it had been committed by the writer in first going over the subject, and it was thought useful to follow it up. It consisted in figuring the vertical component of the shock with reference to the kinetic energy of the vehicle and with an allowance for the axle load instead of only from the speed and the axle load. By the discrepancy in the results some readers may have been induced to figure for themselves that the horizontal component was underrated by the first method and the vertical one slightly overrated by the second method. The correction is easily made and gives figures which should be useful for subsequent comparisons.

Final Front Shock Figures

The vertical shock, figured from the velocity imparted to 1,000 pounds, should be approximately 3,180 footpounds (as by first method), and the horizontal component of BA, as figured from the kinetic energy of the whole vehicle and the angle of the impact, should be 8,524 footpounds (as by second method), making a total of 11,704 footpounds abstracted from the vehicle momentum and a retardation of $50 - 8 \times 5.93 = 50 - 47.44 = 2.56$ feet per second.

The blow delivered against the axle, instead of $12{,}974 - 5{,}269$, is $11{,}704 - 5{,}269 = 6{,}435$ footpounds. The tearing stress on the wheelrim remains 5,269 footpounds, but may be considerably modified—also affecting the other figures—if the wheels slip on the obstacle, this possibility being reserved for consideration in connection with tire equipment.

Rear Wheel Figures

With these corrections made, the action of the rear wheels can be figured. As the ability of the vehicle to pick up, by means of its motor power, the speed lost by the front wheel shock before the rear wheels strike the obstacle, depends on a number of factors relating to the efficiency of the transmission and the air resistance which are not vitally connected with the subject, it is assumed that the vehicle continues with the speed it has after the first shock.

The rear wheels thus move against the ridge at 47.44 feet per second. The rise of 3 inches is effected while the vehicle travels 10.53 inches horizontally. It is known that the retardation will be more than 2.56 feet per second, as the rear portion of the vehicle is heavier than the front portion and the obstacle is assumed unyielding, and the average speed over the obstacle can therefore be estimated at one-half of $47.44 + 44.88$, making 46.16, say 46 feet. At the same time the kinetic energy available before the new shock must be figured with a speed of 47.44 feet, say 47.50 feet per second.

This makes the time occupied on the obstacle, and for the load lift, 0.01907 second, from which there is figured a vertical speed imparted of 157.3 inches = 13.11 feet per second —or, rather, a shock equal to the imparting of this speed. From the formula $h = c^2 : 2g$, giving $13.11^2 : 64$, or $171.8721 : 64 = 2.686$ feet, the work involved in such a shock for a weight of 2,000 pounds is the same as for raising 2,000 pounds to a height of 2.686 feet, which is 5,372 footpounds; and this is consequently the value of the vertical shock delivered in 0.01907 second. The horizontal component of the shock is figured as before, being 10.53 : 27.53 of BA—in Fig. 6, taking it as applied to rear wheel—which in turn is 10.53 : 27.53 of the whole energy of the vehicle divided by 2, as before. This energy, 1-2 mv^2, is now reduced to $3{,}000 \times 47.5^2 : 64 = 105{,}715$. These values give:

Mean of BA (rear wheel) =

$$\frac{105{,}715 \times 10.53}{2 \times 27.53} = \frac{1{,}110{,}007}{55} = 20{,}182$$

$$\text{Horizontal component thereof} = \frac{20{,}182 \times 10.53}{27.53} = 7{,}706$$

The total energy abstracted by the rear wheel shock is thus $5{,}372 + 7{,}706 = 13{,}078$ footpounds, which, deducted from the initial energy of 105,715 footpounds, leaves 92,637 footpounds, giving a speed

$$v_2 = 8 \times \sqrt{92{,}637 : 3{,}000} = 8 \times \sqrt{30.546} = 8 \times 5.52 = 44.20$$

feet per second.

Out of the total shock of 13,078 footpounds, this value minus 17 : 27.53 of 7,706, being $13{,}078 - 4{,}764 = 8{,}314$ footpounds, is spent against the rear axle and the remaining 4,864 footpounds tangentially upon the wheelrim. But the wheelrim is moving circumferentially at the speed of the vehicle, and the thrust actually delivered is much complicated by the friction at the point of impact and at the point of previous ground contact of the wheel—both of which the tangential component tends to overcome—and by the motor effort and the rotary momentum of the wheel as such, as well as by possible brake action just preceding the impact, as before referred to. Were it not for the tangential component, the very considerable friction suddenly coming into action at the point of impact might stop the motor of a springless vehicle, while calling for high flywheel momentum if spring and tire actions are weak, especially in the case of slow and heavy driving by which the value of the tangential component of the shock is reduced more than the friction at the point of impact. There is a glimpse here of one of the factors which make heavy motors desirable for heavy vehicles, whose solid rubber tires are not very elastic when worn down, and also of one of the good reasons for driving trucks rather fast over rough cobblestones.

It may in many cases be hard to determine just what becomes of the force represented by the tangential component, but it seems clear that, even if it overcomes the friction of the wheelrim against the ground and the obstacle and causes a grinding motion of the wheel at the point of impact while the vehicle is being raised over the obstacle, such a motion will not interfere sensibly with the other vehicle movements.

From the Ridge to the Ground Level

The distances from the ridge at which the wheels return to the level of the road are of course functions of the speeds, the height of the ridge and of gravitation. Assuming the length of the wheelbase to be 100 inches, the front wheels will be back on the ground before the rear wheels strike the ridge. The figures will then be as follows: To fall 3 inches takes 0.125 second (see the table, Fig. 2). After the front wheels have passed the top of the ridge the vehicle speed is 47.44 feet per second. At this rate the vehicle travels 5.93 feet in 0.125 second, and the curve described is therefore that shown in Figs. 5 and 6. Similarly, after the rear wheels have passed the ridge, the vehicle speed is reduced to 44.50 feet per second, and the space travelled while they fall becomes 5.56 feet, so that they strike the ground about 4 1-2 inches behind the point where the front wheels strike.

For completeness it should be added that the shocks received when the wheels return to the ground are relatively insignificant, with a springless vehicle and an obstacle of the kind assumed, the vertical component being of course measured by the height of the fall and amounting to 500 footpounds for the rear and 250 for the front portion of the vehicle. The horizontal thrust against the ground at a very small angle apparently reverts to wheel rotation by reducing the resistance to propulsion.

Shape of the Obstacle Decisive

The shape of the ridge which has been under consideration is typical of one class of road obstacles. If another kind, as that indicated as A_2 in Fig. 7, is considered, the results are found very different. It gives only a mild shock at first, as the approach is gradual, but it makes springless vehicles, as well as those with springs, leap and produces the main shock when they come back to the ground. As the distance from the contact point of the wheel with the ground to the top of the obstruction is necessarily greater than in any case when a blow is struck by the front portion of the wheel against a ridge or hump of the same height, the whole action is milder and less typical of the conditions for the sake of which spring suspensions and tires are used. Consideration of it can therefore be postponed.

Wheel Sizes and Center of Gravity

Among factors which have an influence upon shocks and movements, but nevertheless have been mentioned only incidentally in the foregoing, are the location of the center of gravity of the vehicle, the length of the wheelbase and, especially, the wheel diameters. If it may be shown that they influence vehicles with different spring systems and tire equipments differently, it should be necessary to account for the effects and differences in each case, and it is in fact, perhaps, usually considered that large wheels are more beneficial with hard tires and stiff springs than with soft tires and flexible springs, but the preliminary view is here taken that they are simply more necessary when other means for easing the shocks are lacking. Reserving closer inquiry on these possibilities for the chapter on tire effects and with a view to more rapid progress toward applicable conclusions, it is therefore here assumed that the low center of gravity, the long wheelbase and the large wheel diameter make for smoother travelling in similar degree under all circumstances and that it is sufficient for the comparisons to be made to figure with these factors as constants, the center of gravity being always such as to bring the total forward thrust in the axle level, with two-thirds of the weight in the rear and one-third in the front axle, the wheels always 40 inches in diameter and the wheelbase always 100 inches. The effects are, however, indicated in part in Figs. 7 and 8.

Avoidance of Pitching

When the vehicle is running at uniform speed, the traction acting at T, Fig. 8, is equal to the resistances overcome in the driving, and the forward thrust to be considered for the front wheel, when it rises over an obstacle, is composed of this driving-thrust in the direction TB and the whole momentum of the vehicle minus the driving-thrust acting in the direction GB. The resultant of these forces may be in the axle level or above it or below it, accordingly as the vehicle is being accelerated or retarded, and with G located as high as shown it is clear that there is always a tendency, when an obstacle is encountered, to increase the load on B and reduce the load on N, as the action of the momentum is in the direction GH. For accelerations the effect is opposite. And these effects are marked if springs permit the body to move with relation to the running-gear, while their effects on the severity of shocks is less noticeable but none the less present in the case of springless vehicles.

That a low center of gravity and also acceleration, bringing the thrust line nearer to TB, reduce the horizontal component of a shock for the front wheels, is apparent from the diagram and is also a matter of practical experience. The long wheelbase, on the other hand, helps in this respect only when the center of gravity is higher than the axle level and most when the momentum is high in proportion to the driving-thrust. The large wheel is always of assistance, as it raises the axle level and usually permits the center of gravity to be located relatively lower.

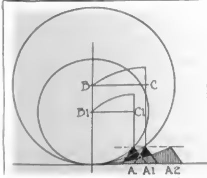
Load Distribution

The effects of the location of the center of gravity for shocks received when driving backward—which are of some importance for business vehicles, especially heavy trucks—are as much more pronounced as the load here is greater and serve as an argument for the even distribution of loads on both axles, in accordance with the practice already adopted for racing cars and for trucks in which all four wheels are driven.

For a ridge of a given height it is plain that the larger wheel sustains the smaller shock, as the distance, BC, Fig. 7, which it covers horizontally in rising above it is greater than the corresponding distance B_1C_1 of the smaller wheel. While a 40-inch wheel in rising over a ridge 3 inches high distributes the shock over 10.53 inches of horizontal progress, one of 60 inches diameter distributes it over 13 inches of progress.

In the next chapter it will be the object to present a time schedule of the spring action following a simple shock.

(To be continued)



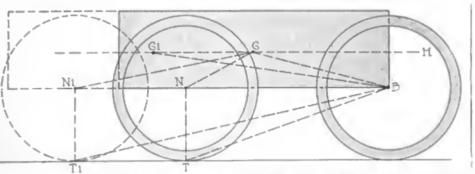


Fig. 7—Illustrating influence of large wheels to smooth the road and help the springs; A_2 type of ridge giving milder shocks than A, A_1.
Fig. 8—Indicating the forces which cause load level and distribution to influence shocks and spring action. (Line N_1G should be N_1G_1.)

New Electrical Equipment Is Feature of Accessories Exhibit

New Motor-Generators and Several New Ford Systems—Refinements in Starters and Generators—Three New Carbureters—Magnetos, Speedometers and Shock Absorbers Show Small Changes

THE greatest development in accessories at the show has been in the starting and lighting field. Several new motor-generators have been brought out for small cars and Fords especially. Some new two-unit systems for Ford machines are also exhibited. Refinement, both in outward appearance and in design, material and finish is found on every hand. The 1915 machine is better looking, more efficient, lighter and better provision has been made for driving. This applies to both starting motors and generators. More attention has been given to voltage regulation, and many other small refinements are noted.

Four new carbureters are exhibited and refinements have been made in several designs carried over. Still others have been put on the market for 1915 without a change. The horizontal connection and double outlet carbureters are noticeable additions.

Little change is found in the magneto field. Few new models have been brought out. In ignition the timer-distributer is gaining favor and several makers are exhibiting these in unit with the generator for the first time.

Some new models are also noted in the shock absorber and speedometer classes, but in the main the lines are much the same as last year.

Gray & Davis

A brand new Ford starting and lighting system has been brought out by Gray & Davis, Boston, Mass. It is a single-unit system of the motor-generator type and supplants the unit system for Fords announced a few weeks ago. This is a radical departure for this concern, which has heretofore made only two-unit systems. The price is $75.

In addition two new generators and a new starting motor are exhibited. The generators are entirely new designs and are of the variable speed type, instead of having a constant speed governor drive as heretofore.

Y-shaped pole pieces also distinguish these machines as well as the new starting motor. The latter is for all but large cars. For bigger machines, a starting motor continued from last year is offered.

In the Ford system provision is made for mounting the motor-generator on the left of the motor. Like all Gray & Davis systems it is a 6-volt design and the outfit includes a battery, indicator for dash regulator, cutout, switches, wiring and all the necessary connections. The drive is by an inclosed silent chain.

Kemco Generators and Motors

The Kemco line has been enlarged so that it now includes starting motors and generators of different types, as well as the original generator which is associated with the Kemco name. The 6-volt system is used in all units.

The complete line consists of four starting motors of graded sizes and for different powered motors. There is a universal starting motor which is designed especially for cars already in use. It is mounted in front of the radiator, taking the place of the starting crank. The reduction gears are contained in the starting motor casing. A smaller edition is made for Fords, and in connection with a fan generator makes a complete starting and lighting system.

Separate generators of 10 and 15-ampere capacity are also offered. These machines differ from former Kemco practice in that they are entirely separate from the fan. They are cylindrical in shape, and voltage regulation is by means of a Ward Leonard combined regulator and cutout. Another generator is a belt-driven type which resembles the fan generator, except it has no blades. These machines are made by the Kemco Electric Co., Cleveland, O.

General Electric Genemotor

The General Electric Co., Schenectady, N. Y., large makers of motors and generators and other electrical apparatus, has brought out a 12-volt motor-generator known as the Genemotor. The machine is designed especially for Fords and sells complete without lamps for $80. A. J. Pickard & Co., 1720 Broadway, New York City, is the sole distributor.

The Genemotor is mounted on the left side of the motor. The drive is by silent chain from a sprocket on the crankshaft. The instrument is cylindrical in shape and may be attached without drilling or tapping of holes. The regulation of the charging current for the battery is accomplished without the use of external regulators, the field windings of the Genemotor itself giving the regulation. The motor starting switch is mounted on the top of the machine, and is actuated by a push rod on the dash. The cutout closes at 9 miles per hour.

Aplco Starting and Lighting

The Aplco line is replete with new features. There is an entirely new motor-generator, built in three sizes, one of these being used in a special Ford installation. In addition there is a separate starting motor and two generators.

The motor-generators are known as the A-25, A-27 and A-28. The standard voltage for starting is 12 and for lighting 6, the change from one to the other being accomplished by a series-parallel switch.

The Ford motor-generator is mounted on the left of the motor and is driven through a silent chain. The voltage regulation is inherent and there is a cutout on the dash which registers ON and OFF.

One of the generators is designed for small machines, and will furnish 5 amperes at 6 volts. The normal driving speed is 1,600 revolutions per minute and the drive is ordinarily by chain. Another generator, known as the S.R.-2, is designed to run at twice engine speed, and will give a 7-volt current of 10 amperes. This unit is also made with a special head containing a timer and distributer. A feature of this combination is that the generator may be removed for repairs without influencing the operation of the ignition system.

The starting motor is designed for small and medium-sized motors, and drives through the flywheel. The feature of the machine is the automatic releasing gear which disengages the gear and opens the switch when the engine starts, even though the foot is on the starting pedal.

Westinghouse Motors and Generators

The feature of the Westinghouse line is a motor-generator. Refinements are found in the other units. The motor-generator is a 12-volt machine, and in this respect differs from former practice. It is permanently geared to the engine.

No cutout switch is used, and at low engine speeds the generator therefore automatically becomes a motor, so that in case the engine is stalled it is automatically started.

Starting motors and generators, both with and without ignition units, are continued with slight refinements.

Northeast Motor-Generator

A single machine for starting and charging the storage battery, made in but one model, is exhibited by the Northeast Electric Co., Rochester, N. Y. There are, however, several different methods of application so that it may be used on any car. For larger cars the system operates on 24 volts while the smaller cars use 12 volts. For old cars a universal system of application has been brought out, the motor being mounted in front of the radiator. Special fittings are also made so that the system may be attached to the Ford. No reduction in size has been made but the efficiency and torque have been improved and a more efficient regulating device is fitted.

Bosch Starters and Generators

Four sizes of motors and two types of generators in sizes to suit the individual manufacturer make up the line of the Bosch Magneto Co., New York City.

Practically no changes have been made in any of the models and they may be considered as continuations of the 1914 series. The latest addition is the Model D starting motor which was announced some months ago.

Both starting and lighting machines are built in both 6- and 12 volts and with single or double wiring. Two types of lighting generators are manufactured. One, a constant voltage design which goes under the Bosch name and the other a constant-current and constant-voltage machine, known as the Bosch-Rushmore.

Dyneto Motor Generator

Two motor-generators are made by the Dyneto Electric Co., Syracuse, N. Y. The model A is a new one designed for small-bore motors and the B is continued from last year. No radical change has been made in these instruments. The generator has been improved so that it begins to charge at a somewhat lower speed. Twelve volts is standard although other voltages can be supplied.

Leece-Neville Systems

Ten cranking motors, three generators and six motor-generators are shown by the Leece-Neville Co., Cleveland, O. Improvements consist in a more rugged construction of the inner parts. Six 12- and 24-volt systems are built and double wiring is standard.

Hartford Ford System

A high-speed starting and lighting system for Fords is shown by the Hartford Suspension Co., Jersey City, N. J. Motor and generator are separate units, the generator being mounted horizontally and the motor vertically, drive being from the front of the generator through a worm gear. The generator runs at approximately twice the speed of the crankshaft with which it is connected by means of a chain. The motor operates at a speed of from 8,000 to 10,000 revolutions per minute. The advantage in the high speed is that low weight is secured. The whole system weighs 54 pounds, it is said.

The cranking speed is about 300 revolutions per minute, and the voltage is 12. The price is $100, complete except lamps.

A new electric starting and lighting system designed for application to old cars is shown by the Chicago Electric Specialties Co., Chicago. Special fixtures are supplied for attaching the outfit to different makes of cars, the Ford attachment being the one pushed at present. The same unit is employed for all. This is a 6-volt motor-generator and is driven by silent chain from the front of the crankshaft.

An unusually attractive feature is the combination of a tire pump with the unit, in such a way that the starting, lighting and tire inflation are accomplished by the same instrument. The outfit for the Ford costs $80 with $15 additional for the pump.

Brown-Lipe Starting Gear

An entirely new and original type of starting gear, which is mounted at the side of the gearset and which drives through the clutch, has been developed by the Brown-Lipe Gear Co., Syracuse, N. Y. By the movement of a heel pedal the gear is first meshed and the switch closed. This is accomplished through a very simple mechanical arrangement. The rod running down from the pedal is pinned to a cross arm whose ends are pinned to the rod which meshes the gear and the rod which closes the switch, the latter two being at right angles to the former. The gear rod is held out of engagement by a comparatively light helical spring, and the switch rod is held out by a spring several times this strength. Also the rod extending down from the heel pedal is pinned to the cross arm nearer the gear rod. The result is that when the heel pedal is depressed the weak spring is compressed its full amount before the stiff spring is deflected appreciably, so that the gear is fully meshed before the switch rod is moved. Further depression of the starting pedal also compresses the stiff spring and closes the switch.

Jackson Ford System

A lighting generator for Fords is exhibited by the Charles A. Jackson Co., Park Square, Boston. It is mounted on a special bracket and is driven by a wide belt which also drives the fan. Its weight is 9 pounds and it gives 8 amperes at 7 volts at a normal speed of 1,800. It is equipped with a cutout. The price is $15.

Bosch NU 4 Magneto

Two new models of magnetos are shown by the Bosch Magneto Co., 225 West Forty-sixth street, New York City. One is the NU4 which was described in THE AUTOMOBILE some time ago. It is for motors of 30 horsepower or less and sells for $40. The usual distributer is eliminated, distribution of the high-tension current being effected by a double slip ring with metal segments which carry the current to the four brushes, connected to the four plug leads. This model is part of a new Ford outfit equipped with gear drive. The secondary winding is carried to the slip ring. The other new Bosch product is a vibrator system designed to make starting easy in cases where the cranking speed is low and the spark weak. The older Bosch magnetos are continued unchanged.

Splitdorf-Cunningham

An entirely new model, the Cunningham, is shown by the Splitdorf Electrical Co., Newark, N. J. It is a water-proof, high-tension instrument and is designed to produce a hot spark at very low speeds. It has a timing range of 75 degrees. The threaded hole spacing and the distance to the tapered driving shaft conform to S. A. E. standard. The interrupter is not new, however. The other Splitdorf magnetos are practically unchanged.

M. F. Carbureter

A new carbureter of unusual design in that the float chamber has been discarded, one that is simple and light is the M. F., manufactured by the Floatless Carbureter Co., 102 Jefferson avenue, Brooklyn, N. Y. The main air inlet is at the bottom and to one side. At slow speed the air rushes up through this passageway, past the spray nozzle, lifting a small disk which is attached to the needle valve. When the motor is idle this valve is forced closed by a flat spring but when the motor is running, the suction raises the disk and allows gasoline to flow out of the nozzle, the amount depending on the height of the disk.

Shakespeare Carbureter

There are no springs in the new Shakespeare Carbureter made by the William Shakespeare, Jr. Co., Kalamazoo, Mich. The float is concentric and the flow of gasoline from the fuel nozzle is regulated by a movable needle which is attached to a floating disk. Increased suction raises the needle and allows more fuel to flow and at the same time the raising of the disk increases the annular opening, allowing more air to flow.

Stromberg Carbureters

The two Stromberg models which were recently announced in THE AUTOMOBILE are on exhibition. One is the K which is featured by a balanced air valve construction which takes the place of the auxiliary air valve. The other is the H and it is notable in that it uses a dash-pot control of the air valve. It also has a secondary jet. Models B, G and C are continued.

Parkin Carbureter

The carbureter which is exhibited by the Light Mfg. & Foundry Co., Pottstown, is known as the Parkin. It has no springs and there is but one air inlet. The mixture is regulated by a special type of throttle valve and a single jet whose opening is controlled by the position of the throttle. Easy starting is provided by means of a choke valve in the air intake.

Rayfield Carbureters

Rayfield carbureters are shown in two types, the G and the L. This is the first time they have been exhibited, as they have been brought out since the last show. The two types are identical except that the G is water-jacketed. Both models are of the two jet type, and there are three air openings, one fixed and operating in conjunction with the low-speed nozzle and the other two having automatic valves linked together and opening simultaneously.

Zenith Carbureter

In addition to its two standard makes the Zenith company has added a new type designated as model O, which is built for the small car trade and sold at a lower price although retaining standard Zenith features. Double outlet carbureters for eight-cylinder motors are shown.

Browne Carbureter

The Browne carbureter, for which the Holt-Wells Co., 1790 Broadway, is selling agent, is a newcomer in which the principal feature is a vacuum-controlled auxiliary air valve by which a constant ratio between the fuel and air is maintained. Only one size of carbureter is made for all makes of cars and the only change for different motors is to put in a new bushing which surrounds the auxiliary air valve and controls the area of the auxiliary air opening. Large motors use bushings with more sharply outcurving surfaces than small ones.

Van Sicklen Speedometer

The Van Sicklen speedometer for Ford cars is the feature of this company's exhibit, made this year for the first time. Other interesting features are a new swivel drive to the front axle spindle of the Ford and a back-of-the-gearset drive by a stamped worm for other cars. The most unique feature of the new instruments is the new black-faced dial with internal lighting.

Corbin-Brown centrifugal speedometers for 1915 are shown with a new feature, a selective trip reset on the odometer by which it is possible to set the trip wheels at any mileage. Another point is the arrangement of the trip odometer wheels on the same spindle as the season wheels, leaving a clean dial.

Formerly Elyria-Dean, Garford speedometers are little changed, but several new flush types have been added.

Standard Speedometers

Standard speedometers have been added to by the introduction of a Ford model. This model is used on Ford cars shipped from the factory as special equipment, bearing the Ford trade-mark. But this mark is not used when sold through dealers.

The Hoffecker-Evans speedlock instruments have been changed this year. Last year the speed lock served to interrupt the ignition when the speed exceeded a set maximum. This year, however, the governor acts on the throttle-control rod.

Waltham Truck Clock

The necessity for operating trucks on schedule has led the Waltham Watch Co., Waltham, Mass., to bring out a special truck clock. It is theft and water-proof and cannot be set without a key.

Stewart Self-Winding Clock

The latest Stewart accessory is the 1-year self winding electric clock. It is a flush type and carries a small dry battery at the back. The clock driving mechanism consists of a short coil spring. A contact maker closes the battery circuit once every 2 minutes, the current energizing a magnet whose armature rewinds the spring. A feature of the booth was the demonstration of the vacuum gasoline system, the exhibit consisting of a portion of a motor car chassis with the system installed. In addition a glass model is mounted at the top of the engine, a red fluid being used to represent gasoline. The motor was constantly turned by an electric motor and the pumping action of the suction tank was strikingly demonstrated.

Triple-Action Shock Absorbers

Two new models have been developed by the Triple Action Spring Co., Chicago, Ill., one for electric cars and the other for trucks. In both cases the new feature is the addition of a third coil.

A new model has been brought out by the Universal Shock Eliminator Co., New York City, in which the coil spring is unusually long and large. It is inclosed in a vertical casing designed to be mounted at the front end of the leaf spring.

A feature of the Hartford Suspension Co.'s exhibit is the new multiple-disk friction shock absorber which automatically increases in stiffness according to the severity of the blow. This was fully described in a recent issue of THE AUTOMOBILE.

Two types of spring shock absorbers are exhibited by the Cox Brass Mfg. Co., Albany, N. Y. One is a Ford design selling for $8 per set of four, or $4.50 for two, and the other is for larger cars and sells for $10 per set of four. Both types use two helical springs suitably inclosed and both are attached in place of the spring shackles.

Two new models have been added to the line of bumpers made by the J. H. Sager Co., Rochester, N. Y. Both feature a method of passing the bar to the arms. The bar is of channel form, the flanges being turned inward. The two models differ in that one is adjustable to any frame while the other is for attaching to a number of standard cars.

The latest Grossman bumper for Fords is designed to provide substantial attachment and also to improve the appearance.

Along with the shock absorbers proper, the Dann Oil Cushion Spring Insert Co. has developed a spring, in which much of the shock is said to be eliminated by constant lubrication between the leaves. This is accomplished by making up springs for the trade, with the oil inserts in place. The lubrication also lessens the liability of spring breakage.

A similar effect is the object of the Brown Oilbox which offers an easy means of feeding oil between the leaves.

Champion Spark Plug

A new Champion spark plug with a one-piece porcelain is the feature of the Champion line. The new plug consists essentially of two pieces, the shell and the large, thick porcelain insulator in which is cemented a heavy center electrode. The points of the spark plug are constructed from a special nickel-manganese steel alloy, which has high heat-resisting qualities. The price is $1.25.

A new spark plug has been brought out by the Brown Co., Syracuse, N. Y. It is a conventional design with a porcelain insulator. It is made in .5-inch, metric and A. L. A. M. sizes and the price is 75 cents.

A special plug for Ford cars is made by the V-Ray Co., New York City. In addition plugs are made for all other cars.

The Benford Mfg. Co., Mount Vernon, N. Y., is showing a Monarch special Overland plug which is the same as the other plugs except that it has a long shank. The price is 75 cents.

Charles E. Miller has brought out a porcelain spark plug listing at 50 cents. It has a blue steel shell and two-point electrode.

Stanweld Rim

A new Stanweld rim made its debut at the show. Its chief points of difference are that the side flanges once applied to a casing remain permanently with it as long as it is used, not being removed in changing tires. These rings are not split. The felloe band has but one bevelled face, that to the rear. The rim is simpler than previous types.

Parker Steel Wheel

Parker pressed steel wheels made from two sheets of metal welded together after pressed to shape, was the feature of the Hydraulic Pressed Steel Wheel Co., Cleveland, O. Advantages claimed are lightness and the elimination of the ordinary felloe band, the rim of the wheel taking the place of the former.

Designed for the purpose of enabling any car which has broken any of its four axle spindles to be towed to the nearest repair shop, the Autorescue made by the Autorescue Mfg. Co., Streator, Ill., consists of an arm which is clamped to the axle and carries the wheel spindle.

Shaler Roadside Vulcanizer

Two new Shaler vulcanizers are on display. One is for tubes and the other for tubes and shoes of Fords. They are designed for roadside work. The correct amount of heat is obtained by a lamp which burns gasoline or alcohol. The price is $2. The Ford is $2.75.

Brown Vulcanizer

A new vulcanizer has been brought out by the Brown Co., Syracuse, N. Y., which is based on a new principle. The device consists of a stove in which is placed a vulcanizing iron. The heat is supplied by the combustion of gasoline or alcohol. When the charge of fuel has burned itself out the iron is hot enough to begin vulcanizing and is clamped over the part to be repaired.

Dayton Pneumatic

A pneumatic tire is exhibited by the Dayton Rubber Mfg. Co., Dayton, O. This concern is continuing its airless tire. The pneumatics are guaranteed for 5,000 miles.

Economy tubes are the new product exhibited by the Dujardin company, 1697 Broadway, New York City. These tubes are said to be proof against blowing out, pinching or rim-cutting. They consist of an extra-heavy red tube reinforced by a knitted stocking of Sea Island cotton.

The Marathon Tire & Rubber Co., Cuyahoga Falls, O., through its New York agents, is showing a new non-skid tread consisting of a number of V-shaped rubber projections distributed evenly over the tread at varying angles.

A newcomer in the tire field is the Gordon Rubber Co., Canton, O., maker of Gordon tires. The feature of the line is the triangle tread. This is a non-skid design with a triangle-shaped raised portion.

D-M Anti-Skid Traction Treads

D-M anti-skid traction treads are designed for solid dual tires and are made by the Dayton Malleable Iron Co., Dayton, O. They are made from malleable iron. Each tread consists of a flat surface with a ridge to prevent skidding. The flat surface rests against the tire. These different units are connected by means of hook and eye joints.

Manzel Motor-Driven Pump

A single-cylinder, air-cooled, gear-driven tire pump for Ford cars is a new offering by the Manzel Bros. Co., Buffalo, N. Y. It is priced at $7.50 complete with steel gears, 12 feet of air hose, a pressure gauge, and everything for immediate installation. It will inflate a Ford tire in about 1.5 minutes and it can be installed in 45 minutes. It is mounted above the crankshaft and to the left and is driven by a gear.

Another Manzel model is a two-cylinder design which sells for $20. Fifteen feet of hose, pressure gauge and air filter are part of the equipment. It may be installed without difficulty on almost any make of car as special fittings are made for all the prominent makes now in use.

Sanford Single-Cylinder Pump

A new motor-driven tire pump is shown by the Brown Co., Syracuse, N. Y. It is called the Sanford and sells for $8.50 complete with gear, hose and gauge. It is suitable for tires up to 34 by 4 inches and will inflate a Ford tire in 1 minute. A four-cylinder garage pump is also new. The feature of this device is the placing of the cylinders at 90 degrees and in the same plane. It is electric driven.

Kellog Pumps

Four new garage pumps feature the line of the Kellog Mfg. Co., Rochester, N. Y. In addition a combination tire pressure gauge and air purifier has been brought out and minor improvements are noted in the line of motor-driven tire pumps which are made with one, two and four cylinders.

One garage pump which is a portable type is completely inclosed in a sheet metal casing, keeping the working parts away from the dust. It is a complete unit containing a motor, air-compressor, storage tank and automatic electric cutout.

Mayo Pumps

Several pumps and pump accessories are on view at the booth of the Mayo Mfg. Co.

The most recent design is the valve cap pump, which is operated by the compression of the motor, but instead of screwing into the spark plug opening is permanently attached to a valve cap. It sells for $15 complete with equipment.

In addition there is the spark plug pump and also a special type for Fords, the former sells for $10 and the latter for $8. There is a special two-cylinder garage pump as well as foot pumps and gauges.

Hartford Single-Cylinder

The Hartford Machine Screw Co., Hartford, Conn., has introduced a single-cylinder pump. The two-cylinder model will be continued. The single will inflate a 34 by 4 tire to 80 pounds pressure in 2.75 minutes. It is gear driven.

The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XXXII Thursday, January 7, 1915 No. 1

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
231-241 West 39th Street, New York City

BRANCH OFFICES
Chicago—910 South Michigan Avenue Detroit—505 Free Press Building
Boston—1035 Old South Building Cleveland—516-517 Swetland Building

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

ADVERTISING
A. B. Swetland, Advertising Manager
W. I. Ralph C. H. Matteson Louis R. Smith
Howard L. Spohn H. H. Gill James F. Healing
F. B. Barrett, Cleveland C. H. Gurnett, Chicago Chas. Anthony, Detroit
Guy W. Mott, Cleveland F. J. Robinson, Chicago

Cable Address . . . . Autoland, New York
Long Distance Telephone . . . . 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico . . . . One Year, $3.00
Other Countries in Postal Union, including Canada . . . . . One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Recognition

THIS week's Grand Central Palace automobile show once more demonstrates that the interest in shows is not waning, an increased paid attendance of 22 per cent. on opening night, over the corresponding night of a year ago, being convincing proof of this. The last 18 months have demonstrated that we are far from arriving at that point in automobile engineering where the road lies straight to the eventual goal. Two years ago some few imagined the eventual had arrived, and that shows would practically cease so far as new interest was concerned. But what false prophets they were, as this year evidences more real engineering activity than any year for some time. And you do not have to go around with the microscope to find many of the improvements.

The present period, due to the great European war, is epochal in American automobile design, in that Europe is bound to take more notice of our activities than heretofore. Unfortunately our status of design has not been so high in continental eyes as could be desired. Our early racing attempts abroad did little to engender respect, and these early memories are still green in the minds of many Europeans. They have not given due credit for what has been accomplished on this side of the ocean. Few of their engineers have seen at first hand our factories. The war is bringing them to our shores and on every hand are heard wholesome comments on the amazing improvements that Americans have made. While production has absorbed much of our energies still design has been carried along. With this situation confronting us, we can look to much closer scrutiny of our designs from Europe, and the good that is in us will not be so hidden under a bushel as in the past.

Engineering Character

EUROPE, which is always slow in co-operative activities, has at last generally acknowledged that the standardization of work, which the Society of Automobile Engineers has been carrying on in America for several years, is most valuable to the automobile industry, and that the Old World countries have not been progressing rapidly enough in this work.

Two years ago a few score of American engineers still believed that the work of the standard committee had in mind the eventual elimination of the engineer, and that car efficiency was being injured by the aggressive work of the various standard committees. Fortunately many of these engineers have been made converts within the last year, and today they are loud in praising the standardization work, now that they see the true object of it, namely, to take needless routine off the shoulders of the engineer, to give him satisfactory materials to work with at lower costs, and to make it possible for him to purchase materials and parts suited to his needs, without long waits for deliveries.

The past year has been a red-letter one in this work, and the various committees at their quarterly sessions have worked on a schedule which has heretofore been wanting. Today this work is more up-to-date than at any previous time, in fact, the work is keeping in step with manufacturing, as shown by the standardizing of flanges for horizontal type carbureters which are just coming on the market. It is of invaluable advantage to both carbureter and motor makers to get these standards settled before manufacture has progressed very far.

What has been done is but the entering of the thin edge of the wedge. Standardizing these flanges does not improve the gearset design of the poor maker or impair the design of the good manufacturer. Standardizing this design is not going to rob one of business and give it to another. These standards not only evidence breadth of intellect in the engineering field, but also point to a most deserving spirit of progress in the manufacturers of such parts. This widening of the views of individuals, individual concerns and groups of concerns, is one of the most considerable indications of the great broad work that the standards committee is accomplishing; and when we compare these accomplishments with kindred work in other industries we can only reach one verdict, namely, our Society of Automobile Engineers is setting a high-water mark in the international engineering field in this work.

rvoort President of S. A. E.

Elected with Full Ticket at Annual Meeting Today—Ex-President Souther Made Life Member—Nine Tire Sizes Considered—Side-Outlet Carbureter Fitting Standardized

CITY, Jan. 6—W. H.
President of the
utomobile Co., is the
Society of Auto-
The other officers
Hutton, first vice-
Anglada, second vice-
er, treasurer and
John Wilkinson,
Kennedy and F. M.
Roller Bearing Co.,

opened the meeting
work of the so-
automobile en-
the value of
truthfully say
He dwelt on the
neers who turn
roduction end of
He stated in
asing number
re trained en-
work of pro-

n who could
new how."
oducing eng
ion to the p
manufacture
that the de
e to take up
igineering.

asurer's report

Clarkson, secr
rered the financ
cember 1, 1914.
ceipts to be $21
ments to be $16,2
n elected since t

which was read
ary of the So-
from October
It showed the
758.48 and the
3.22. The new
e last meeting

take into account those which have en-
tered under the new constitution. There
have been added to the Society's list
thirty-two members, twenty-three asso-
ciates, six juniors, one affiliate, five af-

filiate representative and eleven student enrollments.

Souther Elected Life Member

Henry Souther was presented the silver tray shown yesterday at the Standards Committee meeting and was also elected a life member of the Society as token of appreciation for the work he has done as chairman of the Standards Committee.

The professional part of the meeting this morning was taken up by report of the ball and roller bearing division and the report of the division on carbureter fitting. The ball and roller bearing report was one of progress. A data sheet showing the size of roller bearings has been drawn up and will be submitted to bearing manufacturers for their approval. In addition a table of proposed end thrust bearings is being arranged in which it is hoped to reduce the number of sizes to one-third the present number. This sheet will be sent out shortly. There was no discussion on the report of this division.

The report of the carbureter fittings division as described later under the head of the standards division report of yesterday, was next taken up. This was adopted without discussion. The result of this report will provide a standard fitting for side outlet carbureters which

Vice-presidents and Council of S. A. E. for 1915, the men in control for the next 12 months. Upper row from left to right: Christian Girl, Perfection Spring Co. Cleveland, O.; Howard Marmon, Nordyke & Marmon Co., Indianapolis, Ind.; Henry M. Leland, Cadillac Motor Car Co., Detroit, Mich.; William P. Kennedy, Consult. Engr., New York City. No photograph was available of F. R. Hutton. Lower row from left to right: F. M. Germane, Standard Roller Bearing Co., Phila., Pa.; Walter C. Baker, American Ball Bearing Co., Cleveland, O.; A. B. Cumner, Transportation Engr., New York City; Ernest P. Curtis, Civil Engineer, Toronto, Ont., Joseph A. Anglada, Consulting Engineer, New York City

Dr. Moldenke, Watchung, N. J. Ferdinand Jehle, Com. Eng. Lee

C. W. McKinney, Willys Overland Co. A. Ludlow Clayden, Inst. A. E. of Gt. Br

A. K. Ehler, Overbrook Pa. G. W. Houk, Houk Mfg. Co.

will correspond almost directly to that of carburetors using horizontal flanges for attachment to the intake manifold.

All of Tuesday the standards committee spent arranging the array of standardizing factors which will be presented before the meetings of the society as a whole on Wednesday and Thursday. More than seventy were in attendance. The reports of twelve divisions were heard and the reports threshed out at the Tuesday meeting indicate that the winter session of 1916 will close with much accomplished.

The business of the committee meeting is summed up by the reporting of the twelve divisions devoted to different features of the standardization work, the creation of a new division for the purpose of investigating the possibilities of standardizing the sprocket wheels used in connection with silent chain drive of the timing gearset and the exhibition of a silver tray to be presented to Henry Souther, chairman of the standards committee, by his associates in recognition of the valuable work he has accomplished during his three years of service, from 1910 to 1914. Mr. Souther's most important work has been in connection with his devotion to the subject of S. A. E. standard steels, which have become recognized by engineering bodies throughout the world.

The twelve divisions which have brought the results of their research work before the standards committee, and which will have their reports threshed out at the general meeting, are those dealing with electrical equipment, iron and steel, frame sections, lock washers, carburetor fittings, miscellaneous fittings, ball and roller bearings, electric vehicles, standards exchange, pleasure car wheels, springs and nomenclature.

If the results of the reports of the divisions are what would be expected from the various reports before the standards committee the following good will have been accomplished:

The methods of wiring and insulating the single wire and double wire starting and lighting systems will be clearly defined and the nomenclature of these two systems will be changed to the grounded-return and the insulated-return systems, respectively. Fuse ratings for these systems will be clearly outlined and the method of constructing fuse clips, battery retainers and lamp fittings will also be definitely outlined.

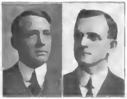
The list of S. A. E. steels will be augmented by the outlining of a set of physical characteristics to which the engineer can work if he so desires, rather than merely to the chemical formulas heretofore supplied. There will also be two silico manganese spring steels instead of one.

Frame dimensions will be so laid down

Alden L. McMurtry, Consult. Engineer David L. Gallup, Worcester Poly Inst.

Chas. B. Whittelsey, Hartford R. W. Co. Walter T. Fishleigh, Univ. of Michigan

R. N. Hodge, Hayes Wheel Co. C. T. Myers, Mech. Engineer



Henri G. Chatain, General Electric Co. C. W. Spicer, Spicer Mfg. Co.

that future designs may follow a definite recommended practice, insofar as the radius of curvature at the frame ends, the depth and the amount of drop is concerned.

The number of lock washers will be reduced much in the same manner that the number of steel tubing sizes were some time ago. Certain lock washer sizes will be made to conform to several sizes of nut.

The method of attaching side-outlet carburetors will be standardized in the same manner as those using the horizontal flange.

Pins for rod and yoke ends will be standard, the list of S. A. E. screw thread sizes will be carried above 1.5 inch to more than 6 inches, and the number of fan belt widths will be reduced to three definite sizes instead of the large number of indefinite widths now used.

A list of standard roller bearing sizes will be submitted to manufacturers for their acceptance and then turned over for adoption by the society.

Electric Vehicle Formula

A definite standpoint from which to judge the performance and capacity of electric vehicles will be adopted. A standard type of name plate will also be fitted to each type of motor.

Bell housings that will be suitable for all makes of unit power plants will become standard. These bell housings are continuations of a standardized crankcase end, and include the flywheel and the gearset.

Tire sizes will be reduced to nine regular sizes with nine over sizes. This is a continuation of the work that has been going on during the past year.

Cantilever springs will be classified and receive a definite nomenclature, and spring bolts, clips, nuts and fittings will receive standard dimensions.

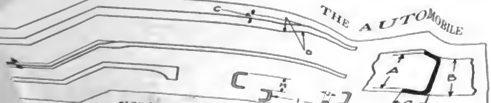
Car parts will be arranged in a logical sequence to facilitate the nomenclature and proper listing of parts for parts catalogs.

Electrical Equipment Division Reports

The electrical equipment division made, among others, the following recommendations, the report being read by Joseph Bijur, of the Bijur Motor Lighting Co.

The division has received from its subcommittee an interim report submitting data as to ordinances in force and headlights dimming devices approved by various municipalities. The division feels, however, that no specific recommendation should be made by it at this time as to a definition of glaring light.

The sub-committee on bulb bases, sockets and connector plugs has recommended that an additional drawing, with dimensions showing details of the connector plug, be added to the S. A. E. data sheets. Also an end view of the socket,



[illegible] will be standardised on frame side members if the standards committee work is carried through

...of location of the bayo-...nd detail dimensions of [illegible]

...ittee has further recom-...lamp bases and connector ...o interchange in the same [illegible]

...ended that the systems of ...commonly known as the "two-...single wire" systems ...respectively "insulated return" ...return systems. ...which (apart from ...frame or bare ...of the return cir-...considered as a "ground-[illegible]

...conductors ...must be protected ...metallic conduit out-... except where ...m the elements, ...with metal sur-...are inside of the ...and instrument ...a straight line ...ps. ...wires ...extending ...chassis and ...s of all cond... must point ...run out of, ...it where exposed ...wnward, so that ...tead of into the ...metal conduit ...must ...ntly clamped ...outside of a ...long.

...e wires are n... s led to a con-...ely soldered, or ...or they are to ...the plug, either ...not exceeding ...ve not less than ...may be of meta... ...ion interposed b... ...ire.

...protected with ...be cleated at in-...10 inches, such ...with a layer of ...tween the cleats ...es must be of t... ...ucted so that ins... ...er or not they ha... ...es should be m... ...g. ...enclosed type, ...ection can show ...e been melted. ...rked with their

...andard fuses shall be 1 1-4 inches over all, with ferrules 1-4 inch in ...eter; or 1 1-2 inches long over all, ...a ferrules 13-32 inch in diameter. ...t is recommended that fuses of 10-, 20- ...d 30-ampere ratings be used. Fuse rating and temperature rise shall ...nform to the specifications of the Na-...onal Board of Fire Underwriters, which ...re [illegible] from time to time, usually ...very two years.

C. W. McKinley, [illegible] engineer of the Willys-Overland company, questioned if the glass type of fuse would fall within the measurements given by the committee. He stated that the glass fuse was in common use and should be considered. Mr. Bijur stated that the glass fuse had been considered by the committee in making up their report and that he thought the glass fuse would fall into the dimensions given.

R. McA. Lloyd brought up the point that the matter should not go beyond recommended practice as conditions are changing too rapidly to standardize this part of electrical equipment. Mr. Bijur replied that the idea of the committee was merely to recommend this as good practice. W. G. Wall, engineer for the National company, stated that he doubted the practicability of the glass fuse and favored the [illegible]. Mr. Bijur replied that the specifications did not require only the transparent type of fuse but that others also would qualify for [illegible].

Alden McMurtry mentioned [illegible] that horizontal fuses of a small size are apt to reclose the circuit on melting and that he would advise a vertical installation. K. W. Zimmerschied, metallurgist of General Motors Co., stated that the rating and not the outside dimensions of the fuse should be the determining factor. Mr. Bijur also stated that the size could be anything desired as long as the rating is correct. He stated that the largest size given in the report of the division is large enough for any installation.

The report of the Iron and Steel division was read by K. W. Zimmerschied. It has not as yet been published but goes into the matter of physical specifications of the S. A. E. steels. It is the idea, as Mr. Zimmerschied brought out in his report, to have the engineer who is using the physical specifications furnish the steel manufacturer with both the chemical and physical analyses of the steel he requires. He may use one or the other but not both as it would seriously handicap the steel fabricator to have to overcome difficulties that the engineer would never foresee.

The idea of the report is two-fold. First to give a definite idea to the engineer using the steel as to what can be expected from each chemical analysis and secondly to protect the steel manufacturer against unreasonable demands of physical analyses of definite steels. At the present time curves of the physical characteristics of the carbon steels have been made and data sheets will be issued before the end of the month. The specifications for S. A. E. chromium-nickel steel have been altered in chromium percentage and two silico-manganese spring steels take the place of the one, allowing greater freedom in the silicon and manganese fractions.

In response to a question by W. G. Wall as regards the definite characteristics of the new silico-manganese steels it was pointed out by Mr. Zimmerschied that one allows from .45 to .55 carbon and 1.80 to 2.10 silicon and the other from .55 to .65 carbon and 1.55 to 1.80 silicon. This satisfies the advocates of both schools: High carbon with low silicon and low carbon with high silicon.

The frame section report is summed up in the accompanying illustrations herewith and the table of dimensions which accompanies it. The report was read by J. G. Perrin, who was chief engineer of the Lozier company. It is a continuation of the report of the committee made at the last meeting but the amount of drop has been increased on account of the growing tendency to flatten the front spring. A letter from A. L. Riker, engineer of the Locomobile company, showed that he acquiesced in practically all the dimensions. The dimension D, in the drawing was the only one he thought impossible for his concern to use.

Walter M. Newkirk, of William & Harvey Rowland, Inc., stated that in his belief the cantilever spring would require a heavier frame. W. G. Wall agreed with this but stated that the 6-inch frame allowed for in the list of dimensions would take care of this.

Carbureter Fittings Division

The report on carbureter fittings was chiefly concerned with carbureters which bolt directly against the cylinder casting with a vertical flange. It was read by C. W. Stiger, President of the Stromberg company. Its recommendations in part follow:

Some time ago certain manufacturers of automobile motors of the block type requested that steps be taken to standardize the method of locating the position of the connecting flange on side-outlet carbureters, in order to avoid the confusion which now exists.

This has been carefully considered by the carbureter fittings division, and after much correspondence between the members and with those most concerned, engine builders and carbureter manufacturers, we recommend the adoption of the present standard flange dimensions and contour, with the bolts placed in a vertical plane, for carbureters of the side-outlet type.

Flared Tube Unions and Union Fittings

It has been found in actual practice that the tolerance now specified for the union nut bore (dimensions M, S. A. E. Data Sheet, 35a, Volume 1) is not sufficient for practical screw machine manufacturing and we therefore recommend that it be increased from .008 inch to .016 inch for all sizes.

The revised dimensions for M would be as follows:

	1/4 inch	5/16 inch	3/8 inch	7/16 inch	1/2 inch
M Bore of female part	[illegible] 0.260	0.317 0.332	[illegible]	[illegible]	[illegible]

Owing to the demand for S. A. E. Standard Flared Tube Unions and Fittings in sizes larger than those now listed, we recommend the addition of 5-8 inch and 3-4 inch sizes.

W. G. Wall brought up the fact that a great many car manufacturers would like to have the dimension of the cylinder to the extreme outside point of the carbureter standardized, as with the streamline type of hood designers are compelled to pinch the hood dimensions to a considerable extent in order to get the sloping effect. C. E. Davis also believed that this dimension should be settled if possible. In response to the natural question as to why the bolts are placed in the horizontal instead of the vertical flange the reason advanced by the committee is that it is easier to arrange the carbureter throttle and the corework on the casting if this is done, even at the sacrifice of accessibility.

Electrical Vehicle Division Report

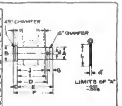
The report of the electrical vehicle division was read by A. J. Slade, consulting engineer. It is extracted as follows:

Electric vehicle speed ratings shall be based on continuous operation with one-half load over hard, smooth and level roads or pavements at the actual average battery voltage.

A	B	C	D	E	F	G	H	I	J	K	COTTER		d-DRILL		DIFF	DIFF
											d	L	NO	DIA	d-d	±K*
3/16	5/16	1/16	[illegible]	19/32	21/32	3/64	1/64	.4464	[illegible]	.0089	[illegible]	5/16	48	.076	.0135	.0264
1/4	3/8	3/32	[illegible]	51/64	57/64	1/16	1/32	.6339	[illegible]	.0089	[illegible]	7/16	48	.076	.0135	.0264
5/16	7/16	3/32	[illegible]	31/32	1 1/16	5/64	1/32	.7946	[illegible]	.0096	[illegible]	1/2	36	.106	.0123	.0218
3/8	1/2	1/8	[illegible]	1 3/32	1 7/32	5/64	1/32	.8943	[illegible]	.0050	[illegible]	5/8	36	.106	.0123	.0218
7/16	9/16	5/32	[illegible]	1 15/64	1 23/64	3/32	3/64	1.0086	[illegible]	.0089	[illegible]	3/4	36	.106	.0123	.0218
1/2	5/8	5/32	[illegible]	1 27/64	1 37/64	7/64	3/64	1.1351	[illegible]	.0081	[illegible]	7/8	28	.140	.015	.0234

ALL DIMENSIONS IN INCHES

* TOTAL CLEARANCE YOKE TO COTTER



Tabulation of cotter pin dimensions which the miscellaneous division is engaged upon in its standardization work

Electric vehicle mileage ratings shall be based on the rated five-hour discharge capacity of the battery and a continuous run with one-half load over hard, smooth and level roads or pavements or the equivalent.

The division recommends the adoption of two classes of motors for use upon electric vehicles, one series designed for 80 to 85-volt operation, characteristic curves to be furnished by the manufacturers for each of these two voltages. The second series of motors to be designed for 60 to 66-volt operation, characteristic curves for each of these voltages to be furnished by the manufacturer.

It is recommended that each motor shall carry a name plate setting forth the following particulars: Manufacturer's name and address, whether series shunt or compound automobile motor, frame size, volts, amperes, r.p.m.

Under volts, amperes and r.p.m should be given the figures for both high and low limits of voltage as recommended above.

The division recommends for testing the comparative efficiency of solid rubber tires the use of the rebound test method

It is recommended that the number of cells in lead acid type batteries be 42 and the number of cells in the nickel iron alkaline type be 60.

The question of the Society making recommendations for the adoption of International standards by the U. S. National Committee of the International Electro-Technical Commission (of which Dr. A. E. Kennelly of the Massachusetts Institute of Technology is secretary) was given consideration by the division, and the suggestion is offered to the Standards Committee that it might be desirable to take some procedure in this direction by offering to this committee for adoption as international standards the recommended practices which our society has accepted covering electric vehicle charging plugs and receptacles and which also have become standard practice of the Electric Vehicle Association of America and the Incorporated Municipal Electric Association of England. It is the opinion of this division that other recommended practices of the society might be advanced for international adoption, and the taking of some action in this particular instance might serve as copy for future action in this direction.

R. McA. Lloyd argued that such standard ratings as are given in the report would not do as a standard of comparison because it would hardly be fair to judge electric vehicles on a 5-hour discharge rate, for instance, if they were customarily operated at a discharge rate in excess of this. Mr. Slade pointed out in relation to this argument that the rating corresponded to the S. A. E. rating of gasoline cars. It is a standard form of rating, and if the designer can get more than the given rating it is a tribute to his skill and hence a good criterion of the actual performance of the car. Outside of the discussion on this point there was no objection offered to the rating methods by the other members of the standards committee.

Miscellaneous Division Reports

J. C. Utz, Perfection Spring Co., read the report of the Miscellaneous Division. The standard yoke and rod end pins recommended were in accordance with the print reproduced herewith, together with the table of dimensions. In relation to screw threads the report of the division follows:

We recommend the following standard diameters and pitches for thread pitch standard above 1.5-inch diameter. We herewith submit two sizes to be known as fine and coarse thread.

The coarse threads to be as follows: Beginning at 1 5-8 inch and advancing by 1-8-inch increments and extending to 2 7-8 inches, inclusive, 12 threads per inch; beginning with 3 inches and advancing by 1-8-inch increments to 5 7-8 inches, inclusive, 10 threads per inch; beginning with 6 inches and advancing by 1-8-inch increments up, 8 threads per inch.

The fine threads to be as follows: Beginning at 1 5-8 inch and advancing by 1-8 inch increments up, 16 threads per inch.

For flat fan belt widths we recommend the following to be standard practice: 3-4-inch, 1-inch and 1 1-4-inch.

The dimensions for the yoke and pins and the S. A. E. standard screw thread dimensions were accepted without discussion. The dimensions submitted on pulley belts for fans created some discussion on the fact that the widths of the woven belts were apt to vary considerably. It was also thought by some that the pulley itself was a fit subject for standardization. The report was finally amended that the figure given would represent a maximum, and from these the pulley makers could figure their own clearances. The report was adopted with the amendment and will be discussed along with the others at the general meeting.

The report of the Ball and Roller Bearing Division was one of progress. A table of proposed roller bearings sizes has been drawn up, and these will be submitted to makers who are interested for comment.

The report of the springs division, which will be fully discussed in a later issue after it has come before the meeting of the whole society, brought out one fact that is of importance. This is the chaotic condition of what really constitutes a cantilever spring. In the report of the division it is aimed to adopt a nomenclature of the various types of cantilever. The biggest part of the discussion was on whether or not the quarter elliptic spring is a cantilever or not. According to accepted definitions of cantilever beams there would still be a doubt as to whether or not it can be classed as a cantilever.

The report of the pleasure wheels division was again concerned with the reduction in the number of tire sizes. This was read by E. R. Hall of the Goodyear Company. The sizes have been finally brought to nine: namely, 30 by 3, 30 by 3 1-2, 32 by 4, 33 by 4 1-2, 34 by 4, 34 by 4 1-2, 36 by 4 1-2, 35 by 5 and 36 by 5 1-2. In addition to these there are the oversizes for these tires. No discussion was offered on the adoption of the report, but Henry M. Leland, president of the society, brought up some interesting figures on the variations in the outside diameters of tires, stating that these are so great that they make a difference of between 4 and 6 per cent. on the speedometer readings. Mr. Leland also dwelt on the chaotic conditions which now obtain abroad on the tire situation, stating that the makers of cars who are at present selling in the European market are having the greatest difficulty in meeting the tire requirements simply because every maker has a size of his own. The unstandardized condition of the millimeter-size tire has militated against the expeditious handling of foreign orders by every concern which has sought the export trade.

The standards exchange division is now principally concerned with the bell housing idea, and has gathered together a set of housings that will probably meet the requirements of the majority of the motor manufacturers. In fact, the work of the committee as brought out by Mr. Zimmerschied has been greatly simplified by the fact that most of the makers are using identical dimensions in a large number of instances.

The nomenclature division is closing its work by submitting a standard form in which to include the whole assembly of a car for the purpose of listing the parts for a repair parts catalog.

Production Favors Metal Body

By H. Jay Hayes

Pres. Hayes Mfg. Co.

bodies are being
ccessfully, the
d finished ready
tion, nothing but
major portion of
ers patent were
all-metal body.
was used on an
roved very satis-

that sheet steel
than formerly.
use of carbon
a smooth sur-

expensive to
s used about
to buyers for
ch have been
gasoline en-
posite bodies
covered with
ere developed.
minating in
cases rust
d of sheet
manufacturer
ill uses cast
the way, are
ed cars from

an advantage
odies. High-
r body panels
fact, together
k or split on
heat and cold,
on, especially
a manufac-
s in finishing
ies in rooms
to see panels
exposed to the
ght cars for

t require one-
body does to
and the cost of
Fewer coats are
count of a filler
wood. Some
enameling the
ing it to the
t a high tem-
perature, making a very durable and satisfactory finish for medium-priced cars.

before Society
id-winter meet-
d 7, 1915.

Best Steel Used

The steel sheets now being made for the automobile industry are the best sheets in every way that have ever been manufactured, either in the United States or abroad. The steel employed [illegible] selected with the greatest care, and is being made from materials specially [illegible] selected for the purpose. It is essential that the chemical composition and the physical structure be such as to permit of developing the high finish necessary, providing at the same time ductility, strength and durability.

THE CARBON CONTENT SHOULD NOT EXCEED .16 PER CENT. TO PROVIDE DUCTILITY, AND THE MANGANESE CONTENT MUST NOT EXCEED .40 PER CENT TO PREVENT DETERIORATION.

During the process of manufacture in each department it is necessary to exercise much skill and employ extreme care to prevent the development of irregularities which may later on cause the stock to become unsuitable for the purpose intended. The precautions taken [illegible] form of additional labor and [illegible] materially decreasing the output. [illegible] The sheets are subjected to a very accurate heat treatment to establish uniform temper and to relieve any internal strain that may have developed during the course of manufacture.

A Body Paradox

THE PERFECT AUTOMOBILE BODY SHEET MUST BE HARD AND SOFT AT THE SAME TIME. IT MUST POSSESS HIGH TENSILE STRENGTH AND GREAT DUCTILITY. ONLY A MIRROR-LIKE SURFACE IS ACCEPTED AND OFTEN TIMES THAT SURFACE IS SUBJECTED TO MICROSCOPIC INSPECTION. FIVE YEARS AGO A FULL PICKLED COLD-ROLLED SHEET ANSWERED ALL PURPOSES. TODAY SPECIAL HEATS, ANALYSIS, CAREFULLY SUPERVISED BAR TREATMENT, HOT-ROLLING, COLD-ROLLING AND ANNEALING MUST BE GIVEN TO MEET EACH INDIVIDUAL REQUIREMENT OF A DISCRIMINATING CUSTOMER.

Body, fender and radiator sheets no longer belong to the same family. They may be of the same genus and look alike, but the basic ingredients and qualities are radically different. Steel to be used for pressing or stamping must be soft enough for drawing without cracking or straining the metal too severely.

Usually the stampings for tonneau backs are made in three pieces, as also for the shroud or cowl, and then joined together by spot-welding or acetylene welding and afterwards soldered and smoothed off to make a good joint. Invariably it is necessary to bump or hammer these parts, which naturally hardens the metal, causing crystallization later. While this has apparently been satisfactory, a great deal of care is necessary in preparing the metal for painting. Painters do not like anything that looks like solder. Occasionally trouble arises after the body has been used a short time, on account of opening at the joint, or the paint coming off, attributable possibly to imperfect cleaning of the metal. Some wonderful press operations are now being conducted, eliminating practically all the above difficulties and crystallization, etc. One-piece stampings of back seats and cowls are now being made very satisfactorily in one operation. This allows the metal to remain ductile with but little, if any, tendency to crystalline.

Four-Piece Body

The one-piece stampings make a complete body shell containing practically four pieces, as follows: Tonneau, cowl, two side panels as against eight pieces with the other construction. Again, less wood frame-work is necessary, as the metal has more rigidity and less weight. The metal is also less expensive to finish.

THE GAUGES OF STEEL SHEETS ARE USUALLY 18, 20 AND 22, ACCORDING TO THE STRENGTH REQUIRED. THE METAL MUST HAVE CLEAN SURFACES BEFORE PAINTING. SAND BLASTING IS USED TO ERADICATE ALL IRREGULARITIES. IF METAL IS TO BE EXPOSED TO THE ELEMENTS FOR ANY LENGTH OF TIME, IT IS BETTER TO COAT IT WITH A PRIMER OF RED LEAD, WHICH, BEING A DOUBLE OXIDE OF LEAD, IS AN EXCELLENT ANTI-CORROSIVE PRIMER.

Gradually metal is taking the place of wood in body building, as in railroad car construction. Some of the largest automobile manufacturers are using all-metal bodies. It will be only a short time before the majority of medium-priced cars will be equipped with all-metal bodies finished with enamel, baked on at a high temperature, saving time and producing a much more durable finish.

Makers Should Base Tire Equipment on Car Weight

By Charles B. Whittelsey

Secretary and Factory Manager, Hartford Rubber Works

A PNEUMATIC tire is a cylindrical ring of air surrounded by a covering of canvas and rubber designed to carry a load and to absorb shocks. If the cylindrical ring of air is not of sufficient volume, it cannot do the work for which it is designed. The cylindrical ring of air should be under such a pressure as to permit the tire to carry the load and to absorb the shock. If the pressure of air used in a tire is too great its service will be similar to that of a solid tire, transmitting the shocks in greater volume, thus shortening the life of the car; while a pneumatic tire of proper size and inflation will prolong the life of a car.

The subjects of proper tire sizes and tire inflation are so closely identified that they will have to be discussed together. The variables to be considered in tire pressures are service, economy and comfort. The nature and construction of the tire cover or shoe should be flexible and yielding, so that it may transmit quickly the shock to the cylindrical ring of air.

More Speed, More Heat

The heat generated within the tire has much to do with the air-pressure used—the faster the speed the greater the heat. The greater the heat the greater the strain, on account of the expansion of air within the tire. Continuous driving generates excessive heat, as well as driving in hot weather. Excessive heat is injurious to the shoe and causes rapid deterioration. If there is not sufficient volume of compressed air within the tire, due to using an improper size, to absorb all of the shock and vibration, the surplus shock and vibration is transmitted to the car and, therefore, shortens the life of the car. The greater the volume of air in a tire, the less the increase of heat and strain when driving under climatic conditions which produce excessive heat, as well as when driving at great speed or doing heavy work.

Degree of Inflation

A tire should be sufficiently large not to flatten at the point of road contact more than 14 per cent. of its sectional diameter or on an average 12 per cent., to give good service.

A tire of sufficient volume to properly carry a load with proper tire pressure will, if not properly inflated, deteriorate much more rapidly from excessive flexing, causing the fabric to break down quickly, and is much more liable to puncture. Still the user closes his eyes to these facts, when he considers only the personal comfort of the occupants of the car, for he well knows that an underinflated tire will give greater riding comfort as it absorbs the vibration and shocks more quickly and thoroughly. After he has driven his tire under-inflated and received a much less than normal mileage from it he is brought face to face with the increase in tire expense which he has brought upon himself.

The personal equation of the driver has to be considered; the tendency not to see that the tires are properly inflated; the manner in which he drives; the service of the car, whether for light or heavy work, the climate and seasons, the geographical location, the type of road-bed, the use of shock absorbers, the spring equipment and the distribution of the load of the car, are also factors.

Oversize Tires

Some automobile manufacturers are inclined to equip their cars arbitrarily with tires not sufficiently large to perform the required service, unless inflated to a pressure making them so rigid as to cause the cars to ride as though equipped with solid tires. This is a short-sighted practice, for the reason that if the user keeps his tires inflated excessively, he shortens the life of his car and increases his car repair bill, and the car maker does not retain the good will of his customer, as he would by putting on tires of sufficient cubical content. This condition caused the tire manufacturers to design what is commonly known as the oversize tire, which was first purchased by the car user after he found out that his car was under-tired, and has since been adopted by many automobile manufacturers.

For example, an automobile manufacturer puts out a car that weighs 2,500 pounds, fully equipped with all the necessary accessories, and designed to carry a given number of passengers, 32 x 3 1-2 tires; these tires are overloaded. He knows that if the tires do not give service the user will, undoubtedly, buy 33 x 4 tires, which have approximately 25 per cent. greater cubical content than the 32 x 3 1-2, but cost approximately 40 per cent. more. The manufacturer might have equipped the car with a 32 x 4 tire, which is amply large to carry the load, but this would have added about 35 per cent. to the tire cost of the manufacturer. He would, however, not only have pleased the car owner with the service from his car and the tires, but insured him a greater mileage on the first set of tires and saved him at least 5 per cent. of the tire bill on each renewal.

Oversize Advantages

It has been stated that an oversize tire properly inflated will not last longer than a regular size tire pumped up to its rated inflation pressure. The oversize tires with their larger cubical content will perform a greater amount of work, because there is less heat developed in them. They will pass over stones and receive the shocks of the road with far less liability of fabric breaks, because of the additional amount of cushion in the air to distribute the strain throughout the greater area. They are less liable to puncture because of their additional strength and carrying capacity, which not only increase the life but afford much easier riding.

Pressure Scale

Tire manufacturers have found from years of experience that tires inflated to a pressure of 20 pounds per cross-sectional inch will give the longest life when driven under normal conditions. For example:

2½" tire	50 pounds
3 " tire	60 pounds
3½" tire	70 pounds
4 " tire	80 pounds
4½" tire	90 pounds
5 " tire	100 pounds
5½" tire	110 pounds

They are trying to educate the user to see that his tires are kept inflated to this pressure by taking readings with a tire pressure gauge, of which there are several reliable makes on the market at a moderate price. Adjustments are being made on this basis. As in years gone by, many tire users do not have a pressure gauge, but judge the proper inflation by kicking the tire to see whether it is hard enough. In most cases where this crude method is used and a tire gauge is afterwards applied it is found that the tires were from 30 to 50 per cent. under-inflated. There is, however, a great reduction in the number of complaints along this line today.

Permissible Tire Loads

Practically all the tire manufacturers use a nearly uniform table, giving the weight the different sized tires are designed to carry at a stated inflation pressure. If tires were used in accordance with this table, the pros and

---

EDITOR'S NOTE—*Paper read before mid-winter meeting of Society of Automobile Engineers, New York, January 6 and 7, 1915* cons of tire inflation would be reduced to a minimum.

The following, is a list of the loads, cars to be weighed without passengers or luggage, which tires of the different sizes are designed to carry, sufficient allowance being made for the usual number of passengers:

	Rear Weight	Front Weight
28 x 2½	225 lbs.	275 lbs.
28 x 3	350 lbs.	425 lbs.
30 x 3	375 lbs.	450 lbs.
32 x 3	375 lbs.	450 lbs.
28 x 3½	425 lbs.	500 lbs.
30 x 3½	450 lbs.	550 lbs.
31 x 3½	475 lbs.	575 lbs.
32 x 3½	500 lbs.	600 lbs.
33 x 3½	525 lbs.	625 lbs.
34 x 3½	550 lbs.	650 lbs.
36 x 3½	600 lbs.	700 lbs.
30 x 4	625 lbs.	750 lbs.
31 x 4	635 lbs.	775 lbs.
32 x 4	650 lbs.	800 lbs.
33 x 4	675 lbs.	850 lbs.
34 x 4	700 lbs.	875 lbs.
35 x 4	735 lbs.	885 lbs.
36 x 4	750 lbs.	900 lbs.
40 x 4	850 lbs.	1000 lbs.
42 x 4	900 lbs.	1050 lbs.
32 x 4½	750 lbs.	950 lbs.
34 x 4½	900 lbs.	1125 lbs.
35 x 4½	935 lbs.	1175 lbs.
36 x 4½	975 lbs.	1225 lbs.
37 x 4½	1010 lbs.	1260 lbs.
38 x 4½	1050 lbs.	1300 lbs.
42 x 4½	1200 lbs.	1450 lbs.
34 x 5	950 lbs.	1200 lbs.
35 x 5	1000 lbs.	1250 lbs.
36 x 5	1050 lbs.	1300 lbs.
37 x 5	1100 lbs.	1350 lbs.
39 x 5	1200 lbs.	1450 lbs.
43 x 5	1400 lbs.	1550 lbs.
37 x 5½	1150 lbs.	1400 lbs.
38 x 5½	1200 lbs.	1450 lbs.

Eleven New Chassis Seen at Show

(Continued from page 17)

front seat to the rear of the chassis. Another change in the car in the way of equipment is the fitting of a power tire pump.

The drive is taken through a disk clutch and a three-speed gearbox. The rear axle is a Hess bevel floating type. Both sets of brakes are on the rear wheels, which are the wood artillery type, with 34 by 4-inch tires.

Considerable improvement in body work and in upholstery is noticeable in the new four. The touring car which lists at $1,375 is of streamline tendencies. It has a slightly sloping hood and a moulded line at the cowl which eliminates any sharp edges along the length of the body. The roadster sells for $40 less, listing at $1,335, and at the purchase price both cars include the electric cranking, lighting and ignition. The standard color is a blue black for both the touring and roadster models.

Jackson Announces New Four

Another Jackson has made its appearance at the show. This is known as model 44, and is really a new edition of what was the Olympic model last year. The power plant is the same as that used in the former Olympic, being a Northway unit having the clutch and gearbox housings integral with the crankcase. The rear construction and the chassis framework are really the same as the former models, but there have been some changes in other details.

This model has a 115-inch wheelbase, 2 inches less than the Jackson of last season. Among the innovations for the company in this model is the use of a generator ignition system worked in conjunction with the Auto-Lite starting and lighting outfit. The underslinging of the rear springs is another feature new to Jackson practice. This gives the car a lower appearance, which distinguishes it at once from the older cars.

The body work of the new car also shows some departures from previous practice. The tendency towards stream lines is new and the use of crowned fenders and double-bulb headlights, with no side lamps, are also Jackson departures.

The motor has L-head cylinders cast in pairs. The dimensions are 4.125 by 4.75 inches. The gearbox furnishes three speeds. The rear axle is a floating Salisbury bevel design geared 3.5 to 1. The tires are 34 by 4 and non skids are standard equipment in the rear. It has a new type of one-man top, which is another feature, making it different from other Jacksons. The car is sold fully equipped for $1,250.

National Adopts Spiral-Bevel Drive

While apparently the National six exhibited at the show is that announced several months ago, it is yet a new model both in name and for the reason that several improvements have been made. The principal change is in the adoption of the spiral-bevel drive. Other changes which are new for 1915 include a lengthening of the wheelbase from 132 to 134 inches, the mounting of the starting system to the flywheel, instead of using the double deck machine with connection to the timing gears by silent chain, and the addition of Hartford shock absorbers as standard equipment. The five-passenger body has been revamped and now has divided front seats and is longer in the tonneau, due to the 2 inches increase in the wheelbase.

Mechanically the cars are otherwise unchanged, except as is necessitated by the slight alterations enumerated above. The Eisemann magneto is still used for ignition, but the Westinghouse outfit is divided into two units, which are not in any way connected, whereas the double deck construction was formerly used. As compared to the six of a year ago the crankcase is heavier and more rigid, and in the springs silico-manganese replaces carbon steel.

The power plant is a 3.75 by 5.5 L-head block, with water-jacketed intake and with inclosed valve mechanism. The carbureter is a Rayfield and the gasoline feed by pressure.

The feature of the body work exhibit of the National company is the four-passenger parlor car, which has individual seats mounted on tracks, so that they can be placed about the body as desired. If required, they can be lifted from the body individually. In the rear of the body there is a folding seat which holds an additional passenger. In the touring body the car sells for $2,375. Equipment is complete, including the top, windshield, speedometer, dash instruments and a full set of tools.

The new Malcolm car selling for $425

Reo Profits in 1914, $2,539,187

13,516 Automobiles Worth $16,332,000 Built—Extra Dividend—100 Cars a Day

LANSING, MICH., Dec. 31—During the fiscal year ending October 31, 1914, the Reo Motor Car Co., made a net profit of $2,539,187.34. As a result, it is stated, that some time in January the shareholders will be given one of the now customary Reo melons in the shape of another large extra dividend.

During the present year there were built and shipped 13,516 passenger cars having a total value of $16,332,000 which brings the total number of cars made by the company since it started in business to a few less than 70,000, having a total value of $75,000,000.

With the increase of its capital stock from $2,000,000 to $3,000,000, arrangements have been made to greatly increase the production facilities of the plant and beginning February 1, a schedule of 100 cars a day will be maintained. This week over 2,300 men were on the pay-roll and this force will probably be increased shortly.

In 1914 the Reo company purchased supplies from manufacturers and merchants located in Lansing and vicinity to the amount of $1,600,000 which naturally helped the general business and the welfare of the people of the city.

The total amount of wages paid during the year was $1,654,577, which is one of the largest total pay-roll accounts of the year among automobile manufacturers.

At the last meeting of the stockholders it was decided to change the end of the fiscal year from August 31 to October 31, thus the annual statements for 1914 cover a period of 14 months instead of 12.

The total assets amount to $5,090,158.87 as compared with $4,217,474.20 in 1913 and $3,604,784.05 in 1912. The biggest item is the one for merchandise inventoried at cost and which totals $1,923,212, or an increase of over $850,000 over the 1913 account and close to $1,000,000 more than in 1912. The property account totals $1,765,989.47, or over $450,000 more than in 1913. Cash on hand and in the banks is shown to have been $734,920.21 as against $885,383.61 in 1913 and $231,216.10 in 1912. The total of the accounts and bills receivable less reserves is $656,785.83, or over $400,000 more than in 1913. Outside investments which totaled $712,500 in 1913 and $714,500 in 1912 are set at only $3,000 for 1914.

The total liabilities consist of $3,000,000 capital stock or an increase of $1,000,000 over the 1913 and 1912 statements. The surplus at the end of the fiscal year was $1,692,082.07, while in 1913 it totaled $2,061,768.23 and $1,296,962.59 in 1912. The accounts payable total $337,578.35 instead of $126,972 in 1913 and $280,882.51 in 1912.

In tabulated form for the last 3 years:

ASSETS

	Oct. 31, 1914	Aug. 31, 1913	Sep. 31, 1912
Cash on hand and in banks..	$734,920.21	$885,383.61	$231,216.10
Accounts and bills receivable less reserves	656,785.83	242,947.53	363,125.86
Merchandise inventory at cost	1,923,212.10	1,064,895.53	980,886.19
Outside investments..........	3,000.00	712,500.00	714,500.00
Property account	1,765,989.47	1,306,856.17	1,313,067.61
Prepaid expenses	6,251.26	4,891.36	1,988.29
Total	$5,090,158.87	$4,217,474.20	$3,604,784.05

LIABILITIES

	Oct. 31, 1914	Aug. 31, 1913	Sep. 31, 1912
Accounts payable	$337,578.35	$126,972.00	$280,882.51
Accrued pay rolls and salaries	45,293.45	20,136.06	19,768.51
Accrued taxes	15,205.00	8,597.91	7,170.44
Capital stock	3,000,000.00	2,000,000.00	2,000,000.00
Surplus	1,692,082.07	2,061,768.23	1,296,962.59
Total	$5,090,158.87	$4,217,474.20	$3,604,784.05

Dort Co. Incorporates for $500,000

FLINT, MICH., Dec. 31—The Dort Motor Car Co., which has just been organized to make Dort cars has been incorporated with a capital stock of $500,000—of which $400,000 is common and $100,000 preferred—and of which $217,000 has been paid in.

The officers are: J. D. Dort, president; D. M. Averill, vice-president and general manager; F. A. Aldrich, secretary-treasurer, and J. D. Mansfield, sales manager. These officers and Geo. L. Simmons constitute the board of directors. Etienne Planche is the chief engineer and designer. At present two models, a touring car and a roadster, will be made, production beginning in February.

Automobile Securities Quotations

NEW YORK CITY, Jan. 5—A number of fluctuations marked the transactions in automobile stocks during the first week of the new year. Most of the stocks made slight gains although a few are listed lower than a week ago. General Motors common shows a gain of 4 3-4 points, while the preferred lost 4. Studebaker common gained 4 1-2, while the preferred is 5 points ahead of last week. Maxwell common is 1 1-2 higher and both the preferred lists 2 points higher. Tire stocks except U. S. Rubber and Goodrich were slightly weaker, Ajax-Grieb common losing 10 points though the preferred gained 1, Goodyear common lost 5 and preferred 1. Kelly-Springfield common lost 4; Miller lost 10 points. Stewart-Warner common gained 2.

	1914		1915	
	Bid	Asked	Bid	Asked
Ajax-Grieb Rubber Co. com..................	195	215	250	...
Ajax-Grieb Rubber Co. pfd..................	98	101	100	...
Aluminum Castings pfd......................	97	100	95	100
J. I. Case pfd.............................	...	...	77	85
†Chalmers Motor Company com...............	...	91	...	88
†Chalmers Motor Company pfd................	90	93	...	92½
Electric Storage Battery Co................	...	...	...	...
†Firestone Tire & Rubber Co. com...........	244	248	350	355
Firestone Tire & Rubber Co. pfd............	102	104	110	112
General Motors Company com.................	38	38½	81	82
Georal Motors Company pfd..................	77	77½	85	90
B. F. Goodrich Company com.................	23	24	23	25
B. F. Goodrich Company pfd.................	80	81½	92	95
Goodyear Tire & Rubber Co. com.............	240	...	185	188
Goodyear Tire & Rubber Co. pfd.............	92	94	101	102
Gray & Davis Inc. pfd......................	92	100	...	...
International Motor Co. com................	...	5	...	...
International Motor Co. pfd................	...	15	...	...
Kelly-Springfield Tire Co. com.............	38	40	69	70
Kelly-Springfield Tire Co. 1st pfd.........	106	108	75	79
Kelly-Springfield Tire Co. 2nd pfd.........	...	...	93	95
Maxwell Motor Compaoy com..................	3	3½	15½	16
Maxwell Motor Company 1st pfd..............	22¼	23¼	43½	45
Maxwell Motor Company 2nd pfd..............	7	7½	18	19
Miller Rubber Company......................	119	125	150	158
New Departure Mfg. Co. com.................	125	...	101	...
New Departure Mfg. Co. pfd.................	100	102	...	120
Packard Motor Car Co. com..................	...	...	...	100
Packard Motor Car Co. pfd..................	92	95	90	...
Peerless Motor Car Co. com.................	15	25	15	20
Peerless Motor Car Co. pfd.................	75	80	...	55
Portage Rubber Co. com.....................	...	40	25	30
Portage Rubber Co. pfd.....................	...	90	80	85
*Reo Motor Truck Company...................	6¾	7¾	10½	11½
*Reo Motor Car Company.....................	14½	15½	22¼	...
Splitdorf Electric Co. pfd.................	42	45	...	...
Stewart-Warner Speed. Corp com.............	49	50	52	53
Stewart-Warner Speed. Corp. pfd............	94	96	99	101
Studebaker Corporation com.................	19½	20½	35¼	35¾
Studebaker Corporation pfd.................	70	71	90	92
Swinehart Tire & Rubber Co.................	69	71	69	71
Texas Company..............................	...	...	130	134½
U. S. Rubber Co. com.......................	58	58½	51½	53
U. S. Rubber Co. pfd.......................	102	102½	100⅞	102½
Vacuum Oil Company.........................	194	198	199	201
White Company pfd..........................	105	110	108	110
Willys-Overland Co. com....................	58	61	83	85
Willys-Overland Co. pfd....................	83	90	92	94

*Par value $10; all others $100 par value. †Ex-dividend.

Consolidated Car Co. Buys Abbott

DETROIT, MICH., Jan. 6—*Special Telegram*—The Consolidated Car Co. has been organized and has purchased the assets, good will and trade name of the Abbott Motor Car Co. R. A. Palmer, president of the new concern, was during 5 years general manager of the Cartercar Co., of Pontiac. A. C. Knapp, who is vice-president, is also president and general manager of the A. C. Knapp Co., automobile body manufacturers. M. J. Hammers, who is treasurer and general manager, was vice-president and treasurer of the Abbott company. D. E. Perry, purchasing agent and F. E. Sangbush, service manager of the Abbott company, continue in these capacities with the new organization. The transfer of the property is said to have involved properties aggregating nearly $500,000. E. F. Gerber, principal stockholder in the Abbott company, who became interested in that concern about a year ago is not identified with the Consolidated concern. It is stated that the Consolidated Car Co. will handle the service business on Abbott-Detroit cars and that the original corps of dealers throughout the country is maintained.

Hood Rubber Common Increased $1,000,000

BOSTON, MASS., Jan. 5—The stockholders of the Hood Rubber Co. have voted to increase the common stock from $1,000,000 to $2,000,000 out of surplus. The directors later voted to issue $150,000 of additional preferred stock. This makes the total amount of preferred stock outstanding, $2,300,000.

Market Reports for the Week

NEW YORK CITY, Jan. 6—The dropping of fine Up-River Para rubber from $0.75 to $0.72 was the only important change in this week's market reports. A weaker tone developed for crude rubber and prices declined all around. The depression was due mainly to a growing belief among some in the trade that the embargo on shipments of plantation rubber from England is likely to be lifted in the near future or at least modified to the extent that rubber previously purchased and now owned by American interests can be brought to this country. Reports current that the English Government is endeavoring to divert to Liverpool shipments of rubber from Brazil destined to New York City, had no effect upon the market. Petroleum from the Pennsylvania wells, went up $0.05 per barrel. Recent reports from Washington state that the output for petroleum in 1914 was the largest in the history of the industry, being estimated at 292,000,000 barrels. It is also estimated that nearly 70 per cent. of this output came from California and Oklahoma. The petroleum change was the only one for the oil and lubricants market. Cottonseed oil rose $0.23 a barrel and was generally steady with a better consuming demand. A better demand for electrolytic copper was shown this week from domestic consumers.

Material.	Wed.	Thurs.	Sat.	Mon.	Tues.	Week's Change
Antimony	.13½	.13½	.13½	.13½	.13½	......
Beams & Channels, 100 lbs.	1.21	1.21	1.21	1.21	1.21	......
Bessemer Steel, ton	18.50	18.50	18.50	18.50	18.50	......
Copper, Elec., lb.	.12⅝	.12⅝	.12⅝	.12¾	.12⅞	+.00¼
Copper, Lake, lb.	.13⅛	.13⅛	.13	.13	.13⅛	......
Cottonseed Oil, bbl.	5.81	5.85	5.85	5.90	6.04	+.23
Cyanide Potash, lb.	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown.	.38	.38	.38	.38	.38	......
Gasoline, Auto, bbl.	.13	.13	.13	.13	.13	......
Lard Oil, prime	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	3.80	3.80	3.80	3.80	3.75	......
Linseed Oil	.50	.50	.50	.50	.50	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.55	.55	.55	.55	.55	......
Petroleum, bbl., Pa., crude.	1.45	1.45	1.45	1.50	1.50	+.05
Rapeseed Oil, refined	.71	.71	.71	.71	.71	......
Rubber, Fine Up-River, Para	.75	.75	.75	.75	.72	—.03
Silk, raw, Ital.	..	3.90	..	3.90	3.90	......
Silk, raw, Japan	..	3.33	..	3.33	3.35	+.02
Sulphuric Acid, 60 Baume.	.90	.90	.90	.90	.90	......
Tin, 100 lb.	32.88	32.75	32.75	33.13	33.00	+.12
Tire Scrap	.05	.05	.05	.05	.05	......

Pratt & Whitney Buy Pope Main Works

HARTFORD, CONN., Jan. 2—Judge E. B. Gager of the superior court of Hartford county has authorized Colonel George Pope, receiver of the Pope Manufacturing Co. to accept the offer of Pratt & Whitney of $300,000 for the main works of the Pope company on Capitol avenue. A hearing on the petition of the receiver was held Thursday of this week. The purchaser, a subsidiary of the Niles-Bement-Pond combination, agrees to pay the broker's commission of $6,000. A pro rata amount of the municipal taxes will likewise be assumed by the buyers. At the present time the Hartford Motor Car Co. is a tenant in the new section, having purchased the Pope-Hartford parts business some time ago. For the time being this concern will continue to occupy the premises. Recently the Smith Worthington Co. rented a portion of the plant, the lease running until May 1. The purchase includes a tract of land 565 feet front on Capitol avenue and 450 feet rear along the bank of the Park river. The Pratt & Whitney property bounds the Pope factories on three sides. As soon as the necessary papers are executed, it is said that the purchasers will immediately move into the new $165,000 addition, which means that employement will be provided for many men now out of work.

Fisk Reduces Prices on Tires

NEW YORK CITY, Jan. 5—The Fisk Rubber Co., this city, has revised its price list showing a drop in several of the popular sizes. The prices on the plain tread casings remain about the same. The prices on white non-skid casings and gray tubes are reduced. The discounts and terms on this list are the same as on previous lists. The following list gives the changes, if any, in several of the popular sizes:

Size	Former Price	New Price
30 x 3	$12.30	No change
34 x 4	26.35	$25.65
35 x 4	27.20	26.45
36 x 4½	37.10	36.85
35 x 5	42.40	41.65

The gray tube 30 x 3½, was formerly $4 and is now $3.70. The red tube has no change, while the Red Top tire and tube are about the same as those on white non-skid and gray tubes heretofore.

Rubber Makers in Quandary

Embargo May Force Them To Close Their Plants or Buy at Exorbitant Rates

NEW YORK CITY, Jan. 5—The crude rubber situation has not been relieved from the embargo tension during the past week and as things now stand Brazil is the only country with a large available supply of rubber, and, it is being sold at inflated prices. American tire makers will soon be compelled to decide whether to buy Brazilian rubber or close their factories. A number of them are holding back and waiting in the event that the British embargo, preventing export of crude rubber from England, will be lifted; others are going ahead and buying Brazilian rubber at the present high rates. Here is where the big question in the minds of the manufacturers arises: Is the manufacturer who is taking in Brazilian rubber supplies at high prices going to be at a disadvantage over those who wait; that is, if the embargo is lifted? It is a fact that the Brazilian prices will fall 50 per cent. if the embargo is removed, and in that event the tire manufacturer with a large supply of high-priced rubber will be nipped. At present, however, the majority of the tire manufacturers are buying very little of the Brazilian supply and are still buying their usual quantities of British rubber, which is selling at about $.50 a pound, and are storing it in Singapore, Colombo, England and Canada for prompt shipment to New York City when trade is resumed. This is all based on the hope for a speedy adjustment of the embargo.

A number of suggestions have been made by American rubber dealers who have suggested the following:

1. The removal of the embargo under proper guarantees, thus immediately restoring the manufacturing industry of this country and the crude rubber industry of Great Britain to a normal and healthy basis.

2. Agreement by the British government that it will not remove the embargo for at least 6 months. This plan, it is stated, would at least give stability to the situation. American manufacturers could buy Brazilian rubber knowing that our market would not shortly be flooded with British rubber.

3. Immediate action by the American Congress prohibiting absolutely the importation of British rubber or products thereof or any kind of manufactured rubber goods into the United States. This plan has not been officially presented at Washington, but unofficially discussed.

If favorable diplomatic or commercial action cannot be obtained by January 10, it is said, the matter will be presented to Congress in the form of a resolution.

In an effort to lift the embargo, B. G. Work, president of the B. F. Goodrich Co., Akron, O., and representative of the Rubber Club of America, sailed on the Lusitania to confer with representatives of the British government.

Rubber Imports 4,876,900 Pounds

NEW YORK CITY, Jan. 1—Imports of rubber from Para to this port, from November 28 to December 22, amounted to 4,876,900 pounds. On November 28, 1,298,800 pounds came in. On December 10, 348,100 pounds came in from Para. On December 16, Manaos brought in 2,890,000 pounds, the largest shipment that month. Another shipment from Para amounted to 285,300 arriving on December 22. Entries for November amounted to 5,920,000 pounds. 1,220,000 pounds were held for later shipment.

The exports of Ceylon grown rubber from January 1 to November 16, 1914, amounted to 30,339,695 pounds as compared with 21,990,065 in 1913. Great Britain was the biggest buyer with 15,940,685 pounds and the United States was next with 9,108,791.

The total exports from Malaya from November 4, 1913 to November 7, 1914, amounted to 81,866,044. Great Britain again led with 61,961,710 pounds with the United States again second with 11,857,069.

Rubber exports from the Straits Settlements, East Indies, from January, 1914 to October amounted to 30,046,000 pounds. The October exports amounted to 4,012,000 pounds as compared with 2,288,000 pounds in 1913.

Arrivals of Guayule rubber from Mexico for the 9 months ending September were 1,075,676 pounds, valued at $440,262, against 4,675,798 pounds, valued at $2,043,813, last year.

Car and Truck Exports During 1914 Total Nearly $28,000,000

WASHINGTON, D. C., Jan. 2—The rapid growth of the exports of automobiles and trucks from the United States, which amounted to nearly $28,000,000 during the fiscal year 1914, exclusive of parts and accessories, reflects the extraordinary development of the American motor car industry, according to a statement issued by bureau of foreign and domestic commerce. While the sum mentioned is not very impressive as compared with the value of the motor cars produced in the United States during the last year, it is nearly forty-five times as large as the value of the motor cars imported into the country in the same year, and thirteen times as large as the exports of automobiles a decade ago.

According to the bureau's statement, the success of the American automobile industry, particularly as regards low and medium-priced cars, is generally attributed to the American methods of standardization, which make possible the extensive use of machinery but which also require production on a large scale. Under such conditions an outlet to foreign markets becomes a necessary adjunct to economical production for the domestic demand and the American manufacturers of motor cars have therefore manifested a keen interest in the conditions affecting the marketing of their products in foreign countries.

One of the first things generally considered in this connection is the import duties imposed on motor cars in foreign countries. In considering the foreign tariffs on automobiles and trucks in connection with the distribution of the American cars exported during the fiscal year 1914, it would seem that the rate of duty is not always the determining factor. Our best two customers for cars are the United Kingdom, which admits them free of duty, and Canada, where they are dutiable at 35 per cent. ad valorem, each taking about one-fifth of our total exports. Australia, in spite of its import duty of about $120 on the body, 5 per cent. on the chassis, and 25 per cent. on the tires, bought American motor cars to the value of more than $2,600,000, while Argentina, with its comparatively low rate of 12 per cent. ad valorem, took only about $1,000,000 worth, or about four times as much as was taken by Brazil, where the duty is about 16 per cent.

An interesting feature in connection with the importation of cars into Australia and New Zealand is the requirement for a detailed list of the prices of the various component parts and accessories as sold for home consumption, such prices being used as a basis for ad valorem duties. This requirement differs from the provision of the Canadian dumping clause, where the statement in regard to the value for home consumption is required for the purpose of preventing or penalizing unfair competition with Canadian producers.

Court Decisions Affecting the Industry

J-M Shock Absorber Does Not Infringe

CHICAGO, ILL., Jan. 5—The court of appeals, sitting in Chicago, reversed the decision of the lower court handed down last May in the suit of the Blackledge Mfg. Co., Chicago, against the J-M Shock Absorber Co. and held that the J-M shock absorber does not infringe the Velvet shock absorber made by the former concern.

Judge Sandburn in the United States district court handed down a decision on May 8, 1914, stating that the J-M shock absorber does infringe the Velvet, which is manufactured under Patent No. 988,229 issued to Charles A. Tilt, March 28, 1911. This patent relates to a shock absorber of the coil spring type which prevents excessive shock being transmitted to the car and passengers and also eliminates side sway.

The Blackledge company claimed in its suit in the lower court that the J-M shock absorber is made under Patent No. 1,015,682 issued to L. P. Jaquet, January 23, 1912. Both this and the Tilt patent are similar. The latter consists essentially of two coil springs operating in cylindrical cylinders and having a guide in the form of a rod inside each spring with metal sleeves which may slide up and down over the rods within the range of spring vibration. The decision of the court of appeals brings to an end this suit, which originally was filed April 13, 1913, against Albert J. Dueth and Alexander J. Dueth, doing business as the Alfredal Co. in Chicago, and handling J-M shock absorbers.

Motz Wins Cushion Tire Suit

NEW YORK CITY, Jan. 5—The Motz Tire & Rubber Co. has won out in a suit brought against it for alleged infringement on a cushion tire with undercut sides. Messrs. E. B. Cadwell, F. P. Johnston and F. M. Ashley, each holding a one-third interest in Patent No. 887,997, issued May 19, 1908, were the plaintiffs. Mr. Cadwell was the inventor. The prayer for injunction was denied by the court. Albert T. Scharps, attorney for the Cadwell interests, states that an appeal will be made.

Judge Sheppard in his memorandum opinion states that the resiliency of the tire under pressure is the object to be attained in the suit and that the opinion of the court is that the arrangement and shape of the tread, lobes, grooves and buttresses in the Motz tire are not anticipated in the Cadwell patent.

He goes on to say, "The tire manufactured by the Motz company is slightly different in construction to that described in its patent but is substantially the same and its features are so arranged that new results are obtained, that is to say, the buttresses in the grooves lie one upon the other when the tire is under strain or load pressure which produces tire cushioning at all points. This cushioning effect seems to be greatly improved and the resiliency increased by use of a double lobe tread with a broken valley between.

"From ocular experiments made in court it does not appear that the Cadwell tire patent issued May 19, 1908, ever with substantial changes in construction would be capable of anything like the same utility.

"The Swinehart patents, Nos. 826,622, issued July 24, 1906, and 902,926, issued November 3, 1908, do not anticipate the Motz invention, No. 925,937, for it is seen in those patents use was made only of a continuous tread and a slight groove inside of the tire."

The suit was filed September 7, 1913, in the United States district court, Southern district of New York.

Reports from Receiverships

CARTHAGE, O., Jan. 4—In his first and final report as receiver for the bankrupt Crescent Motor Company, Carthage, O., Louis J. Huwe, Deputy United States Marshal, declared that the affairs of the company had been remarkably well administered. From September 28, the time of his appointment as receiver, up to the time of his appointment as trustee in bankruptcy of the concern, Huwe made sales and collections amounting to $17,944.51. He spent $8,650.56, leaving a balance of $9,337.51. Huwe reported that he turned over to himself as trustee this balance, together with other assets of the company valued at $101,171.55.

PORT HURON, MICH., Dec. 31—Bids for the real estate, building and power house of the bankrupt Havers Motor Car Co., were so low that none was accepted by trustee Frank A. Wilson, who, however, accepted the offer of $7,500 made by the Harris Brothers Co., Detroit, for the stock, material and other accessories, in other words, the equipment.

KALAMAZOO, MICH., Dec. 30—At yesterday's hearing of Victor L. Palmer, formerly secretary and treasurer of the bankrupt Michigan Buggy Co., referee in bankruptcy W. J. Banyon learned that Palmer has liabilities totaling $1,500,000 while his total assets are scheduled as being worth $1,425. The creditors will receive, according to the referee, one twelfth of one per cent.

It also developed that claims aggregating $1,520,172.40 have been filed against former president Frank B. Lay, Sr., of the bankrupt company. His assets are scheduled at $87,-

164.08. Most of the claims are in the shape of notes which had been signed by Lay in his capacity as official of the company.

Fiat-Isotta Suit Is Settled

NEW YORK CITY, Jan. 6—The two suits brought by the Fiat Automobile Co., Poughkeepsie, N. Y., against the Isotta-Fraschini Motors Co., Milan, Italy, for alleged infringements on its yoke construction on the front end of the tube enclosing the propeller shaft and certain improvements in vehicle frame suspension, have been dismissed, without costs to either party. Both suits were filed in 1913 and involved Patent No. 1,050,049 covering the yoke construction and 979,278, issued January 7, 1913, covering certain improvements in vehicle frame suspension. The inventor of the first patent was Giovannia Agnelli, president of the Fabrica Italiana Automobili Turino. Guido Fornaca was the inventor of the second patent, issued December 20, 1910.

Walpole Tire Sale Set for March 10

BOSTON, MASS., Jan. 4—The Walpole Tire & Rubber Co. will be sold March 10. An attempt was made to fix an upset price at $850,000, but this was defeated. The sale will be made without restrictions, except that no bid will be received unless accompanied by a certified check for $50,000. The sale will be held at Walpole at 11.30 a. m., and the property will be sold as a whole and as a going concern to the highest bidder.

To Sell Lozier Plant Feb. 4

DETROIT, MICH., Jan. 5—The Detroit Trust Co., trustee, will sell the plant of the Lozier Motor Co., Thursday morning, February 4 in the United States district court.

At the meeting of the creditors of the bankrupt company, held last week, it was suggested by Vice-President Joseph A. Bower of the Detroit Trust Co., trustee, that, as there is on hand in the plant $200,000 worth of material by purchasing $300,000 worth of additional new material, it will be possible to build 300 Lozier sixes and 300 Lozier fours, the latter to be sold at $1,000 and the former at $2,000, which would result in obtaining $900,000.

This suggestion was not adopted by the creditors, who, however, voted favorably upon the proposition of attorney Leo M. Butzel that when bona fide offers for cars are received they should be built.

Lansdale in Charge of Krit Companies

DETROIT, MICH., Jan. 2—Henry Lansdale, general manager of the Krit Motor Car Co., has been appointed custodian of that concern and of the Krit Sales Co., both of which filed a petition of bankruptcy last week. At the first meeting of creditors which has been called by referee in bankruptcy Lee E. Joslyn, and which will be held January 18, a trustee will be appointed.

The reason given for the present difficulties of the Krit Motor Car Co., was its inability to secure financial assistance during the last few months.

A dealer speaking about the matter said: "In my territory the demand for the Krit has been greater during the last 2 months than at any time during the whole year. However, people desiring to buy did not want to pay except on long terms. Everybody wants credit, wants six months or more to pay for his car, and, in most cases at the end of the sixth month the money is not forthcoming. It is not a case of the people not having the money, but they prefer to leave it in the bank, as they are still too uncertain as to the future. The effects of the war are by no means as much minimized or improved as people are saying."

Until the meeting of creditors January 18 only the service department of the car company is in operation, all other departments having been closed. However, dealers can buy cars from the company.

Massachusetts Court Holds Tire Core Patent Invalid

BOSTON, MASS., Dec. 31—The tire core patent No. 865,064, covering a collapsible core or mangrel the object of which is to be used in the building up of a tire, after which it may be easily removed, has been declared invalid.

The patent which was granted September 3, 1907 to W. C. State, was taken over by the Goodyear Tire & Rubber Co., Akron, O., which brought suit against the Hood Rubber Co., Watertown Mass., claiming infringement.

The Goodyear company claimed in its suit that the State patent covered all types of cores, used in the manufacture of detachable tires, having substantially non-extensible edges and comprising a plurality of independent sections held in ring formation by one or more rings overlapping the inner portions of the sections.

The decision, which was rendered by Judge Dodge in the U. S. district court for the district of Massachusetts, stated that prior to the invention of this core by State, substantially the same construction had been in commercial use at several other tire making plants, in the manufacture of detachable tires, having substantially non-extensible edges.

This core is made of four independent segments with inwardly projecting portions constituting an annular beading, with a pair of rings adapted for clamping these members in a proper relation to each other. In constructing the outer tubes or wear-resisting casings of pneumatic tires, this core or mandrel, which is annular, is employed on which the tire is built up of rubber and fabric. During this operation the edges on the side bands of the tire, engaged by retaining means of a wheel rim, are so formed as to render them as inextensible as possible. After the tire has been built up and has been vulcanized, the segments of the core may be easily removed.

The suit just decided was filed December 5, 1910. Another suit on the same patent brought by the Goodyear Tire & Rubber Co. against the Ajax-Grieb Co. is now pending in the United States District Court for the District of New Jersey.

On October 27, 1914, the de Laski & Thropp Circular Woven Tire Co., Trenton, N. J., was awarded the decision in the U. S. district court there in its suit against the W. R. Thropp & Sons Co., Trenton, on a tire wrapping machine put out by this company, under patent No. 1,011,450, dated December 12, 1911.

OWEGO, N. Y., Jan. 4—The Owego Car Co., Inc., manufacturer of the Owego cyclecar, with a plant in Owego and offices in New York City, at 286 Fifth avenue, has filed a petition in bankruptcy in the latter city with liabilities of $43,642 and assets of $25,078.

Universal Rim Co. Claims Infringement of Three Patents

CLEVELAND, O., Dec. 30—Suit has been filed in the U. S. district court here by the Universal Rim Co., Chicago, against the Standard Welding Co. of this city. The former claiming specific infringement of its three patents Nos. 1,095,770, 1,095,775, 1,095,953. These three patents relate to demountable rims and are claimed by the Universal company to be infringed by rims Nos. 20 and 21, made by the Standard Welding Co.

The patent No. 1,095,770 was issued to Joseph A. Anglada, May 5, 1914, and transferred to the Universal Rim Co., which claims particularly infringement of claims 3 and 4, which read:

"A transversely-split, integrally flanged tire-carrying demountable rim having a hole 15 in one end, in combination with a rigid latch 13 fixed on the other end of the rim, extending beneath the end containing said hole and having a lug to snap into said hole, to connect said ends.

"An integrally flanged tire carrying demountable rim transversely split upon a plane inclined to a radius of the rim and having a hole 15 in one end, in combination with a rigid latch member 13 on the other end of the rim, extending beneath the end 10 containing said hole and having a lug 14 to snap into said hole, to separably connect said ends of the rim."

Patent No. 1,095,775 was issued to Erle K. Baker, and assigned to the Universal Rim Co., the patent date being May 5, 1914. In this patent the Universal company claims infringement particularly of claims 1 and 9, which read:

"A one-piece integrally flanged demountable rim of the bolted-on class described and transversely split at one point only in its circumference, in combination with a plate extending across said split and positively and non-adjustably but detachably connecting the ends of the rim, for the purposes specified.

"A one-piece integrally flanged demountable rim of the bolted-on class described transversely split at one point only in its circumference and presenting straight cut non-interlocking opposed rim ends, and means on said ends positively but detachably connecting the same to render the rim inexpansible by the bolting-on devices, for the purposes specified."

Both of the patents above mentioned were filed in 1910, together with something like forty others, and in the following year, in February, the third patent upon which this suit is brought was filed. This, No. 1,095,953, also issued to Baker, and patented on May 5, 1914, relates to a rim of such construction that the rim shall be automatically centered upon the wheel when placed upon it. It relates to improvements in which the demountability is secured

View of the National Automobile Chamber of Commerce Banquet held at the Waldorf-Astoria Hotel. Attendance 480

Maryland Law Is Held Valid

WASHINGTON, D. C., Jan. 5.—*Special Telegram*—The constitutionality of Maryland's automobile law, imposing a tax on Washington motorists traveling in that state was upheld today by the supreme court of the United States in an opinion rendered by Justice McReynolds, which was concurred in by the entire court. The case was that of Hendrick vs. Maryland. Justice McReynolds, in the decision of the court, affirming the decree of lower court, said:

> The suit was brought in July, 1910, by J. Tilghmann Hendrick, a Washington, D. C., motorist who was required to carry a Maryland license before he was allowed to drive his car in the state. He decided to make a test case of the matter and it was argued before the supreme court in November of this year. The decision of Justice McReynolds establishes the right of a state to require an automobilist living in another state to take out a license before traveling over its roads.

Good-Fellowship at N. A. C. C. Banquet

NEW YORK CITY, Jan. 6—Colonel Charles Clifton, as toastmaster, struck the dominant note of the National Automobile Chamber of Commerce, Inc., banquet held at the Waldorf-Astoria last night, when he spoke of the friendship among the members of the automobile industry. This is the first annual banquet of the Chamber which represents the outgrowth of the Association of Licensed Automobile Manufacturers, the National Association of Automobile Manufacturers and the Automobile Board of Trade.

There were 480 in attendance representing the leaders in the car industry and the feeling of good fellowship exhibited throughout the evening bore out Colonel Clifton's remark that the automobile field is different from any other in that everyone seems to know one another and hence the petty rivalries engendered by business competition vanish under the influence of the friendship which permeates the industry.

There was but one speaker, Irvin S. Cobb, who told of his experiences in the zone of war. His remark that the speed of the automobile in bringing wounded quickly to a place where they could be attended to, had probably saved many a life, was greeted with applause.

Besides the speaker the entertainment was largely made up of cartoons of men prominent in the industry and bearing suitable inscriptions which evoked continual roars of merriment. These were thrown on a screen.

The affair represented the greatest gathering ever held of men influential in the automobile industry. The spirit of good-fellowship which prevailed was typified when H. B. Joy, leader of the Kardo patent group and Alfred Reeves of the Chamber of Commerce waltzed together down the center aisle of the banquet hall to an improvised parody entitled "It's a Long Way to Judication," the reference being to the present legal war between the N. A. C. C. and the Kardo group.

Remy to Move Plant to Detroit

DETROIT, MICH., Jan. 6—*Special Telegram*—The first step in the removal to this city of the entire plant of the Remy Electric Co., now located at Anderson, Ind., has been taken in the purchase of a desirable factory property. It is the intention to begin building operations at once with the idea of eventually locating the entire plant here. The negotiations for the bringing of the Remy organization here have been under way for about 2 months, the Detroit Board of Commerce being largely responsible for it.

When completed, the plant now contemplated will employ about 200 men. The Remy factory at Anderson is said to employ about 1,500 men.

Klaxon Removes Competitor's Horn from Show

NEW YORK CITY, Jan. 6—Charging that a large motor-operated horn exhibited at the New York Automobile show by the Heinze Electric Co. constitutes unfair competition in that it is an imitation in appearance of the right angle design of the type-L Klaxon, the Lovell-McConnell Mfg. Co. caused the horn to be temporarily removed from the show yesterday. The removal was upon a restraining order of the Federal court which will hold a hearing on the matter Friday.

Burman Breaks A. A. A. 5 to 50 Mile Records for 1-Mile Dirt Tracks

BAKERSFIELD, CAL., Jan. 3.—*Special Telegram*—Barney Oldfield again met defeat at the hands of Bob Burman today, the American speed kind duplicating the victory scored at Los Angeles last Sunday in the second of a series of 50-mile races held on the local 1-mile dirt track and incidentally establishing new A. A. A. records from 5 miles to 50 miles, inclusive.

Burman traveled the half-century in 40 minutes 58 seconds. The best time previously for this distance was 47 minutes 21 seconds, made by Louis Disbrow at San José Burman lowered the 25-mile record from 22 minutes 26 seconds to 20 minutes 28 4-5 seconds and cut the 5-mile mark from 4 minutes 6 1-2 seconds to 4 minutes 2 seconds.

Chicago Tests Truck Fenders

Dummy Trials Fail to Show Value of Equipment Required for Vehicles by City Ordinance

CHICAGO, ILL., Dec. 30—The City of Chicago today conducted a series of tests on a new safety vehicle fender to determine whether this type conformed to the specifications set down by the fender committee. More than 100 dealers from motor row, most of them members of the Chicago Automobile Trade Assn., witnessed the tests.

The test is the initial one of a series, the outcome of the recent publication of a city ordinance as follows:

> Section 2550 1-2. It shall be unlawful for any person, firm or corporation to use and operate within the City of Chicago any motor car or truck for the purpose of conveying therein bundles, parcels, baggage or wares, merchandise or other similar articles, unless said motor car or motor truck is provided with a fender as in the case of street cars operated and used within said city, or such design as shall meet the requirements for uniform tests to be made under the direction of the clerical, mechanical and inspection bureau of the Department of Police and shall be approved as efficient by the General Superintendent of Police.
>
> Section 2. Upon being duly approved and published, this ordinance take effect and be in force from and after March 1, 1915.

In the tests conducted three leather dummies were used and each dummy was put through a number of different tests. Those in charge have outlined a series of something like 120 different tests for each fender, using three different dummies, one representing a child, another a youth and a third a full-grown man. Each dummy is placed in a number of different positions, there being something like thirteen of these and the vehicle strikes the dummy at various speeds ranging from 3 to 15 miles per hour.

In today's tests the dummy was invariably carried along the ground in front of the fender in all the tests above 7 miles per hour. At 3 miles per hour the dummy was struck and thrown in front of the fender but the driver, knowing the dummy was about to be hit, stopped the car before it again reached the false man. In other words, if a real man were struck at 7 miles per hour or more he would be thrown down by the fender, and then scraped along the ground until the car was stopped. In the tests the driver knows he is going to strike the object and he can stop within a short distance. In one test the dummy is made to face the vehicle. This seems an unfair test since a man facing a vehicle naturally will see it and hence move out of the way. With the dummy facing, its feet are caught under the fender.

Raise Car License Fees in Ontario

WINDSOR, ONT., Jan. 2—An increase in the automobile license taxes which have gone into effect in Ontario with the first day of 1915, will, it is estimated, result in increasing the revenue of the province of Ontario by $100,000 annually. The rates are now as follows: for gasoline cars up to 25 horsepower, $6; from 25.1 horsepower to 35 horsepower, $10; from 35.1 horsepower to 50 horsepower, $20; over 50 horsepower, $25; electric vehicles, $5. Dealers and manufacturers fee is $25, for which they will be supplied with five plates or markers.

Canadian Armored Battery Nearly Complete

OTTAWA, ONT., Dec. 31—Borden's Armored Battery is the name that has been given to the battery of armored cars which has been presented to the government by a number of prominent Montreal gentlemen, and which is under the command of Major Holland, V. C., of Ottawa. The battery is at present housed in Montreal awaiting the completion of its equipment. The type of car which is being used by this battery is unique and the novel lines on which it is being constructed are the invention of the commander of the battery, Major Holland. The car carries a turret in which the quick firing gun is mounted. This turret can be swung in a complete circle so that the fire of the gun can be brought to bear on any point of the compass desired. The swinging of the turret is effected by the gunner, who to turn himself, his turret and his gun does not have to take his hand from the breech of his weapon, the movement being entirely effected by his feet. There are many other novel and valuable features to the cars, among them being a triangular shaped loophole at the front and rear for rifle fire, and it enables the marksman in the car to direct his fire to either side as well as to directly in front of him, the direction to which he is limited in the case of cars fitted with circular loop-holes. Several of the ideas for this car were gathered by Major Holland during his work with armored cars in South African War, and the improvements he has made are the outcome of his experience there.

1200 London Buses Commandeered

NEW YORK CITY, Jan. 2—Twelve hundred motor buses formerly used on the streets of London have been commandeered by the British government for war purposes, according to W. E. Mandelick, secretary of the London General Omnibus Co., who has just arrived in this country. This number is practically one-third of the fleet of 3,500 buses owned by the General Omnibus Co. The chauffeurs also have been commandeered and are now employees of the government.

The buses are used as ambulances and for the transportation of troops and supplies of food and ammunition. According to reports from the scene of fighting on the Continent, which have been given out through the war department in London, the buses have made excellent showing. The general staff has many times commended the drivers for excellent service.

The government has also commandeered the entire output of the factory as fast as the buses can be built and equipped.

M. & A. M. Elect Four Directors

NEW YORK CITY, Jan. 6—The Motor and Accessory Manufacturers elected four new members to the Board of Directors at its twelfth annual meeting held today at the Waldorf-Astoria. They are as follows: L. M. Wainwright of the Diamond Chain & Mfg. Co., E. W. Beach, of the Manufacturers' Foundry Co., E. H. Broadwell of the Fisk Rubber Co., and Christian Girl of the Perfection Spring Co. They will serve for 3 years and replace the retiring directors, J. H. Foster, of the Hydraulic Pressad Stel Co., H. E. Raymond, B. F. Goodrich Co., T. J. Wetzel, Spicer Mfg. Co. and C. W. Stiger, Stromberg Motor Devices Co.

There were about 100 present and the meeting was presided over by J. H. Foster, president. Tonight the annual banquet at the Waldorf-Astoria will be held at which there will be 400 in attendance.

$50,000 for Armored Cars in U. S. Army Appropriation Bill

WASHINGTON, D. C., Jan. 2—The army appropriation bill, when reported to the house of representatives, will be found to contain a new item of $50,000 for the purchase and manufacture of armored automobiles and motor trucks. This appropriation will be expended under the direction of General W. L. Crozier, chief of ordnance.

At the recent hearing before the committee there was some consultation with Gen. Crozier when he appeared before the house committee on appropriations. It appears that there is at present under construction a vehicle which is intended for experimental use. Gen. Crozier believes that there will be no difficulty in obtaining these motor cars in sufficient number when necessary, inasmuch as the armament and the armor will be easily and quickly obtainable, and it is believed there will be no delay in buying the chassis.

It is necessary, however, to design the armor and to determine its location, the main point being to protect the vulnerable parts of the engine. The quest of the army experts at present is in the direction of a satisfactory model, Gen. Crozier believing that several of the types now in commercial use may be easily converted to armored cars of the necessary powers of resistance to attack. The armored car is intended to carry two machine guns and eight men, including the driver. It is proposed to have three places in the car where the machine guns may be operated and so arranged that the ordnance may be shifted to meet the necessities of a particular occasion.

The results obtained with the armored car in Europe have impressed the officers as suggesting a new form of mounting ordnance, but a vehicle of this sort may not be as available in this country as it is in a Continental European war, because of the lack of roads in the United States which would render the armored car serviceable to the extent it has been evidently used abroad during the present war.

French Factories Want Workmen

Many Automobile Makers Working Overtime on War Orders—Small Export Business Started—Touring Cars in Convoy Work—Four-Wheel-Drive Tractors in Demand

By W. F. Bradley

Special Representative of THE AUTOMOBILE with the Allied Armies in France

PARIS, Dec. 23—During the months of August, September and October there was a drop in the English automobile exports of $1,536,340, while the imports fell $5,910,880 during this period.

France is the greatest loser in this diminished trade. Up to the end of July the volume of business done by both England and France was considerably above the average, there being every indication that 1914 would be a record year. The first 3 months of the war, and particularly the first 2, will doubtless prove to be the most unsatisfactory for the European factories.

Workmen Needed

The declaration of war stopped all business and for a month there was complete stagnation. Gradually the factories got to work on army orders, with the result that at the present time very few firms are closed, and some are working at full pressure. The work is not uniformly spread over the industry, for certain factories produce types of cars unsuited for military purposes and have failed to secure contracts for ammunition. In France the greatest difficulty is to secure sufficient men. The army authorities are consenting to release hundreds of men in the automobile trade when it is found that they can be better employed in the factories than in the firing line. Numerous Belgian mechanics have found work in the French factories. Notwithstanding this, the cry is still for more men, and at practically all the French factories the Hands Wanted notice is constantly displayed.

As an example of the change which has come over the industry, the Darracq factory, which was practically closed during the month of August, is now running 700 men, all of them working overtime, and is increasing the staff every day. Two-thirds of these men are making shells, the remainder are producing cars to be used for ambulance work, doing army repair work, and producing a small number of cars for the foreign markets. Out of 700, Delage had forty men left when mobilization was completed. The force is now 500 strong, working 7 days a week and 12 to 14 hours a day. There was a big stock of cars in hand when the war broke out, but as orders have been placed by the French and Belgian governments for light trucks and ambulances, the number of chassis in hand is now very small. In addition to cars, big quantities of shells and aeroplane arrows are being produced. All the heads of departments, including Chief Engineer Michelat, have been released for army service in order to keep the factory running.

Active on Tractors

Panhard is working at full capacity on trucks, four-wheel-drive tractors, touring car chassis to be used as light transports, and a certain amount of private car work. Certain sections of the works are under military orders, the directors of the company being employed at the factory under direct military control. Renault is specializing in four-wheel-drive tractors, armored cars, and trucks. Other firms producing large numbers of trucks for the French army are Saurer, Delahaye, Berliet, Aries, Bayard-Clement, Mors, Latil, and DeDion Bouton.

Very satisfactory prices are being obtained for army contracts. In some cases firms having held back their stock of touring car chassis have now been able to sell them for light convoy or ambulance work at an increase of 15 per cent on ordinary rates. It is maintained that this increase is justified by reason of the higher cost of raw material. At any rate, the army does not object to paying the higher amount.

No Private Trucks

Requisitions of private trucks stopped 10 days after the declaration of war, when there were no more trucks left in private service. Since then the army has been getting its supplies direct from the factories. In Paris, as well as in many other districts of France, the requisition of private cars has stopped, for it is found that the factories can meet the demands, and the service given by cars coming direct from the works is more satisfactory than that of vehicles taken straight out of private service. At the outbreak of the war cars had to be secured at a moment's notice, and the only possible plan was for private cars to be taken. Now that it is a question of maintaining the numbers, or of gradually increasing to meet the shortage of horses, deliveries of series of cars from the factories is obviously much more suitable than the taking of individual cars from the private owner. The method of requisitioning was for owners to be informed by means of placards that their cars must be presented. At the outbreak all machines had to be presented, and most of have been enough voluntary presentations of cars to meet them were taken. Since the first few weeks of the war there all requirements. A general scale of payment is arranged in advance, but a certain amount of latitude is allowed the officer in charge of the operations.

Tire Factories Busy

There is plenty of activity in the tire factories. Michelin, Bergougnan and Goodrich have their solid tire sections under military control, and produce exclusively for the army authorities. Immense stocks of pneumatics have been requisitioned in the Michelin, Dunlop, Continental, Goodrich and Bergougnan factories, but there is no direct interference with the supply of pneumatic tires to private customers, providing army orders are given preference.

The Continental Tire Company's factory, near Paris, was seized by the French government some weeks ago, but the works are now running under the direction of a government manager and for the benefit of the army. The machinery put into force is that of a receivership. Whether the factory will finally be wound up and the proceeds handed over to the company, whether it will be transformed into a French company, or whether the whole will be seized remains to be seen. There are literally thousands of German firms in France being run under the same conditions at the present time; when peace conditions are discussed it will be decided what shall be done with these businesses. The number of automobile and kindred firms seized is not particularly high. It comprises Continental, Bosch, Mea magnetos, Mercedes show rooms and factory, and such German agencies as Benz, Opel, Horsch, Mathis, and some of the ball-bearing makers' agencies.

Workmen Scarce

The heads of the various automobile factories are now faced with the problem of getting enough men to execute the orders they have in hand. Practically all the work has come from the French and Belgian army authorities. Big orders have been placed for commercial vehicles; the factories specializing in trucks have never been slack, but they are now busier than at any period since the outbreak of the war. A big use is also being made of touring car chassis as light trucks. Many of these orders are for the Belgian government, for this nation has long made use of private car chassis for transporting goods.

The French, however, are also finding the value of 16-horsepower chassis, fitted with pneumatic tires, carrying a covered platform body, and capable of moving one-half-ton loads. These are the ordinary touring car chassis with rather heavier springs, a bit lower gearing and less inclined steering column. Convoys of ten or twelve vehicles of this type, all of one make and equally loaded, can travel with the regularity of a train, bringing goods forward with greater rapidity than is possible with ordinary trucks.

Factories Make Shells

The greatest amount of work, however, undertaken by the French automobile factories is the making of shells, gun fittings and aeroplane darts. As all the factories are within a radius of 3 miles of the city of Paris, they are very conveniently situated for this work. Renault, DeDion Bouton, Darracq, Unic, Delage, Delaunay-Belleville are particularly busy on this class of work, some of these firms having received an unlimited order and many of them aiming to turn out 1,000 shells a day.

The greatest demand is for lathe men, although there is also plenty of work for the hardening departments. Every available man is snapped up as soon as he is liberated from military obligations. In certain cases machinists are set free from military duties in order to work in the factories. Government inspectors see to it that these men are actually employed on army work, and not on the private business of the company. When men are released from the army they have to return to the factory originally employing them. Others released because of some physical infirmity unfitting them for service in the field, are free to work where they wish, and in order to secure such men the automobile factories are increasing the rate of pay.

France Is Exporting

There is also a certain development in the passenger car situation. Although there is still an official restriction on the exportation of automobiles, the authorities are now allowing cars to go out of the country when not required for military purposes. One cross-channel route to England is working regularly on this class of transportation. The result is that cars are being sent to England and then shipped abroad to various destinations. The volume of business is not great, but it is as much as the factories can handle with their present limited staffs. It appears that orders for high-grade cars were not generally cancelled by customers outside Europe and deliveries are now being made after a 3-months' delay.

New Paris Buses

There is an important order awaiting the French factories for the replacement of the 1,100 motor buses taken off the Paris streets when war broke out. The new design for these buses has been approved, and comprises a number of body changes, but very few modifications in the chassis. This order cannot be given out to foreign firms, and as the factories capable of executing it are too busy with army production, it is being made to stand over until a more convenient moment. In the meantime Parisians have to find other means of locomotion.

The knowledge that automobile orders have gone to American firms does not worry French automobile manufacturers. It is recognized that if orders have been sent abroad it is because they cannot be executed at home, and that the arrival of these vehicles will not have any influence on the normal trade of the country under peace conditions. If America can help to make up the French and Russian deficiencies, there is also the possibility that she may attempt to do the same for Germany.

French Repair Departments

The repair departments of all the French automobile factories are working under high pressure. There are hundreds of touring cars which have covered 200 miles for 100 consecutive days. Some have done more, for it must be remembered that army cars travel as much by night as by day, and are only held up to allow the driver to obtain food and sleep. An unskilled or rough driver will probably wreck his machine under such conditions. A clever driver will keep his car going all the time, but at the end of 20,000 miles it will have need of a factory visit. It is on such work that the repair departments are now busy. Drivers obtain 2 or 3 days' leave of absence in order to make a quick trip to Paris and there have the repair work carried out with the least possible delay. As all the work is of an urgent nature, some of the factories have made arrangements to keep staffs ready for night and Sunday work.

Tire economy is not considered at the present time. Shoes are run until they burst, then left on the roadside. Partly worn casing which under ordinary circumstances would be carried on the car until they could be given to the repair department are thrown away for lack of carrying capacity and for lack of a tire repair department to treat them.

Another of the little wastages is gasoline and oil tins. French gasoline is delivered in 1-gallon tins, and English gasoline in 2-gallon vessels. Every driver carries from 1 to 10 of these cans on his car as a reserve supply, and as he has no means of refilling them, he almost invariably throws them away. As each can is worth 15 cents, the wastage, multiplied by thousands, would be considered important in times of peace; under war conditions it is negligible.

Boillot Too Daring for French General

NEW YORK CITY, Jan. 4—According to a cable to the *New York Times*, Gen. Joffre has selected a new chauffeur, a reservist named Edmond Théodore from Niort, who passed his conscript service as a naval mechanic. His former driver was Boillot, the famous racing driver, whose eagerness to gratify the General's fondness for speed caused him to take unnecessary risks. After one particularly hairbreadth escape Gen. Joffre, without reproaching Boillot, quietly announced his intention of making a change, not owing to the danger, but because Boillot's daring swerves kept him awake.

SEATTLE, WASH., Dec. 31—An automobile holding company that will engage in the selling of used cars on an elaborate scale on the Pacific Coast is now being formed by L. H. Rose, formerly connected with the Studebaker and Lozier factories on the Pacific Coast, and Paul Smith, former sales manager of the Studebaker Corp. The company is to be incorporated with a capital stock of $50,000 and will act as a holding company for a chain of stores along the entire Pacific Coast from Seattle to Bakersfield, Cal. Headquarters will be established in San Francisco.

Miscellaneous Items of the Industry

Pennsylvania Fees Total $1,085,039.50

HARRISBURG, PA., Jan. 2—Automobile licenses netted the state of Pennsylvania $1,085,039.50 for the year 1914. The statement of licenses just issued shows that 106,401 pneumatic tired cars were licensed; 6,453 solid tire machines; 1,176 tractors and 118 trailers. Over 52,000 drivers and operators received licenses and 3,579 dealers were given privilege to operate cars pending sale. Thus far 30,000 pneumatic tired vehicles and 3,500 solid tire machines have been licensed for 1915.

DES MOINES, IA., Jan. 2—The revenue of the state of Iowa from motor cars during the year 1914 was $1,025,000 and the total number of automobiles registered was 106,000. This was the announcement of the state motor vehicle department at the end of 1914. It is expected that the automobile registration in Iowa will pass the 130,000 mark this year. Receipts in the state department are now running over $10,000 a day.

Northway to Show Eight at Chicago

DETROIT, MICH., Jan. 4—Keeping step with the public demand the Northway Motor & Mfg. Co., Detroit, Mich., is preparing to place on the market an eight-cylinder motor of the already well-known V-form. The decision of the company follows experimenting over a considerable period. The first motor which will have cylinders measuring 3 1-2 by 4 1-2, giving an S. A. E. horsepower rating of 39.2, will be exhibited at the National Automobile Show in Chicago during the week January 22 to 30.

To Build 500 Twombly Taxicabs

NEW YORK CITY, Jan. 2—The Twombly 20-cents-a-mile, two-passenger taxicab which it had been planned would be placed in service here January 1 by a cab company will not appear on the streets until March 15 and then under the management of W. Irving Twombly, the maker. He has formed the Twombly Taxicab Co. with $300,000 capitalization under the New York laws and is preparing to build 500 cabs. About twenty-five of these will be ready for service March 15. He has also added a cab which will carry four passengers and will build on the proportion of 80 per cent. for two passengers and 20 per cent. for four passengers. The rates will be: two passengers, 25 cents the first mile and 5 cents a quarter thereafter. Four passengers, 30 cents the first mile and 7 cents a quarter thereafter.

1915 Buick Averages 21.75 M. P. G.

SEATTLE, WASH., Dec. 31—In an unofficial combined speed, economy and endurance test, between Seattle and Vancouver, B. C., on December 24, a 1915 model 25 Buick touring car carrying five passengers covered the 174 miles in 6 hours and 15 minutes and the round trip in 14 hours and 4 minutes. Only 16 gallons of gasoline were consumed on the round trip, an average of 21.75 miles to the gallon.

LANSING, MICH., January 2—Each of the 2,400 men and women, from the office boy and the telephone girl to the heads of the various departments, of the Reo Motor Car Co., and the Reo Motor Truck Co., were given a $5 gold coin as a New Year's present.

In former years the employees received a part of the profits, based upon their annual wages. This form of distribution has not proven satisfactory, because it could not, owing to the general industrial conditions, result in a fair appropriation for each employee, some departments closing part of the year during the dull season, while in others men were temporarily laid off.

Lincoln Highway Decoration for Detroit Show

DETROIT, MICH., Jan. 1—To this city or rather to the Detroit Automobile Dealers' Assn., will go the credit and honor of presenting in connection with the annual automobile shows one of the most attractive new decoration schemes. There will be several different decorative schemes, as a matter of fact, but the principal one will be the Lincoln Highway which will be shown from coast to coast in a series of forty panels of about 18 by 14 feet and which will represent the most interesting and picturesque scenes in every state along the famous highway. This will be the decoration of the main passenger car showroom, in the second and larger one of the two show buildings.

The first building will house the commercial cars and trucks. From the truck building to the passenger car building the visitor will have to go through a 30-foot passage which will be put up in the shape of a grotto.

The first floor of the pleasure car show will be a Japanese garden in which red and mahogany will predominate. On the next floor will be the Lincoln Highway.

NEW YORK CITY, Dec. 31—The vehicle equipment department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., is opening sales-service locations in this city, Cleveland, Detroit, Chicago and Indianapolis. It will probably open similar stations on the Pacific Coast. In New York City, the station is at 250 West Fifty-fourth street; in Cleveland, at 2025 Euclid avenue; Detroit, on Woodward avenue; Chicago at 2007 Michigan avenue and in Indianapolis at 427 North Meriden street.

Germany Using Castor Oil as Lubricant

BERNE, SWITZERLAND, Dec. 28—German agents are attempting to procure castor oil from neutral countries. Germany requires this especially for oiling the motors of aeroplanes and motor cars which are used in very low temperatures.

74,906 Fords in Past 4 Months

DETROIT, MICH., Dec. 31—The Ford Motor Co., reports that in the 4 months ending November 30 there were 74,906 Ford cars sold and delivered. This demonstrates quite conclusively that the tremendous Ford schedule of 300,000 cars for the year is being maintained.

Cleveland Spends $1,000,000 on Cars

CLEVELAND, O., Jan. 2—Cleveland owns $1,000,000 worth more automobiles this year than it did in 1913, according to the tax returns compiled by County Auditor Zangerle. The average value of automobiles returned for taxation was $796. The total return for this year amounts to $5,790,000 as against $4,946,000 a year ago.

Keeton Continues Four-Cylinder Model

BRANTFORD, ONT., Jan. 2—Keeton Motors, Ltd., will continue its 35-horsepower, four-cylinder chassis for 1915. The car has a Northway power plant, Delco starting, lighting and ignition; Salisbury axles, the rear one floating, and is equipped with Hyatt roller bearings. It has a V-shaped radiator and wire wheels and has left drive and center control. It is furnished only as a five-passenger touring car, finished in real leather, and provided with mohair top and complete equipment. It sells at $1,390 in Canada. Until 1913 the company marketed a six-cylinder, 48-horsepower model, which was superseded by the present one for 1914.

Lee Oldfield Has Ten-Cylinder Racer

MINNEAPOLIS, MINN., Dec. 31—Lee Oldfield, the racing driver, has under construction here a racing car with ten-cylinder, two-cycle rotary motor of the aeroplane type with 3-inch bore and stroke and air cooling. Piston displacement is 210 cubic inches on this basis, or well within the 300-inch limit. Plans were drawn several months ago and the motor parts have been completed. The engine is to be assembled soon and then tests will start. It is planned to keep the car within 10 pounds of the A. A. A. limit of 1,600 pounds for racing cars.

NEW YORK CITY, Jan. 4—The taxicab companies in this city have lost their fight for a private taximeter rate as against the legal fare set by the Aldermen today, when Mayor Mitchel approved the amendment to the ordinance putting every vehicle operating with a meter under the public hack law.

The terms of the amendment mean that the owners must either operate the meters at the legal rate or take the meters off their machines if they wish to charge more.

Factory Miscellany

THREE Buildings for MotoKart—Plans for The MotoKart Co.'s new shop at Scranton, Pa., show three manufacturing buildings numbers one, three and four, two of them 60 by 300, one 60 by 260, and each three stories in height; a power plant 40 by 80 and a three-story storage and administration building 60 by 250, a total of over 200,000 square feet area, approximately 5 acres under roof. While foundations and supporting columns are planned for three stories, it is the company's intention to erect each building two stories in height before adding the third, this so as to earlier carry out the planned sequence of manufacturing operation. Building No. 1 now being erected will ultimately become the company's general machine shop, all parts of the car being manufactured therein and transferred via bridge passages to the second floor of building No. 3, which will be known as the unit assembly department, and where individual parts will be grouped to form motors, axles, steering gears, etc., the finished units being delivered to the lower floor of the same building, which will be the chassis assembly room. The progress of the chassis construction will be towards the rear of the plant, the finished chasses crossing an open court to the floor of building No. 4, the general assembly department, bodies being manufactured in the upper floor of the same building. The routine of manufacture as planned is one calculated to insure continuous progress of material and the lowest minimum of productive cost. Differing somewhat from many up-to-date plants, where perhaps centralization has been carried out to an extreme, each of the three manufacturing buildings of The MotoKart Co.'s plant will constitute an independent unit, having its own storeroom, lavatories, employees' entrance, etc., and receiving needed materials direct through the open courts dividing these buildings. Detailed plans have now practically been completed, and building No. 1 should be under roof by March 15.

Firestone Uses 24,000,000 Pounds Steel—The Firestone Tire & Rubber Co., Akron, O., used 24,000,000 pounds of steel last year in the manufacture of its rims. The storage of the raw steel required 15,386 square feet of floor space. A force of 400 men and a working floor space of 150,000 square feet are used in the rim plant. There are sixteen electric welders, one of them specially constructed to handle stock 14 inches wide. Sixty automobile manufacturers will use Firestone rims during the coming year.

Takes Over Columbia Car Plant—Alterations are now in progress at the former plant of the Columbia Motor Car Co., Hartford, Conn., acquired by the Billings & Spencer Co. For some time past the Billings & Spencer Co. has been putting the works in shape looking towards ultimate occupancy. Because of the general objection to the forge department of the company, at present located in a residential section, the move of this portion of the present plant to the new quarters is logical. These have been materially improved. In fact, the original two forging departments of the Columbia plant are being remodeled into one approximately 350 feet long and 80 feet wide. The old roof is being replaced by a steel affair. A machine department is to be installed in the north wing and the head room increased. Under the improvement plan a new boiler house is to be built. Structural steel is being liberally used throughout the building. Large cranes, capable of carrying about twenty tons, are to be installed. The alterations will cost about $100,000.

The Automobile Calendar

Jan. 2-9	New York City, Annual Automobile Show, Grand Central Palace.
Jan. 2-9	New York City, Automobile Salon, Grand Ball Room of Astor Hotel, Automobile Importers' Alliance, E. Lascaris, Pres.
Jan. 8-10	Buenos-Aires, Argentina, Grand Prize of Argentina.
Jan. 7-9	Pasadena, Cal., Show, Hotel Maryland Amphitheater.
Jan. 8-14	Milwaukee, Wis., Show-Auditorium, Milwaukee Auto. Dealers' Assn.
Jan. 9	San Diego, Cal., Road Race.
Jan. 9-16	Philadelphia Show, Metropolitan Bldg., Philadelphia Auto. Trade Assn.
Jan. 11-16	Buffalo, N. Y., Show, Broadway Auditorium, A. C. of Buffalo.
Jan. 16	Detroit, Mich., Show.
Jan. 16-23	Cleveland, O., Show., Cleveland Automobile Show Co., F. H. Caley, Mgr.
Jan. 18-23	Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 20-28	Lancaster, Pa., Hiemenz Auditorium.
Jan. 23-30	Montreal, Que., Show, Allen Line Liverpool Bldgs., Montreal Automobile Trade Assn., T. C. Kirby, Mgr.
Jan. 23-30	Portland, Ore., Show.
Jan. 23-30	Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 25-30	Fall River, Mass., Show.
Jan. 25-30	Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 28	New York City, S. A. E. Met. Section Meeting; Report Research Com. on Greases. Supplementary subject: Asphalt vs. Paraffin base lubricants.
Jan. 30-Feb. 6	Columbus, O., Show, Memorial Hall, Columbus Auto Club and Columbus Auto. Trades Assn.
Jan. 30-Feb. 6	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Automobile Trade Assn.
Feb.	Portland, Ore., Show, Portland Auto Trade Assn.
Feb.	Toledo, O., Show, Toledo Auto Show Co.
Feb. 1-6	Louisville, Ky., Show, Louisville Auto. Dealers' Assn., First Regiment Armory.
Feb. 4-6	Marinette, Mich., Show, Dealers Assns of Marinette and Menominee.
Feb. 2-7	Kalamazoo, Mich., Show, Armory.
Feb. 8-13	Toledo, O., Show, Terminal Bldg., Toledo Auto. Showe Co., H. W. Blevins.
Feb. 8-14	Kansas City, Mo., Show.
Feb. 9-12	Eau Claire, Wis., Eau Claire Auto. Dealers' Assn.
Feb. 9-12	Peoria, Ill., Show, Peoria Auto & Motor Cycle Dealers.
Feb. 15-20	Grand Rapids, Mich., Show, Klingman Furniture Exposition Bldg., Grand Rapids *Herald*; C. L. Merriman.
Feb. 15-20	Omaha, Neb., Show, Auditorium, C. G. Powell.
Feb. 15-20	Bridgeport, Conn., Show, State Armory; B. B. Sterber.
Feb. 22	San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Feb. 23-27	Syracuse, N. Y., Show, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27	Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 25	New York City, S. A. E., Metropolitan Sec. Meeting; Report of Research Committee on Kerosene Carbureters. Research Com. Report on Non-Electric Continuous-Torque Transmission.
Feb 27	San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13	New York City, Made in the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13	Canton, O., Show, Auditorium, Stark Co. Auto. Show and Electrical Exposition.
Mar. 8-13	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17	Venice, Cal., 300-Mile Road Race.
April	Calumet, Mich., Show, Coliseum.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., Two-mile Track Meet.
June 16	Chicago, Ill., Speedway, 500-Mile Race, Speedway Park Assn.
June 25	Sioux City, Ia., Track Meet.
July 4	Tacoma, Wash., Road Race.
Aug. 20-21	Elgin, Ill., Road Race.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

VELIE Makes Important Changes—The board of directors of the Velie Motor Vehicle Co., Moline, Ill., as well as of the Velie Engineering Co. have elected R. R. Bush, formerly sales manager, to the office of manager, and, as the title implies, he will have full charge over the entire affairs of both concerns hereafter. G. H. Lloyd is placed in charge of sales, filling the office made vacant by the advancement of Mr. Bush while W. H. Morgan continues in sales jurisdiction over the trade in Illinois, Iowa and Wisconsin. H. T. Wheelock assumes charge of the advertising department in addition to his affiliation with motor truck sales.

Hart Manager—J. T. Hart is general manager of the Auto Parts Co., Chicago, Ill.

Heath Sales Manager—C. B. Heath has been appointed general sales manager for the Bantam Anti-Friction Co., Bantam, Conn., with headquarters at the factory.

Trumbull President Hartford Auto Parts—J. H. Trumbull has been elected president of the Hartford Auto Parts Co., Hartford, Conn. James Carney has been elected treasurer of the company.

Wheeler Makes Change—T. Wheeler, who was district sales manager of the Chalmers Motor Co., Fort Worth, Tex., is now general manager of the Bryant Machinery Co., that city, which will handle the Chalmers car.

Harper Heads Newark Truck Club—David Harper was unanimously chosen president of the recently organized Motor Truck Club of New Jersey at a meeting held last week at the clubhouse of the New Jersey Automobile and Motor Club, Newark, N. J.

Smith Heads Brooklyn Lexington—The Lexington Sales Co., Inc., with warerooms and service stations at 1174 Bedford avenue, Brooklyn, N. Y., has been formed with A. T. Smith at the head and M. J. Swetland as business and financial manager.

Kramer Severs Overland Connections—F. W. Kramer, of Grand Rapids, Mich., formerly manager of the Grand Rapids Overland Co., has severed all connections with that concern in order to devote his time to his other interests. Mr. Kramer left in December for a vacation trip.

George Resigns—C. A. George, for 4 years in the export sales department of the Willys-Overland Co., Toledo, O., has resigned, and has become export manager for the O.K. Light Delivery Truck Co., Detroit. He has left for England, where he will establish his European headquarters for the present.

Boulden Chase Sales Manager—H. T. Boulden assumed the general sales managership of The Chase Motor Truck Co., Syracuse, N. Y., on January 4. Mr. Boulden will have entire charge of selling and in addition will look after all advertising. E. A. Kingsbury continues as secretary and treasurer, while Mr. Chase, who has had charge of sales, will devote his entire time to the manufacturing and production end of the business.

Reeves Pilot Representative—J. F. Reeves, formerly of Dallas, Tex., has been appointed California representative for the Pilot car, with headquarters at San Francisco, and will establish agencies in the territory north of Bakersfield. The Wilshire Automobile Co., Los Angeles, will control the southern portion of the State.

Ris Heads N. Y. Knight Tire—L. I. Ris, who for the past year has been a traveling sales representative for the Republic Rubber Co., in New York State and Connecticut, has been appointed manager of the New York City branch of the Knight Tire & Rubber Co., Canton, O., which is just being opened at 215 West Fifty-first street, New York City. Mr. Ris was formerly connected with the Century Tire Co., in charge of its Buffalo branch, and worked under the direction of H. J. Woodard, general manager of that company. Mr. Woodard is now eastern district manager of the Knight Co., and will direct the operation of the Knight branches in Boston, New York, Philadelphia and Baltimore.

Garage and Dealers' Field

Mutty Moves in Boston—The L. J. Mutty Co., Boston, Mass., has moved to 175 Congress street.

Opens Delaware Tire Agency—With C. C. Matthews as manager, a local sales branch of the Delaware Tire Sales Co. has been opened at 15 West North street, Indianapolis, to sell Delaware tires in Indiana.

Hartford Pierce-Arrow Service Station—S. A. Miner, Pierce-Arrow distributor for northern Connecticut, has opened up a fully equipped service station at 105 Albany avenue, Hartford, Conn. The building has just been completed.

Columbus Kissel Enlarges Territory—The Kissel Service Co., 241 North Fourth street, Columbus, O., recently organized with C. G. McCune as general manager, has taken the agency for the KisselKar in seventeen counties in central Ohio. Sub-agencies will be established later.

Polack Tire in Motor Mart—The Polack Tire & Rubber Co. has leased the store at 10 West Sixty-second street, New York City, in the Motor Mart, with 7,500 square feet of basement space, the rear portion of the second floor for its executive offices and the large electric sign on the roof.

Prohibits Gasoline for Washing—Safety Director Holmes of Cincinnati, O., has given orders prohibiting the use of gasoline in the washing of cars. A number of fires have recently taken place through the use of gasoline in that manner. Director Holmes suggested that coal oil, which is not as volatile as gasoline, be used.

Fire Destroys Lancaster Garage—The Overland Garage, located on West Main street, Lancaster, O., owned by L. E. Huddle, was completely destroyed by fire recently, entailing a loss of approximately $80,000. In all about sixty cars of all kinds were burned. The garage caught fire through the back fire on an engine, and a number of gasoline explosions occurred. In all ten new cars were saved from the flames.

Los Angeles Co. Enlarges—The Carlton-Faulkner-Bowles Co., Los Angeles, Cal., has taken over the large building on Eleventh and Flower streets, formerly occupied by the Thomas Motor Car Co., having outgrown the location on Tenth and Hope streets. The annex is to be used as a salesroom for Jeffery trucks and as a service depot for the Fiat, McFarlan and Jeffery pleasure cars handled at the agency's old location.

Gets Out Automatic Salesman—The Standard Woven Fabric Co., Framingham, Mass., has gotten out a handy brake lining cabinet which is called the Automatic Salesman. Each cabinet is built so as to hold 700 feet of brake lining, each roll having a separate compartment and revolving on a separate axis, so that the desired quantity can be easily rolled off at any time. Another innovation is the marking of its goods with plain white lines at intervals of exactly 1 foot.

Remy Acquires Detroit Location—H. W. Griffith, general manager of the Remy Electric Co., Anderson, Ind., closed a deal last week involving the purchase of a tract on East Grand boulevard, Detroit, near the Packard Motor Car Co.'s plant, having a frontage of 500 feet on the boulevard and a depth of 150 feet. A building to house the engineering, experimental laboratories and drafting departments, as well as Detroit branch and service station, with about 20,000 feet floor space, three stories high, will be erected at once and will probably be ready for occupancy in between two and three months, at which time the departments mentioned above will be moved from the main plant at Anderson, Ind.

Changes in Philadelphia—Before or during the Philadelphia Show Week, January 9 to 16, several motor car companies will indulge in a general shifting of locations, more changes taking place than ever before during a similar period. The Lee Tire & Rubber Co., now located at 334 North Broad street, will remove to 660 North Broad street. The Colonial Motor Co., 330 North Broad street, local distributers of the R. C. H. and the Partin-Palmer cars, goes to 664 North Broad street. The properties 334-336 North Broad street will be made into one, the enlarged building to be the home of the Chevrolet; 336 North Broad street is at present occupied by the Hupmobile, but the Hupp company will remove two doors below, 332. The Johnson Motor Car Co., handling the Haynes and Saxon, is to occupy the present quarters of the Overland car, 132-134 North Broad street, the Overland company having leased the building at the northeast corner of Broad and Wood streets, the old Fiat headquarters. The Fiat company has already removed to Chestnut street, west of Eighteenth.

JANUARY 14, 1915 10 CENTS A COPY

The AUTOMOBILE

MAGAZINE LOAN COLLECTION

Power and *endurance* combined with *beauty* and *refinement* find their highest motor car expression in the splendid PATHFINDER.

Besides, this car comes equipped with a detachable limousine top which may be attached or removed in an hour without changing the body in any way, not even so much as rearranging the elaborate wiring.

If interested in a car of the highest refinement, marketed at the [illegible] conservative price, be sure [illegible] call on us at the Chicago show, space B-6 or write us for complete information.

MOTOR CAR MFG. COMPANY
1134 Division St. Indianapolis, Indiana

Cleveland Public Library
MAGAZINE LOAN COLLECTION
Date when due marked below
C.P.L. Form 1218 Reading

Well-known Users of the AC Line

- Apperson
- Buick
- Cadillac
- Chalmers
- Chase
- Chevrolet
- Cole
- Commerce
- Cartercar
- Dodge Bros.
- Dort
- Federal
- Ferro
- General Motors
- Haynes
- Harley-Davidson
- Henderson
- Hudson
- Hupp
- Jackson

Try This When Your Motor Is Hot

Nearly all plug manufacturers make this claim: **Our plugs do not leak compression**—WHY? Because this feature is essential to insure an efficient spark plug.

Plugs that leak are the cause of many defects that are not generally attributed to the spark plugs. Pre-ignition—Inability to throttle down—Engine knocks—Loss of power—are a few of them and they shorten the life of the motor.

We do not know of any plugs made today, aside from the AC-TITAN and CICO, that do not leak when the motor is hot. Make the test pictured above and see for yourself.

AC-TITAN AND CICO PLUGS ARE GAS TIGHT UNDER ALL CONDITIONS

We make only the AC-TITAN-CICO spark plugs. Do not be misled by a similarity of names.

Well-known Users of the AC Line

- Knox
- Lambert
- Lexington-Howard
- Marathon
- McLaughlin
- Monroe
- Moon
- National
- Oakland
- Olds
- Peerless
- Pilot
- Premier
- Pullman
- Reo
- Saxon
- Stearns
- Touraine
- Velie
- Wilcox Truck
- 1915 AC Packard

CHAMPION IGNITION COMPANY .... FLINT, MICHIGAN

Vol. XXXII New York—Thursday, January 14, 1915—Chicago No. 2

The Automobile

Saving Trucks at the Front in France

British Army Repair Depot Conditions Vehicles Worn with 4 Months of Active Field Service and Rehabilitates or Amalgamates Wrecks

By W. F. Bradley

Special Representative of THE AUTOMOBILE with the Allied Armies in France

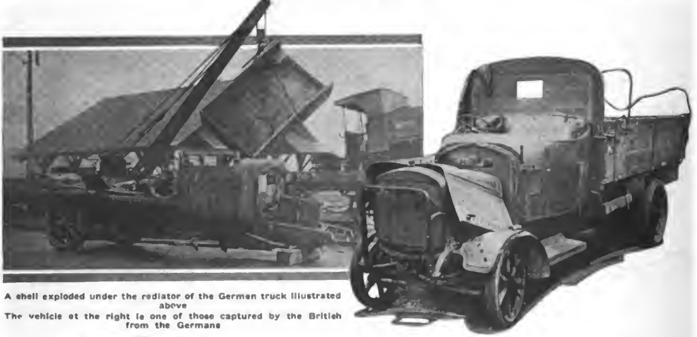
PARIS, Dec. 28—Four months' active service, 120 days without seeing the inside of a garage, over roads which have varied from city boulevards to rocky highways; 120 days hard driving, pursuing the enemy or being pursued by him, day and night work to the limits of human and mechanical endurance; 4 months under sunshine, rain, hail and snow, alternating with shot and shell—after such service it is to be expected that the army automobile repairman is busy and that the junk heap is piling up to respectable proportions.

Usefulness Proven

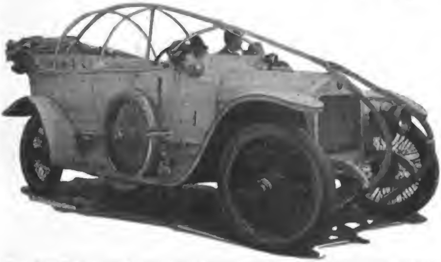
Nobody knows how many cars have been destroyed in this war. It would not serve any very useful end to have this information, for everybody is convinced of their usefulness, and that conviction would not be altered if it were officially announced that hundreds of cars had been destroyed.

Touring cars wrecked in the war. In the foreground is a Benz captured from the Germans, while back of it is a Ford. Note the other with radiator and dash marked Scrap

A large amount of the destruction is due to the failure of the horse. Under the fire of guns horses have melted like a candle in a drafty alley. When plans were drawn up in comfortable offices at home, and when those plans were tested at pleasant autumnal maneuvers, it was understood that automobile trucks should travel from railhead to rendezvous; that at this point, some 5 or 6 miles back of the firing line, the food



A shell exploded under the radiator of the German truck illustrated above
The vehicle at the right is one of those captured by the British from the Germans



Minerva touring car fitted with special device for cutting barbed wire which is sometimes found strung across the road. The photograph was taken near Nancy

and ammunition should be transferred to the horse transports for direct conveyance to the men at the front.

The London bus driver who promptly responded to the call "Your King and Your Country Need You," soon found that he was not going to lose any of the fun. Some of the early fighting resulted in wholesale slaughter of cavalry horses. Indeed it was hardly necessary to slaughter to produce a shortage. Almost any kind of a bullet wound is sufficient to put a horse out of business; and it is amazing what an easy target the horse offers to the enemy. With their horses melting away, the cavalry swooped down on the Army Service Corps, took the animals most suited to their purpose, and when the ex-bus drivers and others reported at the rendezvous there was nobody there to greet them. Thus the trucks went right up to the firing line. It was a situation which might have been foreseen if the organizers had possessed less routine and a little more imagination. The lack of foresight, however, was a matter of small importance. Men and trucks forgot that the horse ever had been a factor; they carried ammunition right up to the batteries, they made night trips to the men in the trenches, they had skirmishes with the enemy's scouts, they were sometimes shelled, but they did their business and did it considerably better than it could have been done under the old system.

This new method of working is largely responsible for the great wreckage of automobile trucks. It is impossible to go within range of the opponents' guns without being hit from time to time, and it is certainly difficult to travel over roads which have been dug up by hoofs, wheels and shells without occasionally breaking springs and other sundries. Thus, after 4 months of war the repair department is working at high pressure.

War Repair Depot

The British army has tackled this breakdown problem in a business-like way. Wrecked trucks and touring cars are brought into the railhead, just back of the firing line, train loads are made up, and they are sent to a big repair depot 100 miles and more to the west of the scene of operations. Every kind of vehicle, in every possible and impossible shape, is gathered up from the roadside and shipped to the rear. They are not merely English cars; captured and abandoned German vehicles are gathered up with the others and sent to the depot. They come in trainloads or in isolated trucks, day after day and night after night they roll in, silent testimony to the destructiveness of war. The trains are brought right into the repair depot, which is equipped with traveling cranes and all necessary material for rapid and convenient loading and unloading.

The sight in this yard is unique. On the tracks is a train with wreckage from the front. In the yard is to be found row upon row of motor vehicles of every kind. Every British firm is represented in this yard. The history of some of the vehicles is known; around the majority one must weave romance, which will not be half so strange as the truth.

At the beginning of a row of fifty were two German touring cars, a Benz and a Dixi. The Benz had been captured from the Germans, it had been used by British officers and finally abandoned by them when a shell blew away the radiator and the front axle. The Dixi had gone over a bank when the driver was shot by a British scout. For weeks the machine lay rotting in the mud until the breakdown gang brought it in. But its useful life was not finished. Although it was covered with mud, although its metal work was red with rust, and although its fenders and running boards had been carried away, the instruction card read "Complete overhaul; return to advanced base."

A corner of the scrap heap at the British army war depot for truck repairs. Note the advertising matter still on the bodies

Next door were three London taxicabs, vehicles taken straight out of peaceful service and thrust into the thick of the battle. They were destined for the scrap heap. Further along, an English truck with a big hole in the waterjacket of the forward cylinder. A sharp frost had surprised the driver, who in his annoyance had put a hammer through the frost-bound jacket.

Nearby were three examples of how radiators suffer in the war. Practically all the trucks sent into France from England at the outbreak of hostilities were without radiator guards, with the result that scores of trucks have been permanently crippled by their companions backing into them. A guard is not only essential, but it should be of such stout construction as to afford protection against all violent shocks.

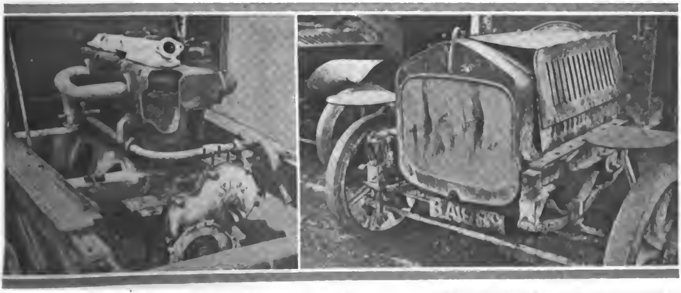
A few yards away was a wreckage in which the stoutest radiator guard would have been no protection. While going over a grade crossing at night a big army type Leyland truck filled with ammunition, was struck by a train. It would only be a waste of time to attempt to describe it, but probably the most wonderful thing is how all the bits were collected and brought back to the depot 150 miles from the scene of the accident.

On a railroad truck, ready to be unloaded, was a six-cylinder Daimler on the front wing of which a shell had exploded, killing the driver and the man by his side and carrying away most of the front portion of the vehicle. Behind it was a yellow Mercedes with the German arms painted on the door panels. The car had been used by a general who was killed by a British shell. It had been impossible to get the car away and it was later captured by English soldiers.

Immediately after being unloaded, the vehicles are examined with a view to determining what shall be done with them. Some are marked down as scrap, but it is very rarely that an entire unit has to be sacrificed. Out of what appears to be a mass of wreckage it is generally possible to pick out a motor, a gearbox, a rear axle, a set of wheels, or some other component parts. Very frequently two wrecked vehicles can be united into one perfect automobile. This particularly applies to the captured German cars for which spare parts are difficult to obtain. With the English vehicles there is no such difficulty. Whatever parts are required can be obtained; but if the vehicle as a whole is not worth repairing its component parts are picked out and sent to the store room.

Lack Machine Tools

In the big depot at which the vehicles are received there are workshops but no machine tools. Thus the work undertaken is of a selective nature, together with such repairs as call for the simple change of units. A short distance away is a complete automobile factory taken over by the British army. It has been manned with English mechanics drawn



Left—A sharp frost surprised the driver of this British truck, who, in his annoyance at finding the motor frozen, put a hammer through the waterjacket. Right—An instance of where a radiator guard would have been useful from the various English automobile factories and having enlisted for the length of the war. Although the men are working at their own trade, they are soldiers; the entire organization is military. A number of the original workmen attached to the factory have been retained for the machine tools, but although these men are not in uniform, they are under military control. It is in this factory that all the truck repairs are undertaken. Some touring cars are attended to, but so great is the demand on the staff that a very considerable proportion of this work is turned over to the French automobile factories in the neighborhood. Practically all the Daimler and Rolls-Royce cars are given to the French branches of these companies, for the work being special can be handled more economically by these firms than by outsiders. At the Daimler factory alone the average number of cars under repair is about fifty. Another of the factories undertaking this work usually has forty cars in hand.

Soldiers at the Forge

Some rather curious situations have arisen in connection with this work. The organization is under the control of Army Service Corps officers and every man is a soldier. Probably 80 per cent. of these men have enlisted for the length of the war, and have had no military training; they are not fighting men. Incorporated with them are men of the A. S. C. branch of the regular army; practically all the noncommissioned officers come in this class.

As good pay has had to be offered to get the drivers and mechanics, it generally happens that the private is better off, financially, than his superior. Most of the mechanics are paid from $10.60 to $11 per week, food and lodging being provided, and in addition are entitled to a separation allowance if married. The rate of pay would be very satisfactory at ordinary times, but being under military rule the men have to work longer than they would do at home and really do not draw as much as the French mechanic who is free from military service and can claim from 22 to 29 cents an hour. Nevertheless, the drivers and mechanics are the most highly paid of all the men serving with the armies in the field.

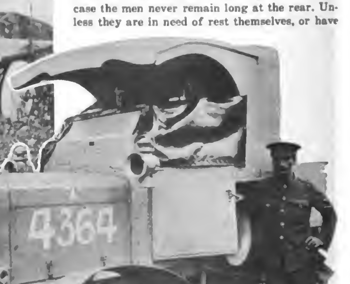
Caravans to the Front

When a truck is ordered to the repair depot, its two drivers accompany it. The men may either be kept at the depot, employed in various ways, until their vehicle is ready, or more frequently they are sent back on another truck. The parties returning to the front travel in convoys of about twenty trucks under the control of an officer in a touring car. In any case the men never remain long at the rear. Unless they are in need of rest themselves, or have

A Siddeley-Deasy sent back to the repair depot for a new rear axle

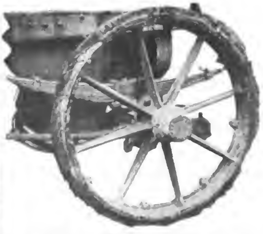
A German truck in the hands of English soldier-mechanics

Above—French truck, destroyed by the Germans. The photograph was taken immediately after a trip to the trenches



Right—How the drivers of the British army trucks are protected. Note the broad arrow mark of the government and the number of the vehicle

Some of the London taxicabs at the repair depot after service at the front



How solid rubber tires look after 4 months in war service. Trucks frequently have to get off the crown of the road to permit others to pass and the lateral wear results

Once a London motor bus, now a wrecked army truck

A Sunbeam built up with parts from five other cars

to get together a fresh kit, they are allotted a fresh vehicle and return to the scene of operations within a few days.

Drivers Well Protected

When impressed trucks were sent into France they carried all the advertising matter of their original owners. When they come into the depot they are painted gray, which color appears to be replacing the khaki tint adopted at the outset. Much greater attention is now paid to the protection of drivers. Every repaired vehicle is fitted with foredoors and a high curved dash surmounted by a leather apron on both front and sides. The steering wheel is entirely under cover, only the driver's head appears and as there is a substantial wood roof extension the men are almost as well protected as in a closed car. Certainly the average touring car driver is not so well protected from the elements.

Before being sent away all repaired vehicles are tested in hilly country. Originally they were sent away as soon as they had passed the shop foreman's hands; but there were so many breakdowns 15 to 20 miles from home, that it was found to be better policy to give each an individual trial.

Knuckles, Springs, Axles

Four months' service have been sufficient to give the mechanical transport department a lot of valuable comparative data on army trucks. Despite the unsatisfactory conditions under which this war was begun—for, notwithstanding German statements to the contrary, the British army was not prepared for a great Continental war—the mechanical transport department has given remarkably efficient service. Certain types are more highly appreciated than others, but very few can be considered unsatisfactory. One firm has earned for itself a poor reputation by reason of broken steering knuckles; another has weak rear springs, while a third make would be perfect if more clearance were given to the rear axle.

A very common complaint is the insufficient protection of radiators. Even when guards are fitted they are in many cases insufficient for their work. It has been shown that the most highly specialized commercial types are the least satisfactory for war.

English Buses Weak

The London omnibus chassis is generally recognized to be the finest of its kind in existence and most admirably suited for work on London streets. Under war conditions it is giving a considerable amount of trouble. Police regulations have caused weight to be cut to the danger line. Although this is not apparent on city streets, it is painfully evident at the seat of war.

The motors, which have thermo-syphon cooling, persistently overheat when put to heavy work. The vehicles are incapable of hauling another of equal load and weight. Spring breakages are common. This is not a condemnation of the B type chassis; for its own particular work it is second to

(Continued on page 59)

Engineering Analyses—Part II

Foreign Engineer Applies First Principles to Designs at Palace Show—Discusses Three-Point Suspension—Future of the Small Four—Likes Dog Clutch Design

By A. Ludlow Clayden
Member Institute of Automobile Engineers of Great Britain

THREE-POINT suspension, now the rule, has two advantages, one being that it relieves the crankcase of twisting stresses coming from the road; but since the average case is more than strong enough to take care of itself in this matter one has to look to the second point, which is greater facility of erection in the shops. If three-point suspension had not been a manufacturing advantage we should have heard very little of it. It is interesting, however, to reflect upon the amount of work done by the two main attachments at the rear of a motor, especially in cars where the drive is also against the unit power plant. It is obvious that a fluctuating load of a complicated kind is perpetually upon these points of fixing, and thence one may deduce the necessity for proportioning the frame so that it can distribute the stresses over its entire length (and so to the road springs) without setting up vibrations of its own.

Three-point suspensions can therefore be arranged so that the third or forward point gives either good or poor support to stresses other than weight. That is to say if it is in proper relation to the center of gravity of the power plant in the vertical plane it can steady it against vibration much better than when it is placed too high or too low.

If it were not for the manufacturing advantage aforesaid there is much in favor of making the crankcase part of the frame by using four, or even more attachments. This is the favorite Italian style, and that it stands up well against the racking stresses of Alpine roads shows that the rigid style is not injurious to the motor. The subject is one upon which very little investigation has been made, but it is a worthy study for laboratory engineers and for *practical* mathematicians.

Stroke-Bore Ratio Stationary

No consideration of motor design would be complete without mentioning stroke-to-bore ratio. Europe has now come to fairly general agreement that between 1.3 and 1.5 gives the best all-round features, including manufacturing facility. The average American motor is now just over the bottom limit, and the absence of restrictive taxation on a basis of bore makes it unlikely that the ratio will run much higher.

The 1.3 ratio makes a conveniently shaped symmetrical motor of which the width and height both suit modern body lines. Also vibration troubles increase as the square of the stroke and the cost of eliminating them probably rises at a much more rapid rate still. It is to be observed that the British light car engines, which all produce extremely high power per cubic inch of displacement, have exhibited a strong downward tendency in stroke during the past year

Favors Pump Circulation

After a long study of European work it is surprising to see so few cars with thermo-syphon water circulation, but a moment's thought shows that the American maker is right in sticking to the pump, because he has to be prepared to deal with temperatures where tropical heat is the rule and water perhaps scarce. It would seem, however, that the water pipes on a good many motors are too small to allow a free flow, or perhaps it would be better to say that the return water pipes from the cylinder to the radiator are often so small that the amount of work the pump has to do is needlessly increased.

A type of compromise between pump and syphon which has been tried out in England with conspicuous success seems peculiarly applicable to this country, though it does not appear to be used here. In it the water will circulate by thermo-syphon and the pipes are large, the intake from the radiator to the cylinder block being arranged at the front so that the elbow comes directly behind the fan spindle. In the elbow is a small glanded bearing and the fan spindle is carried through, having mounted on its inner end a small screw propeller. This screw serves to accelerate the natural circulation very greatly, but if it ceases to rotate it does not block the pipe and cooling continues syphonically. Thus in hot weather the fan and screw together insure ample cooling, while in winter it is only necessary to remove the fan belt in order to let the motor warm up.

Chain Camshaft Drive

Just a word as to camshaft drives. The gear drive is dead in England and the silent chain has given no trouble whatever except in very rare instances. Against the chain British makers have only expense to urge, and this is being overcome in several cases by using a roller chain instead of the silent pattern. The roller is not so quiet, but it is a very great deal quieter than the gear and almost as cheap as the gear.

It *must* have a tensioning adjustment however, but this need be nothing more elaborate than a spring-loaded jockey pulley. Such an arrangement has been used for 3 years on one British car sold in fairly large quanities and the writer has not so far heard a single complaint of its performance. Another point in favor of the roller chain is that it can be taken round sprockets in either direction, which is sometimes useful.

The Cheap Four Motor

So far it is the sixes that have been in mind in considering the features of design because the most advanced thought has been put into them, yet there is a sufficient number of fours to make this seem neglectful. So very many of the fours, however, have been designed with cheapness as the be-all and end-all of everything and such engines can only be regarded from a machine shop viewpoint.

There are a few fours typical of the highest engineering skill and to them applies almost every thought that has been voiced concerning the six but the motors of the cheaper cars do not generally come near the rest for refinement of any kind. The limit of width between end bearings for the economical use of the two-bearing crankshaft is distinctly on the high side here as compared with Europe, but this is perhaps offset a little by the slightly smaller stroke to bore ratio. The cheap four is, however, a proposition so totally different from anything ever attempted on the other side of the ocean, that it needs a closer study than is possible in an automobile show before it would be wise to give definite opinions upon it.

Since 3 years it seems to have neatened greatly, but it does not appear to be so accessible or to have such good valves and gas passages as even the inexpensive sixes.

Hopes for Fours

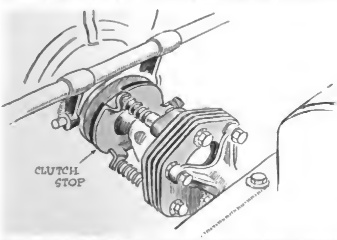
Seeing that the bulk of the best engineering brains of the country have been turned on the six for the past 2 years or more it would not be natural to expect the four to have advanced so much on the average; so the writer will content himself by saying in conclusion, that the introductions of some of the latest comers in the four field has set a new standard to which the older four-cylinder producers may shortly have to work. For this reason, and because the small four, well made, is an ideal machine for the vast majority of automobile buyers, it is reasonable to anticipate a new concentration on this type. With the example of the six to follow great things are to be expected of the engineers and doubtless this expectation will not be disappointed.

Chassis Similarity

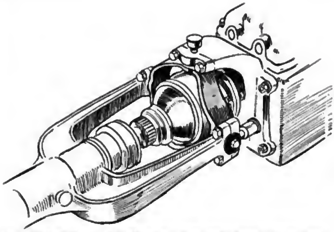
In European chassis there is almost as much variation back of the motor as in the motors themselves, because there is no standard system of arrangement for the transmission. Some use the unit powerplant, some the separate gearset—these being the majority, and a few the combined axle and gearset. Also with clutches there are an infinity of kinds and all sorts of ways of connecting the drive from the clutch to the gear shaft. Here in America the almost universal adoption of the unit powerplant, and still more the great popularity of the standard types of axles and gearsets made by the specializing companies, produces an extraordinary similarity of detail in the after part of the chassis.

Asked at the show, in what particulars the writer considered the American makers were ahead of Europe he found the reply somewhat difficult, on account of the influence of difference in taste between the buying public on opposite sides of the ocean. One might easily say that the self-starter is the outstanding example of American initiative, but while this is true in a way, it is a fact that there is not yet a very strong desire for the starter on the other side. The much smaller average dimensions of the motors and the lesser extremes of climate, added to the fact that the gasoline is of much better quality, means that there is no difficulty in starting unless something actually is wrong.

So that, while the starter has got to come sooner or later, it is likely to be later. Thus attention must be turned to some other part and after considerable reflection the conclusion arrived at is that the feature of American design which the European makers would be best advised to take up is the dry-plate clutch.



Neat way of combining clutch stop and leather universal coupling on chassis with independent gearset



Forked end of torque tube set to swivel on same center as universal joint

Of course, there have been dry-plate clutches on De Dion cars for many years, but these were single-plate designs and had rather a complicated operating mechanism. It is the multiple-disk having half the surfaces steel and the other half woven wire and asbestos fabric that seems the ideal variety. Ease of gear changing varies with the square of the weight of the clutch, the diameter being unchanged, and a clutch which is intrinsically light and of small diameter also is infinitely to be preferred to any larger or heavier kind.

The great simplicity of the cone clutch has made it preferable to the multiple-disk, which needs to run in oil, this latter type usually being susceptible to damage if it fails to receive really careful attention in the way of lubrication and of tension adjustment.

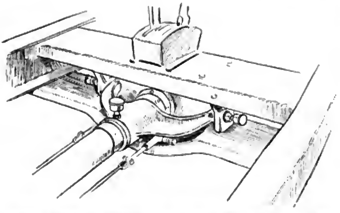
The dry-plate clutch has all the advantages of light weight and small diameter and it needs no more attention than a brake; in fact much less, because its use is so much less severe. Anyone who has had experience of clutches of the disk kind that run in oil and are contained in a narrow compartment of the powerplant unit has had the opportunity of learning their inaccessiblity when the renewal of a plate or two is necessary. Also another disadvantage of lubricated disks is their tendency to adhere by the coagulation of the oil in cold weather, this making gear changing almost impossible until all the motor is well warmed up.

Accessibility Rules

It should be a golden rule of design that only those parts that require no attention can be made really inaccessible, and in using a unit powerplant with an all inclosed flywheel the clutch is bound to be difficult of access. This should rule out the cone almost, because it needs dressing or adjusting or even relining fairly often, while it usually requires a good deal more room; though where the unit is open at the top and has a flywheel pit instead of a full case this disadvantage vanishes.

The reason that the unit powerplant is not very popular in Europe is that it is often uneconomical when the output is limited, as the handling of so large a casting calls for big and expensive machines. It has been used on a good many small cars and on some big ones—notably the Lanchester, for a good many years, but there was no sign at the 1913 shows that it had gained appreciably in popularity. Here on the other hand, one immediately wonders why; when the eye lights on a chassis with a separate gearbox.

With respect to the rear axle location for the gearset the writer maintains a perfectly open mind on the question of



Rigid method of attaching fulcrum pins for torque tube fork

the pros and cons of sprung weight *versus* unsprung, but he has a most positive idea that no axle location has yet been devised that did not sooner or later give trouble by reason of the long rods needed for gear operation. Unless made very heavy there is spring or whip in the connections between the gear shift lever and the axle, while it is difficult to arrange the parts so as to avoid exposed bearings difficult of lubrication, which means a tendency to rattling or squeaking. Also owing to one cause or another, an old car with axle gearset location is commonly difficult to change speed upon. The thought occurs that should the electric gearshift become usual this trouble of operation would vanish and one could give due weight to the manufacturing advantages of having a motor unit and a transmission unit, and to the engineering points in favor of a very long shaft with a single universal joint, but this is as yet a matter for speculation only. In passing, however the opinion might be expressed that there seems no reason why the electrically operated gear change should not become popular, because the advantage of the power to pre-select a gear is undoubted; it has, by the way, been one of the features of a most successful British truck, the Commer, for many years past, though the pre-selection was therein obtained by mechanical instead of electrical means.

Easy Clutch Pedal

Returning for a moment to clutches, having complimented America on the use of an almost ideal type perhaps one constructive criticism may be permitted and this is that the pedal pressure generally necessary to release the clutch seems to be excessive. Now that so many more ladies are taking to the wheel a light clutch action becomes more important, and the strongest of males can do better work with the gearshift lever if no appreciable effort is needed to operate the clutch. To lighten the clutch action needs the provision of one extra pivot and a multiplying lever, calling for a slight increase in the cost of the chassis to the manufacturer. Probably a dollar would cover it if schemed for on a reasonable output and it is an improvement worth thinking about for 1916.

Splined Gearset Shafts

To a European it is amazing to find so many gearsets in which a square shaft is used on which to mount the sliding gears. To deal firstly with its advantage it is a trifle cheaper to make than a splined shaft and the gears can be slotted instead of needing the use of a drift, but when one remembers that most of these gearsets are made by big corporations turning out thousands upon thousands of sets it is difficult to believe that there is any measurable saving in cost. On the other hand the splined shaft is altogether better in use.

One of the greatest causes of noisy gears is whip in the shafts and a square shaft is bad because it is stronger against bending on the diagonals than it is across the flats, which is a likely producer of vibration. Then again a sliding gear has to be an easy fit on its shaft and this means there is always a degree or two of backlash. With a square shaft a given degree of accuracy in workmanship means much more of this angular wobble than it does on a splined shaft, so squared shafts ought only to be used when price overrules everything else.

There has lately been evident a tendency to abandon the plain spigot bearing in the gearbox and many ball bearing constructions have been put forward; this is a place where the small permissible diameter makes difficulties, so the roller appears to be especially adaptable and several American constructions take advantage of this very cleverly. Still the whole question has been complicated by the fact that England and Germany have produced the best ball bearings in the world while American makers have given attention to the roller and it would be very difficult to judge to what extent this may have affected American and European automobile design.

Gearshift Problems

As to gearshifting mechanisms the adoption of the left-hand wheel position which the writer ventured to predict nearly 4 years ago, because it is fundamentally correct, has enabled a great simplification. There is no difficulty with a left-hand gearshift such as one gets with a centrally placed lever and a right hand wheel, but the British public are shy of it and so it is only gaining favor slowly. There is one small disadvantage in the customary mounting for a central lever, that is in the lid of the gearbox, this being that should any trouble arise with the gears it is impossible to watch what is going on while shifting the lever. The point is a small one but if a central position can be combined with a means of inspecting the gears without demounting the lever, then so much the better, and several examples at the show made clear the fact that there are no great difficulties in the way of such a combination. There seems to be no reason at all for the retention of the old-fashioned gate, still seen on a few cars, since the water and dirt-proof, hemispherical covered lever foot should meet all requirements—one does not change speed by eye.

The Gearset Lock

Another feature of the European gearset which often is lacking on American chassis is a device for locking the gear strikers that are not in use. This is valuable when a car has had a good deal of use because, when the slots in the strikers have worn a little, it is possible to get across from one side to the other without disengaging the first striker properly. On two occasions recently it has been the writer's experience that this could be done on new cars even and the resulting effect of having two gears engaged at once is disconcerting, to say the least of it. A positive lock which makes such action impossible is not a costly addition to a gearset and it is a refinement that makes all the difference between first-class work and mediocrity.

As to the gears themselves they are, on the average, rather smaller in width by comparison with the power to be transmitted than is usual with British design, also the pitch is slightly coarser. If the case is not complicated with other variables it is a rule that the coarser the pitch the easier the gear change and Europe has shown an upward trend with respect to pitches. French designers favor larger diameters for gears than does the British school and, while the greater number of teeth in a large wheel necessarily increases durability, it also tends to make the gear more difficult to quiet. This is, partly because of the higher peripheral speed, but it is also due to the greater liability of a big gear to warp in hardening. It may be shrewdly suspected that the gears on some of the less costly American cars have been reduced in diameter and width with a view to making the machining as cheap as possible. Where cheapness is the first requisite the writer has a feeling in favor of two *good* speeds rather than three indifferent ones and he would expect one Ford gearset to outwear several sets of gears such as are fitted to some of the light cars.

The Weight Ratio

Before going further it might be well for the writer to state that the supposedly British notion that weight is strength is not the reason for criticism of the cutting down of parts which he has just made and will again have occasion for making. If one allows that surface spells durability on moving parts it may be possible to increase that surface without increasing weight. If so, then so much the better, but if not, then there are instances where extra weight can spell extra satisfaction to the user. It should be every engineer's ambition to keep the ratio dead weight over live weight as small a fraction as he can but let him see firstly to the wearing surfaces and then tackle the mass.

Before leaving the gearset a word should be said concerning its support in the frame. The unit power plant has generally a good deal of rearward overhang from the supporting arms and, though this is satisfactory enough in most cases, it is at least conceivable that rather more support might enable a little dead weight to come out of the aluminum of the unit. There is an ever present inclination to consider only the *weight* of the powerplant, and to overlook the internal and external stresses imposed upon it. In cases where the driving effort is taken in a ball socket on the torque tube, then the socket should certainly be so situated that its thrust is transferred to the frame of the chassis by rigid connections.

(To be concluded)

Saving Trucks at the Front in France

(Continued from page 55)

none; it is certainly superior to the Paris bus. But while the French vehicle is free from breakdowns, for it was designed with war service as a possibility, the English bus chassis is proving a weakling. It is merely a case of overspecialization.

Tires have been submitted to a particularly severe test. Vehicles which went into service early in August have come back during the first days of December with their rubber tires worn down to the metal rims. The wear is not normal; in northern France and Belgium the roads are paved with granite sets, and on each side of the paved track is a dirt road almost as wide as the road itself. At times traffic at the railhead and on the road to the front is as dense as at the wharfs in New York at 11 a. m. Convoys frequently have to get off the crown of the road to allow others to pass. This alternative contact with the dirt surface and with the edge of the granite blocks causes a lateral frittering away of the rubber tire.

Heavy Tire Wear

These conditions probably explain why wheels with twin tires sometimes have the inner tire worn completely away, while the outer tire is in comparatively good condition. Trouble has also been experienced with tires stretching and coming entirely off the rim. It is difficult to explain this otherwise than by a general loosening of the whole tire when pulling out of a difficult position with wheels skidding violently.

When the tires have gone it is generally necessary to send the truck back to the repair depot for a fresh set to be fitted. More often than not mechanical repairs have to be carried out at the same time. The work of fitting new tires is entrusted to the tire manufacturers. In certain cases, where fleets of one type are employed, spare wheels are sent out, but this is not very commonly done.

During the past few weeks the difficulties of army automobile drivers have been increased by reason of the weather. To prevent the cooling water freezing denatured alcohol has been served out to the mechanical transports. Where this anti-freezer has not been available the men have had to empty radiators and jackets. The attempt to do this has revealed the fact that on some types it is almost impossible to drain off the whole of the water. Before letting the water run to waste the precaution has to be taken to see that a supply of running water will be available the next morning. Water is not the only source of trouble. During cold nights oil congeals to such an extent that it is impossible to crank the motors. A little kerosene will soon slacken off a gummed-up motor, but unfortunately kerosene is generally an unknown article at the front. It is not even required for side lamps, for night trips have to be made in complete darkness.

French Army Authorities Make Census of Touring Cars

PARIS, Dec. 22—After suspending the requisition of automobiles for a few weeks, the army authorities are now making a census of all touring cars in France with a view to ascertaining the resources of the country. This census has to be completed by January 1. Special facilities are being offered men who are not eligible for service in the army to join the automobile corps. There must be thousands of automobilists not suitable physically for a place in a line regiment, or not having been called up because the army had no present use for them, who could render excellent service in the motor brigade. Such men are being encouraged to join voluntarily. All men entering this corps must possess the government driving license and in addition have to pass a test to show that they understand various makes of vehicles.

Plans are being carried out on a large scale for the transformation of touring cars into wagonnettes capable of moving eight men and their equipment. The body is a very simple type; it is being fitted to exisiting open cars, while closed cars are retained for officers' use. The English have made similar arrangements by the importation of hundreds of motorbuses transformed into single deckers. These arrangements are evidently being carried out in anticipation of a general advance of the allied troops. As the Germans will destroy all railroads on retreating, the importance of the automobile will be greater than ever when the forward movement of the Allies is begun. The Germans, in their scheme for a high-speed trip to Paris realized to the full the value of the automobile and by its use were able to harass seriously the retreating Allies. Now that the time is almost ripe for the Allies to move forward in a mass, the automobile invasion has been prepared on an even bigger scale.

As the result of protests, the French financial department has decided to pay cash, when desired, for all requisitioned automobiles. At the outbreak of the war automobile owners were given treasury bonds redeemable after the war, while the proprietors of horses and carts could draw cash. Under the new arrangement the person whose automobile is taken over by the army can claim cash or treasury bonds bearing 5 per cent. interest.

1915 Truck Chassis More Flexible

Simplicity and Lighter Parts Also Big Features—Worm Drive Increasing—More Drives Through Springs—Unit Power Plant Popular — Four-Wheel Drive Models Are More Numerous

SIMPLICITY, greater flexibility of parts and lighter trucks are the three salient features of 1915 motor truck design.

Simplicity has been effected by the grouping of the parts in units. For example, in several cases the gearset amidships has been moved up and made a unit with the crankcase. In other cases the jackshaft and gearset have been combined.

Radius rods and torque tubes have been discarded in many cases and the drive taken directly through the springs. This has resulted not only in a reduction in parts, but has decreased the weight and increased the flexibility of the drive.

Two hundred and fifty-three makers of gasoline and electric trucks and industrial electric trucks have entered their names as makers of commercial vehicles for 1915. Thirty of these are new. On the other hand fifty-seven makers who were with us last year have dropped out.

Turning now to the changes that have been made, the most important is the rise in the use of worm drive, which carries with it many secondary effects. In fact, the introduction of worm drive generally means the complete redesigning of the truck and, therefore, it is found that the machines equipped with this type of drive embody more improvements than called for by the drive itself. Many makers have been held back from adopting this form of drive due to the fact that many changes in design are expedient at this time, but when a decision is made to use the worm-and-gear reduction invarlably changes to bring the design up-to-the-minute from hood to tailboard are also incorporated.

Shaft Drive Increasing

Due to some extent, no doubt, to the practical extinction of the chain-driven passenger car, American buyers have a strong leaning toward the shaft in all its forms. While the chain still holds the balance of power in the offerings of the manufacturers, shaft drive by worm, by bevel, by internal and by double reduction combination spur and bevel have almost caught up, and it seems only a matter of time before these forms will supersede the chain. True flexibility of frame, which is now an accredited ideal of truck designers, is impossible with chain drive as we know it, owing to the fact that the distance rods must rigidly separate the driving axle and the frame to keep the sprocket centers the correct distance apart.

Of the different forms of shaft, the worm gears lead. Axle makers are in the main responsible for this.

Flexibility is admirably attained by the adoption of worm drive in place of chain. Instead of having a jackshaft in addition to gearset and motor, all bolted more or less rigidly to a frame which must be heavy enough to carry these parts spread over it, the worm drive makers have in the main grouped the gearset, motor and clutch in one unit, and mounted this unit on a flexible three-point suspension leaving the frame free to weave and twist as required.

Flexibility has also been effected by taking the torque and propulsion through the vehicle springs instead of through radius rods and torque members. The use of the tubular drive shafts in worm-driven vehicles of long wheelbase has eliminated the extra universal and bracket which is necessary with the two-part solid shafts.

Flatter Springs

Flexibility has been further attained by the use of flatter springs and flexible frames, permitting the springs to have less throw and to be carried lower. Pressed steel frames are increasing in popularity due to the fact that the process of manufacture has been cheapened with the result that it is now possible to obtain a pressed-steel frame at about the same figure as a built-up frame from structural steel shapes. The pressed-steel frame has the advantage of lightness and strength.

To illustrate the reduction in the number of parts which has been made in a great many cases the experience of one maker is cited. By the elimination of radius rods and torque arms and driving through the springs eighty-six parts and thirteen wearing surfaces were done away with. Fifty-seven parts were rendered useless by the adoption of center control, mounting the levers on the gearbox. A reduction of fifty-nine parts and eight wearing surfaces was made by the substitution of a hollow torque tube for a solid shaft and an extra universal and supporting bracket. Eighty-six more parts and eleven wearing surfaces were cut out by the use of a unit power plant in place of a separate gearset. The total saving in parts over the same design last year, the latter being a chain, was 306. Oil holes were also reduced from about sixty to fifty.

Single ignition and fixed spark have also had their part in simplifying the chassis. Accessibility has been increased by the compact grouping of the parts that has evinced itself as the trend and by the placing of the parts most needing attention where they are most easily reached. The necessity for adjustment and lubrication has been reduced by decreasing the number of wearing surfaces, by distributing others so that group oiling is possible and to some extent by the use of self-oiling or magazine-oiled boxes.

Governors are now standard equipment, thus relieving the driver of the care of keeping the speed below a safe limit in the city and protecting the chassis from the evils of overspeeding. The standard speeds for trucks of different capacities vary from 16 miles per hour for a .5-ton truck to 5 miles per hour by a 10-ton truck.

In a cursory survey of the changes that have been made in existing lines and the new models that have appeared there are certain facts that stand out.

Worm drive has been adopted by Available, B. A. Gramm, Croce, Federal, Ideal, Independent, Modern, Moreland, Nelson & Le Moon, Old Reliable, Rowe, Service, Standard of Detroit, Velie and Sternberg. New trucks with worm drive are Ætna, Morton, Netco, Old Hickory and Signal.

Four-Wheel Drive

Four-wheel drive has been adopted by C. T., Walter, Golden West and Morton, making ten in all, these being added to the Couple-Gear, Duplex, Four-Wheel Drive, Jeffery, Nevada and Ware of last year. Front drive is used by two trucks, the A & B and the M & E.

Auglaise has changed from internal gear drive to bevel. This is a 1,500-pounds truck. Ætna is a newcomer with top worm drive. It is made in 1.5 and 2.5-ton models.

There is a decided trend to lighter vehicles. This is well illustrated by the new 600-pound Brasie. Buick, maker of a 1,500-pound chassis, has discarded the L-head motor for a valve-in-head type, which is standard Buick practice in the pleasure cars. The Mercury company has entered a new field by bringing out the Bully tractor. It is a novel design in that it is mounted on three wheels with the motor located at the back where its weight increases the traction. An ingenious toe-hitch allows thirteen cars to be pulled around a corner in the same track.

Commerce trucks have been changed by taking out the friction drive and substituting a sliding gearset and cone clutch with bevel drive in the rear axle. Chase has eliminated the two-cycle, air-cooled motor, wood frame, full elliptic springs, planetary gearset and high wheels except in one model, which is a 1,000-pound vehicle. The new models have a four-cylinder motor under the hood, and chain or worm drive. Commerce has increased the capacity to 1,500 pounds, has put in a bigger motor, cast-case radiator.

Four-Wheel Drive has added a 6-ton model, which is the largest truck of this type ever built in this country. G. M. C. has brought out a 1,500-pounder to round out its line of heavier vehicles.

The Knox company is planning to bring out a tractor mounted on four wheels instead of three. Improvements have been made in the motor and hydraulic brakes have been fitted, the advantage of these being that the strain of hand-braking a heavy tractor and set of trailers is removed from the driver.

Kisselkar is bringing out a 1,000-pound machine.

Lauth-Juergens has adopted internal gear drive, abandoning chain and the name has been changed from Lauth-Juergens to Fremont-Mais. Locomobile has recently announced two lighter models of 2 and 3 tons to go with the single-chassis 5-ton design of last year. But it has also put out a 6-ton.

Mais has added a tractor of 16,000 pounds capacity. The Old Reliable company has made a 1.5-ton to go with its line of heavier machines.

Worm Drive on Packards

Packard is building six new overhead worm-driven models from 1 to 6 tons, all with left steer and left control. On its 1,500-pound machine Republic has adopted internal gear drive instead of chain, which is standard on the others. This car is an entirely new model with motor under the hood instead.

Sanford is making a 1,500-pound car this year to sell with the 2,000 and 3,000-pound models, which are continued. Sternberg has brought out a 1,000-pound machine to go with its 2 to 7-ton line. Service has dropped friction drive in favor of a cone clutch and a sliding gearset.

Transit has added a 1-ton model, the 2-ton model of last year being continued. Velie has brought out two lighter models, a 1 and 1.5-ton.

Wagenhals has installed a sliding gearset in place of the planetary. The new gearset, transversely situated, is a special type, however, in which the driven shaft is a sleeve surrounding the drive shaft, thus bringing the sprocket close to the motor. Wilcox has added 1,000 and 2,000-pound models.

The average truck for 1915 costs $2,500, has a capacity of 4,500 pounds and is equipped with left steering and center control.

The motor is placed up front under the hood. The cylinders are cast in a block, are of the L-head type and the bore and stroke are 4 1-6 by 5 1-4 inches. The S. A. E. rating is 27.6 horsepower. Lubrication is by circulation splash oiling. Water cooling is by centrifugal pump and a cast case finned-tube radiator. A single high-tension magneto is used and the governor is driven from the motor. The speed of the car is limited to 15 7-16 miles per hour.

1915 Composite Truck

From the motor the power is transmitted through a cone clutch to a combined sliding gearset and jackshaft. Three speeds forward are usual and drive to the rear wheels is by double chain. The total ratio on high gear is 8 2-3 to 1. Radius rods are used. Semi-elliptic springs are used front and rear and tires are 35 by 4 front and 36 by 4.5 dual rear. Wheels are wood with square spokes. The wheelbase is 132 inches and the frame is pressed steel.

A more interesting study than the truck just described is the average truck as revealed by the trends of the year. Certain changes have been made, such as in the adoption of worm drive, for example, to show that there is a decided leaning in this direction and that more worm drives will be seen next year.

The composite truck which shows the trend of 1915 practice inasmuch as it is an average of the latest developments in truck design, resembles the average truck in having a motor under the hood, but its price is $2,000 instead of $2,500, and its load capacity 2 tons instead of 4,500 pounds. The motor and gearset are in unit, the motor being an L-head, block-cast type with 4 by 5.25 cylinders and an S. A. E. rating of 25.6 horsepower. Oiling is by circulating splash and cooling by a water pump of the centrifugal type in connection with a cast case, finned-tube radiator. A single high-tension magneto is standard. The maximum speed as regulated by the governor is 15 miles per hour.

The cone clutch and three-speed gearset are continued, but as already stated they are in unit, making the whole power plant very compact. Drive to the rear axle is by a tubular shaft, the advantage in the tubular construction being that it is stiffer and stronger than a solid shaft of the same weight. Torque and propulsion strains are taken through the springs. The rear axle reduction is a worm gear and pinion. Front tires are 36 by 4 inches and rear ones 36 by 7 inches, dual.

In analyzing the different trends in design probably the most important single item is the tires and it is found that the solid type lead with 87.5 per cent., pneumatic being second with 11.33 per cent. Single tires are almost universal on front wheels, being standard on 98 per cent. of the trucks, but on the rear the field is nearly evenly divided, 51.5 being single and 48.5 dual.

As regards motor location, pleasure-car practice is becoming more popular. Seventy-seven per cent. have the motors so placed, 13 per cent. have them under the floor, 5.33 between the seats, 3 per cent. under seats and the remaining 1.66 per cent. is for under-body locations.

Ninety-six per cent. of the motors have four cylinders, the two-cylinder finding favor with 3.33 per cent. of the makers and the six and the three both being popular to the extent of .33 per cent. Block casting is used in 54 per cent. of the motors, pairs find favor in 38 per cent. and single cylinders are used in only 7 per cent.

The L-head construction is common in 71 per cent. of the motor, the T-head in 17.5 per cent., side and head 7 per cent., and in head 3.5 per cent. The valve-in-head construction is not as popular as it is in pleasure cars, apparently.

Cooling in three cases out of four is by means of a centrifugal pump, the gear pump is used in 5.5 per cent. of the designs and thermo-syphon, which is so popular on pleasure cars, is found on only 17.66 per cent. of the machines.

The finned tube radiator leads with a percentage of 42, the cellular type is second with 27.25 per cent. and the square tube has a popularity rating of 22.

Single ignition is employed on 54.25 per cent. and dual on 41.25 per cent. Hand-spark advance is still employed on the majority of the cars, 59.75 per cent. being so equipped, but the fixed and automatic advance systems are gaining. Twenty-one and a quarter per cent. are fixed and automatic is found on 17.33.

Governors on Majority

Centrifugal governors are used on two machines out of every three, loose ball governors are used on 8.5 per cent. of the machines and suction governors on 7.5 per cent. Governor drive is from the motor in nine out of ten cases. No governors are fitted to 22 per cent.

Clutches are of all types, the cone being the most popular, however, with a percentage of 42.25, the dry disk is used on 28 per cent., the disk in oil on 17.75 and the dry-plate on 8 per cent.

A Directory of Truck Makers

253 Gasoline, Electric and Industrial Electric Commercial Vehicles for 1915—Names and Addresses of Builders—List of Capacities

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures do not refer to number of models*															
			Under ½	½	¾	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7 and over
A & B	American & British Mfg. Co	Providence, R. I								3				5				
A & R	Abendroth & Root Mfg. Co	Newburgh, N. Y								3		4		5				
Adams	Adams Bros. Co	Findlay, O				1	1½	2										
Admiral	Admiral Motor Car Co	St. Louis, Mich					1½											
Aetna	Aetna Motor Truck Co	Detroit, Mich					1½		2½									
American	American Motor Truck Co	Detroit, Mich				1												
American-Argo*	American Electric Car Co	Saginaw, Mich		½		1												
Armleder	O. Armleder Co	Cincinnati, O				1	1½	2										
Atlantic*	Atlantic Vehicle Co	Newark, N. J		½		1		2			3½			5				
Atterbury	Atterbury Motor Car Co	Buffalo, N. Y			¾	1		2		3				5				
Auglaize	Auglaize Motor Car Co	New Bremen, O			¾													
Autocar	Autocar Co	Ardmore, Pa					1½											
Automatic**	Automatic Transportation Co	Buffalo, N. Y				1		2										
Available	Available Truck Co	Chicago, Ill				1		2										
Avery	Avery Co	Peoria, Ill				1		2		3				5				
B. A. Gramm	Gramm-Bernstein Co	Lima, O				1		2			3½			5				
Baker*	Baker Motor Vehicle Co	Cleveland, O		½		1		2			3½			5				
Barker	C. L. Barker	Norwalk, Conn				1		2										
Bauer	Bauer Machine Works Co	Kansas City, Mo		½	¾													
Beardsley*	Beardsley Electric Co	Los Angeles, Cal		½		1												
Beaver*	Beaver State Motor Co	Portland, Ore																
Beck	Beck & Son	Cedar Rapids, Ia					1½		2½									
Bessemer	Bessemer Motor Truck Co	Grove City, Pa				1	1½	2										
Best	Durant-Dort Carriage Co	Flint, Mich		½														
Bingham	Bingham Mfg. Co	West Park, O			¾													
Blair	Blair Motor Truck Co	Newark, O						2		3		4		5				
Board	B. F. Board Motor Truck Co	Alexandria, Va																
Brasie	Brasie Motor Truck Co	Minneapolis, Minn	¼					2										
Brennan	Brennan Mfg. Co	Syracuse, N. Y																
Brockway	Brockway Motor Wagon Co	Cortland, N. Y			¾		1½	2										
Bucklen	H. E. Bucklen, Jr. Motor Truck Co	Elkhart, Ind			¾		1½		2½									
Buckwalter**	Elwell-Parker Electric Co	Cleveland, O																
Buffalo	Buffalo Auto-Truck & Motor Co	Buffalo, N. Y																
Buffalo*	Buffalo Electric Vehicle Co	Buffalo, N. Y				1												
Buick	Buick Motor Co	Flint, Mich			¾													
Bulley Tractor	Mercury Mfg. Co	Chicago, Ill																T.
Caldwell	Empire Axle Co	Dunkirk, N. Y.																
Capitol*	Capitol Truck Mfg. Co	Denver, Col																
Carl*	Carl Electric Vehicle Co	Toledo, O																
Carlton	Carlton-Hill Motor Car Co	Rutherford, N. J																
Carroll	Carroll Motor Car Co	Strasburg, Pa																
Casey	F. A. Casey Co	Billerica, Mass		½														
Chase	Chase Motor Truck Co	Syracuse, N. Y			¾		1½			3								
Coleman	Coleman Carriage & Hardware Co	Ilion, N. Y				1		2		3								
Commerce	Commerce Motor Truck Co	Detroit, Mich			¾													
Connersville*	Connersville Buggy Co	Connersville, Ind																
Continental	Continental Truck Mfg. Co	Superior, Wis					1½			3								
Corbitt	Corbitt Auto Co	Henderson, N. C					1½											
Couple-Gear	Couple-Gear Freight Wheel Co	Grand Rapids, Mich									3½			5				
Couple-Gear*	Couple-Gear Freight Wheel Co	Grand Rapids, Mich									3½			5				
Cowan Transveyor**	Cowan Truck Co	Holyoke, Mass						2										
Crawford	Crawford Automobile Co	Hagerstown, Md								3								
Crescent	Crescent Motor Truck Co	Middletown, O								3				5				
Croce	Croce Auto Co	Asbury Park, N. J			¾			2										
Crown	Crown Commercial Car Co	North Milwaukee, Wis			¾		1½		2½									
C. T	Commercial Truck Co. of America	Philadelphia, Pa												5				
C. T.*	Commercial Truck Co. of America	Philadelphia, Pa		½		1		2			3½			5				
Curtis	Pittsburgh Machine Tool Co	Braddock, Pa						2		3								
Daimler, American	General Vehicle Co	Long Island City, N. Y														6		
Dain	Dain Mfg. Co	Ottumwa, Ia				1												
Dart	Dart Motor Truck Co	Waterloo, Ia		½		1		2										
Dayton	Durable Dayton Truck Co	Dayton, O				1						4						
Dayton*	Dayton Electric Car. Co	Dayton, O																
Decatur	Parcel Post Equipment Co	Grand Rapids, Mich	¼			1												
DeKalb	DeKalb Wagon Works	DeKalb, Ill					1½		2½									
Denby	Denby Motor Truck Co	Detroit, Mich			¾	1												
Detroit*	Anderson Electric Car Co	Detroit, Mich						2										
Diamond-T	Diamond-T Motor Car Co	Chicago, Ill			¾		1½			3								
Dispatch	Dispatch Motor Car Co	Minneapolis, Minn		½														
Doane	Doane Motor Truck Co	San Francisco, Cal														6		
Dorris	Dorris Motor Car Co	St. Louis, Mo			¾			2										
Duffy	Duffy Bros. Motor Truck Co	San Francisco, Cal																
Dunlap*	Dunlap Electric Co	Columbus, O		½														
Duplex	Duplex Power Car Co	Charlotte, Mich						2		3								
Durocar	Amalgamated Motors Corp	Alhambra, Cal		½														
Duryea	Duryea Laboratories	Philadelphia, Pa		½														
Dynamic**	Cleveland-Galion Motor Truck Co	Galion, O																
Eastern	Eastern Power Truck Co	Providence, R. I																
Edison*	Edison Electric Vehicle Co	Lawrence, Mass																
Electromobile**	Electromobile Co	St. Louis, Mo				1	1½											
Elwell-Parker**	Elwell-Parker Electric Co	Cleveland, O						2										

*Electric. **Electric industrial (indoor). †Steam.

253 Vehicles, Their Makers and Capacities

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures do not refer to number of models*															
			Under ½	½	¾	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7 and over
Erie	Erie Motor Truck Mfg. Co	Erie, Pa																
Evans	Evans Motor Car & Parts Mfg. Co	Travers City, Mich																
Fargo	Fargo Motor Car Co	Chicago, Ill			¾	1												
Fawick	Fawick Motor Car Co	Sioux Falls, S. D.		½	¾	1		2										
Federal	Federal Motor Truck Co	Detroit, Mich					1½											
Field*	Field Omnibus Co	New York City																
Flint	Durant-Dort Carriage Co	Flint, Mich				1												
Forschler	Phillip Forschler Wagon Co	New Orleans, La					1½											
Four Wheel Drive	Four Wheel Drive Auto Co	Clintonville, Wis.						2		3						6		
Franklin	Franklin Commercial Truck Co	Franklin, Pa																
Fremont-Mais	Lauth-Juergens Motor Car Co	Fremont, O						2										
Fritchle*	Fritchle Automobile & Battery Co	Denver, Col																
Fuller	Fuller Power Truck Co	Delphos, O																
Gabriel	Gabriel Auto Co	Cleveland, O		½	¾		1½											
Garford	Willys-Overland Co	Toledo, O.						2		3		4		5		6		
G. A. Schacht	G. A. Schacht Motor Truck Co	Cincinnati, O.						2		3								
Gay	S. G. Gay Co	Ottawa, Ill				1												
Geneva	Geneva Wagon Co	Geneva, N. Y.			¾													
GMC	General Motors Truck Co	Pontiac, Mich					1½	2			3½			5				
GMC*	General Motors Truck Co	Pontiac, Mich		½		1	1½	2		3		4		5		6		
Golden West	Golden West Motors Co	Sacramento, Cal																
Gramm	Gramm Motor Truck Co	Walkerville, Ont					1½	2			3½			5				
Great Eagle	United States Carriage Co	Columbus, O																
Great Southern	Great Southern Auto Co	Birmingham, Ala																
G.V.*	General Vehicle Co	Long Island City, N. Y		½		1		2			3½			5				
G.V.**	General Vehicle Co	Long Island City, N. Y						2										
Hahn	Hahn Motor Truck Co	Hamburg, Pa																
Handy Wagon	Auburn Motor Chassis Co	Auburn, Ind	¼	½	¾													
Harrison	Robert Harrison Co	South Boston, Mass																
Harvey	Harvey Motor Truck Works	Harvey, Ill					1½			3								
Hercules	Hercules Motor Truck Co	South Boston, Mass																
Hoagland-Thayer**	Hoagland-Thayer, Inc	Newark, N. J						2						5T				
Homer	Homer Motors Co	Los Angeles Cal		½														
Horner	Detroit-Wyandotte Motor Co	Wyandotte, Mich				1	1½	2		3				5				
Hunt**	J. W. Hunt Co	West New Brighton, N. Y						2										
Hupmobile	Hupp Motor Car Co	Detroit, Mich	¼															
Hurlburt	Hurlburt Motor Truck Co	New York City				1		2			3½							
Ideal	Ideal Auto Co	Fort Wayne, Ind				1	1½		2½									
IHC	International Harvester Corp	Akron, O		½														
Independent	Independent Motors Corp	Port Huron, Mich			¾		1½											
Indiana	Harwood-Barley Co	Marion, Ind					1½			3				5				
Imp	W. H. McIntyre Co	Auburn, Ind	¼															
Jeffery	Thomas B. Jeffery Co	Kenosha, Wis			¾		1½	2										
Juno	Juno Motor Truck Co	Juneau, Wis																
Kalamazoo	Kalamazoo Motor Truck Co	Kalamazoo, Mich					1½											
Kanawha	Kanawha Auto Truck Co	Charleston, W. Va																
Kearns	Kearns Motor Car Co	Beavertown, Pa		½														
Kelly	Kelly-Springfield Motor Truck Co	Springfield, O				1		2			3½			5				
King	A. R. King Mfg. Co	Kingston, N. Y.									3½							
Kisselkar	Kissel Motor Car Co	Hartford, Wis			¾	1	1½		2½		3½					6		
Kleiber	Kleiber Co., Inc	San Francisco, Cal					1½		2½		3½			5				
Knox Tractor	Knox Motors Co	Springfield, Mass														6T		10T
Koehler	H. J. Koehler S. G. Co	Newark, N. J				1												
Kopp	Kopp Motor Truck Co	Buffalo, N. Y					1½			3				5				
Kosmath	Kosmath Co	Detroit, Mich		½														
Krebs	Krebs Commercial Car Co	Clyde, O.				1		2										
LaFrance	American LaFrance Fire Engine Co	Elmira, N. Y												5				
Lambert	Buckeye Mfg. Co	Anderson, Ind	¼		¾	1	1½	2										
Lange	Lange Motor Truck Co	Pittsburgh, Pa					1½		2½									
Lansden*	Lansden Co., Ltd	Brooklyn, N. Y.																
Lauth-Juergens	Lauth-Juergens Motor Car Co	Fremont, O				1		2		3				5				
Lewis	Lewis Motor Truck Co	San Francisco, Cal							2½	3				5				
Lippard-Stewart	Lippard-Stewart Motor Car Co	Buffalo, N. Y			¾	1	1½	2										
Little Giant	Chicago Pneumatic Tool Co	Chicago, Ill				1												
Locomobile	Locomobile Co. of America	Bridgeport, Conn								3		4		5		6		
Lord Baltimore	Lord Baltimore Motor Car Co	Baltimore, Md				1		2										
Maccar	Maccar Co	Scranton, Pa				1	1½	2										
Mack	International Motor Co	New York City				1								5		6		
M & E	Merchant & Evans	Philadelphia, Pa									3½			5				
Mais	Mais Motor Truck Co	Indianapolis, Ind					1½	2	2½	3								8T
Mansur	Mansur Motor Truck Co	Haverhill, Mass																
Marmon	Nordyke & Marmon	Indianapolis, Ind			¾													
Martin	Martin Carriage Works	York, Pa				1	1½		2½		3½							
McIntyre	W. H. McIntyre Co	Auburn, Ind			¾		1½			3								
Menominee	D. F. Poyer & Co	Menominee, Mich			¾	1	1½											
Mercury	Mercury Mfg. Co	Chicago, Ill		½														
Mercury Pullem Tractor**	Mercury Mfg. Co	Chicago, Ill																T.
Milburn*	Milburn Wagon Co	Toledo, O																
Modern	Bowling Green Motor Truck Co	Bowling Green, O				1	1½											
Mogul	Mogul Motor Truck Co	St. Louis, Mo						2				4				6		
Monitor	Monitor Automobile Works	Janesville, Wis		½		1												
Moon	Joseph W. Moon Buggy Co	St. Louis, Mo					1½											
Moore	Pacific Metal Products Co	Torrance, Cal					1½	2		3		4		5				
Moore	Moore Motor Truck Co	Philadelphia, Pa																
Moreland	Moreland Motor Truck Co	Los Angeles, Cal			¾		1½		2½		3½			5			6½	
Morton	Morton Truck & Tractor Co., Inc	Harrisburg, Pa					1½	2	2½	3	3½			5		6		10T
Motokart	Motokart Co	Scranton, Pa	¼															

*Electric. **Electric industrial (indoor). †Steam.

A Directory of Truck Makers

253 Gasoline, Electric and Industrial Electric Commercial Vehicles for 1915—Names and Addresses of Builders—List of Capacities

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures do not refer to number of models*															
			Under ½	½	¾	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7 and over
A & B	American & British Mfg. Co	Providence, R. I								2				5				
A & R	Abendroth & Root Mfg. Co	Newburgh, N. Y.								3		4		5				
Adams	Adams Bros. Co	Findlay, O				1	1½	2										
Admiral	Admiral Motor Car Co	St. Louis, Mich					1½											
Aetna	Aetna Motor Truck Co	Detroit, Mich					1½		2½									
American	American Motor Truck Co	Detroit, Mich				1												
American-Argo*	American Electric Car Co	Saginaw, Mich		½		1												
Armleder	O. Armleder Co	Cincinnati, O				1	1½	2										
Atlantic*	Atlantic Vehicle Co	Newark, N. J		½		1		2			3½			5				
Atterbury	Atterbury Motor Car Co	Buffalo, N. Y			¾	1		2		3				5				
Auglaize	Auglaize Motor Car Co	New Bremen, O			¾													
Autocar	Autocar Co	Ardmore, Pa					1½											
Automatic**	Automatic Transportation Co	Buffalo, N. Y				1		2										
Available	Available Truck Co	Chicago, Ill				1		2										
Avery	Avery Co	Peoria, Ill				1		2		3				5				
B. A. Gramm	Gramm-Bernstein Co	Lima, O				1		2			3½			5				
Baker*	Baker Motor Vehicle Co	Cleveland, O		½		1		2			3½			5				
Barker	C. L. Barker	Norwalk, Conn				1		2										
Bauer	Bauer Machine Works Co	Kansas City, Mo		½	¾													
Beardsley*	Beardsley Electric Co	Los Angeles, Cal		½		1												
Beaver*	Beaver State Motor Co	Portland, Ore																
Beck	Beck & Son	Cedar Rapids, Ia					1½		2½									
Bessemer	Bessemer Motor Truck Co	Grove City, Pa				1	1½	2										
Best	Durant-Dort Carriage Co	Flint, Mich		½														
Bingham	Bingham Mfg. Co	West Park, O			¾													
Blair	Blair Motor Truck Co	Newark, O						2		3		4		5				
Board	B. F. Board Motor Truck Co	Alexandria, Va																
Brasie	Brasie Motor Truck Co	Minneapolis, Minn	¼					2										
Brennan	Brennan Mfg. Co	Syracuse, N. Y																
Brockway	Brockway Motor Wagon Co	Cortland, N. Y			¾		1½	2										
Bucklen	H. E. Bucklen, Jr. Motor Truck Co	Elkhart, Ind			¾		1½		2½									
Buckwalter**	Elwell-Parker Electric Co	Cleveland, O																
Buffalo	Buffalo Auto-Truck & Motor Co	Buffalo, N. Y																
Buffalo*	Buffalo Electric Vehicle Co	Buffalo, N. Y				1												
Buick	Buick Motor Co	Flint, Mich			¾													
Bulley Tractor	Mercury Mfg. Co	Chicago, Ill																T.
Caldwell	Empire Axle Co	Dunkirk, N. Y																
Capitol*	Capitol Truck Mfg. Co	Denver, Col																
Carl*	Carl Electric Vehicle Co	Toledo, O																
Carlton	Carlton-Hill Motor Car Co	Rutherford, N. J																
Carroll	Carroll Motor Car Co	Strasburg, Pa																
Casey	F. A. Casey Co	Billerica, Mass		½														
Chase	Chase Motor Truck Co	Syracuse, N. Y			¾		1½			3								
Coleman	Coleman Carriage & Hardware Co	Ilion, N. Y				1		2		2								
Commerce	Commerce Motor Truck Co	Detroit, Mich			¾													
Connersville*	Connersville Buggy Co	Connersville, Ind																
Continental	Continental Truck Mfg. Co	Superior, Wis					1½			3								
Corbitt	Corbitt Auto Co	Henderson, N. C					1½											
Couple-Gear	Couple-Gear Freight Wheel Co	Grand Rapids, Mich									3½			5				
Couple-Gear*	Couple-Gear Freight Wheel Co	Grand Rapids, Mich									3½			5				
Cowan Transveyor**	Cowan Truck Co	Holyoke, Mass						2										
Crawford	Crawford Automobile Co	Hagerstown, Md								3								
Crescent	Crescent Motor Truck Co	Middletown, O								3				5				
Croce	Croce Auto Co	Asbury Park, N. J			¾			2										
Crown	Crown Commercial Car Co	North Milwaukee, Wis			¾		1½		2½									
C. T	Commercial Truck Co. of America	Philadelphia, Pa												5				
C. T.*	Commercial Truck Co. of America	Philadelphia, Pa		½		1		2			3½			5				
Curtis	Pittsburgh Machine Tool Co	Braddock, Pa						2		3								
Daimler, American	General Vehicle Co	Long Island City, N. Y														6		
Dain	Dain Mfg. Co	Ottumwa, Ia				1												
Dart	Dart Motor Truck Co	Waterloo, Ia		½		1		2										
Dayton	Durable Dayton Truck Co	Dayton, O				1						4						
Dayton*	Dayton Electric Car. Co	Dayton, O																
Decatur	Parcel Post Equipment Co	Grand Rapids, Mich	¼			1												
DeKalb	DeKalb Wagon Works	DeKalb, Ill					1½		2½									
Denby	Denby Motor Truck Co	Detroit, Mich			¾	1												
Detroit*	Anderson Electric Car Co	Detroit, Mich						2										
Diamond-T	Diamond-T Motor Car Co	Chicago, Ill			¾		1½			3								
Dispatch	Dispatch Motor Car Co	Minneapolis, Minn		½														
Doane	Doane Motor Truck Co	San Francisco, Cal														6		
Dorris	Dorris Motor Car Co	St. Louis, Mo			¾			2										
Duffy	Duffy Bros. Motor Truck Co	San Francisco, Cal																
Dunlap*	Dunlap Electric Co	Columbus, O		½														
Duplex	Duplex Power Car Co	Charlotte, Mich						2		2								
Durocar	Amalgamated Motors Corp	Alhambra, Cal		½														
Duryea	Duryea Laboratories	Philadelphia, Pa		½														
Dynamic**	Cleveland-Galion Motor Truck Co	Galion, O																
Eastern	Eastern Power Truck Co	Providence, R. I																
Edison*	Edison Electric Vehicle Co	Lawrence, Mass																
Electromobile**	Electromobile Co	St. Louis, Mo				1	1½											
Elwell-Parker**	Elwell-Parker Electric Co	Cleveland, O						2										

*Electric. **Electric industrial (indoor). †Steam.

253 Vehicles, Their Makers and Capacities

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures do not refer to number of models*															
			Under ½	½	¾	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7 and over
Erie	Erie Motor Truck Mfg. Co	Erie, Pa																
Evans	Evans Motor Car & Parts Mfg. Co	Travers City, Mich																
Fargo	Fargo Motor Car Co	Chicago, Ill			¾	1												
Fawick	Fawick Motor Car Co	Sioux Falls, S. D.		½	¾	1		2										
Federal	Federal Motor Truck Co	Detroit, Mich					1½											
Field*	Field Omnibus Co	New York City																
Flint	Durant-Dort Carriage Co	Flint, Mich				1												
Forschler	Phillip Forschler Wagon Co	New Orleans, La					1½											
Four Wheel Drive	Four Wheel Drive Auto Co	Clintonville, Wis						2		3						6		
Franklin	Franklin Commercial Truck Co	Franklin, Pa																
Fremont-Mais	Lauth-Juergens Motor Car Co	Fremont, O						2										
Fritchie*	Fritchie Automobile & Battery Co	Denver, Col																
Fuller	Fuller Power Truck Co	Delphos, O																
Gabriel	Gabriel Auto Co	Cleveland, O		½	¾		1½											
Garford	Willys-Overland Co	Toledo, O,						2		3		4		5		6		
G. A. Schacht	G. A. Schacht Motor Truck Co	Cincinnati, O						2		3								
Gay	S. G. Gay Co	Ottawa, Ill			¾	1												
Geneva	Geneva Wagon Co	Geneva, N. Y																
GMC	General Motors Truck Co.	Pontiac, Mich					1½	2			3½			5				
GMC*	General Motors Truck Co.	Pontiac, Mich		½		1	1½	2		3		4		5		6		
Golden West	Golden West Motors Co	Sacramento, Cal																
Gramm	Gramm Motor Truck Co	Walkerville, Ont					1½	2			3½			5				
Great Eagle	United States Carriage Co	Columbus, O																
Great Southern	Great Southern Auto Co	Birmingham, Ala																
G.V.*	General Vehicle Co	Long Island City, N. Y		½		1		2			3½			5				
G.V.**	General Vehicle Co	Long Island City, N. Y						2										
Hahn	Hahn Motor Truck Co	Hamburg, Pa																
Handy Wagon	Auburn Motor Chassis Co	Auburn, Ind	½	½	¾													
Harrison	Robert Harrison Co	South Boston, Mass																
Harvey	Harvey Motor Truck Works	Harvey, Ill					1½			3								
Hercules	Hercules Motor Truck Co	South Boston, Mass																
Hoagland-Thayer**	Hoagland-Thayer, Inc	Newark, N. J						2						5T				
Homer	Homer Motors Co	Los Angeles, Cal		½														
Horner	Detroit-Wyandotte Motor Co	Wyandotte, Mich			¾	1	1½	2		3				5				
Hunt**	C. W. Hunt Co	West New Brighton, N. Y						2										
Hupmobile	Hupp Motor Car Co	Detroit, Mich	½															
Hurlburt	Hurlburt Motor Truck Co	New York City				1		2			3½							
Ideal	Ideal Auto Co	Fort Wayne, Ind				1	1½		2½									
IHC	International Harvester Corp	Akron, O		½														
Independent	Independent Motors Corp	Port Huron, Mich			¾		1½											
Indiana	Harwood-Barley Co	Marion, Ind					1½			3				5				
Imp	W. H. McIntyre Co	Auburn, Ind	½															
Jeffery	Thomas B. Jeffery Co	Kenosha, Wis			¾		1½	2										
Juno	Juno Motor Truck Co	Juneau, Wis																
Kalamazoo	Kalamazoo Motor Truck Co	Kalamazoo, Mich					1½											
Kanawha	Kanawha Auto Truck Co	Charleston, W. Va																
Kearns	Kearns Motor Car Co	Beavertown, Pa		½														
Kelly	Kelly-Springfield Motor Truck Co	Springfield, O				1		3			3½			5				
King	A. R. King Mfg. Co	Kingston, N. Y									3½							
KisselKar	Kissel Motor Car Co	Hartford, Wis			¾	1	1½		2½		3½					6		
Kleiber	Kleiber Co., Inc	San Francisco, Cal					1½		2½		3½			5				
Knox Tractor	Knox Motors Co	Springfield, Mass														6T		10T
Koehler	H. J. Koehler S. G. Co	Newark, N. J				1												
Kopp	Kopp Motor Truck Co	Buffalo, N. Y					1½			3				5				
Kosmath	Kosmath Co	Detroit, Mich		½														
Krebs	Krebs Commercial Car Co	Clyde, O				1		2										
LaFrance	American LaFrance Fire Engine Co	Elmira, N. Y												5				
Lambert	Buckeye Mfg. Co	Anderson, Ind	½		¾	1	1½	2										
Lange	Lange Motor Truck Co	Pittsburgh, Pa					1½		2½									
Lansden*	Lansden Co., Ltd	Brooklyn, N. Y																
Lauth-Juergens	Lauth-Juergens Motor Car Co	Fremont, O				1		2		3				5				
Lewis	Lewis Motor Truck Co	San Francisco, Cal							2½	3				5				
Lippard-Stewart	Lippard-Stewart Motor Car Co	Buffalo, N. Y			¾	1	1½	2										
Little Giant	Chicago Pneumatic Tool Co	Chicago, Ill				1												
Locomobile	Locomobile Co. of America	Bridgeport, Conn								3		4		5		6		
Lord Baltimore	Lord Baltimore Motor Car Co	Baltimore, Md				1		2										
Maccar	Maccar Co	Scranton, Pa				1	1½	2										
Mack	International Motor Co	New York City				1								5		6		
M & E	Merchant & Evans	Philadelphia, Pa									3½			5				
Mais	Mais Motor Truck Co	Indianapolis, Ind					1½	2	2½	3								8T
Mansur	Mansur Motor Truck Co	Haverhill, Mass																
Marmon	Nordyke & Marmon	Indianapolis, Ind.			¾													
Martin	Martin Carriage Works	York, Pa				1	1½		2½		3½							
McIntyre	W. H. McIntyre Co	Auburn, Ind			¾		1½			3								
Menominee	D. F. Poyer & Co	Menominee, Mich			¾	1	1½											
Mercury	Mercury Mfg. Co	Chicago, Ill.		½														
Mercury Pullman Tractor**	Mercury Mfg. Co	Chicago, Ill.																T.
Milburn*	Milburn Wagon Co	Toledo, O																
Modern	Bowling Green Motor Truck Co	Bowling Green, O				1	1½											
Mogul	Mogul Motor Truck Co	St. Louis, Mo						2				4				6		
Monitor	Monitor Automobile Works	Janesville, Wis		½		1												
Moon	Joseph W. Moon Buggy Co	St. Louis, Mo					1½											
Moore	Pacific Metal Products Co.	Torrance, Cal					1½	2		3		4		5				
Moore	Moore Motor Truck Co	Philadelphia, Pa																
Moreland	Moreland Motor Truck Co	Los Angeles, Cal			¾		1½		2½		3½			5			6½	
Morton	Morton Truck & Tractor Co., Inc	Harrisburg, Pa					1½	2	2½	3	3½			5		6		10T
Motokart	Motokart Co	Scranton, Pa	½															

*Electric. **Electric industrial (indoor). †Steam.

253 Vehicles, Their Makers and Capacities

Name	Manufacturer	Address	MODELS IN TONS CAPACITY *Figures do not refer to number of models*															
			Under ½	½	¾	1	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7 and over
Natco	National Motor Truck Co	Bay City, Mich				1												
Nelson & LeMoon	Nelson & LeMoon	Chicago, Ill				1	1½	2										
Netco	New England Truck Co	Fitchburg, Mass					1½											
Nevada	Nevada Mfg. Co	Nevada, Ia								3								
New York	Tegetmeier & Riepe Co	New York City					1½											
O.K	O. K. Motor Truck Co	Detroit, Mich					1½											
Old Hickory	Kentucky Wagon Mfg. Co	Louisville, Ky					1½											
Old Hickory*	Kentucky Wagon Mfg. Co	Louisville, Ky				1												
Old Reliable	Old Reliable Motor Truck Co	Chicago, Ill					1½	2		3		4		5				7
Overland	Willys-Overland Co	Toledo, O	⅜															
Owosso	Owosso Motor Car Co	Owosso, Mich																
Packard	Packard Motor Car Co	Detroit, Mich						2		3		4		5		6		
Palmer	Palmer-Meyer Motor Car Co	St. Louis, Mo				1	1½											
Palmer-Moore	Palmer-Moore Co	Syracuse, N. Y				1												
Paulding	St. Louis Motor Truck Co	St. Louis, Mo	¼		¾	1		2										
Peerless	Peerless Motor Car Co	Cleveland, O								3		4		5		6		
Perfex	Perfex Co	Los Angeles, Cal		½														
Phoenix	Phoenix Auto Works	Phoenixville, Pa																
Pierce-Arrow	Pierce-Arrow Motor Car Co	Buffalo, N. Y						2						5				
Plymouth	Plymouth Motor Truck Co	Plymouth, O				1		2										
Power	Power Vehicle Co	Milwaukee, Wis																
Purity*	Purity Bread Co	St. Paul, Minn																
Reedsburg	Reedsburg Motor Truck Co	Reedsburg, Wis																
Reo	Reo Motor Truck Co	Lansing, Mich						2										
Republic	Republic Motor Truck Co	Alma, Mich			¾	1	1½											
Rockford	Rockford Motor Truck Co	Rockford, Ill																
Roland	Roland Gas Electric Vehicle Corp	New York City				1				3	3½							
Rowe	Rowe Motor Co	Downingtown, Pa					1½	2		3				5				
Royal	Royal Motor Truck Co	New York City									3½			5				
Safety-First	Safety-First Motor Car & Truck Co	Kalamazoo, Mich																
Sandow	Sandow Truck Co	Chicago, Ill					1½	2		3								
Sanford	Sanford Motor Truck Co	Syracuse, N. Y			¾		1½	2										
Saxon	Saxon Motor Co	Detroit, Mich	¼															
Schleicher	Schleicher Motor Vehicle Co	New York City						2		3				5				
Selden	Selden Motor Car Co	Rochester, N. Y					1½											
Service	Service Motor Truck Co	Wabash, Ind				1	1½	2		3				5				
Siebert	Siebert Motor Truck Co	Toledo, O			¾													
Signal	Signal Motor Truck Co	Detroit, Mich				1												
Smith-Milwaukee	A. O. Smith Co	Milwaukee, Wis									3½					6		
South Bend	South Bend Motor Car Works	South Bend, Ind						2				4						
Speedwell	Speedwell Motor Car Co	Dayton, O						2				4				6		
Standard of Detroit	Standard Motor Truck Co	Detroit, Mich								3								7
Standard of Ohio	Standard Motor Truck Co	Warren, O			¾	1	1½	2			3½							
Stanley†	Stanley Motor Carriage Co	Newton, Mass			¾		1½											
Stegeman	Stegeman Motor Car Co	Milwaukee, Wis			¾		1½		2½		3½			5				
Sternberg	Sternberg Motor Truck Co	Milwaukee, Wis		½				2		3				5		6		7
Stewart	Stewart Iron Works	Covington, Ky				1												
Stewart	Stewart Motor Corp	Buffalo, N. Y			¾													
Storms*	Storms Electric Car Co	Detroit, Mich	¼															
Studebaker	Studebaker Corp	Detroit, Mich			¾													
Sullivan	Sullivan Motor Car Co	Rochester, N. Y					1½											
Tiffin	Tiffin Wagon Co	Tiffin, O			¾	1		2										
Toeppner	Toeppner Bros	Bay City, Mich																
Toledo	Toledo Motor Truck Co	Toledo, O																
Trabold	Trabold Motor Mfg. Co	Johnstown, Pa				1		2		3								
Transit	Transit Motor Car Co	Louisville, Ky				1		2			3½			5				
Trumbull	Trumbull Motor Car Co	Bridgeport, Conn	¼															
Tulsa	Tulsa Automobile & Mfg. Co	Tulsa, Okla			¾	1	1½											
Tuttle	Tuttle Motor Co	Canastota, N. Y																
United States	United States Motor Truck Co	Covington, Ky						2	2½	3		4						
Universal	Universal Motor Truck Co	Detroit, Mich					1½			3								
Urban*	Kentucky Wagon Mfg. Co	Louisville, Ky			¾		1½		2½			4						
Van Winkle	Van Winkle Motor Truck Co	Atlanta, Ga																
Velie	Velie Motor Vehicle Co	Moline, Ill				1	1½		2½			4		5				
Vim	Touraine Co	Philadelphia, Pa		½														
Voltacar*	Cyco-Electric Car Co	New York City	¼															
Vulcan	Driggs-Seabury Ordnance Corp.	Sharon, Pa							2½		3½		4½		5½			7½
Wagenhals	Wagenhals Motor Car Co	Detroit, Mich	⅜															
Wagenhals*	Wagenhals Motor Car Co	Detroit, Mich	¼															
Walker*	Walker Vehicle Co	Chicago, Ill		½		1		2	2½		3½							
Walter	Walter Motor Truck Co	New York City												5		6	7½	12T
Ward*	Ward Motor Vehicle Co	Mount Vernon, N. Y	1	½		1		2			3½			5				
Ware	Ware Motor Vehicle Co	St. Paul, Minn								3								
Washington	Washington Motor Car Co	Hyattsville, Md												5		6		7
Waverley*	Waverley Co	Indianapolis, Ind	¼	½		1		2			3½			5				
West Coast	West Coast Wagon Co	Tacoma, Wash																
White	White Co	Cleveland, O			¾		1½			3				5				
Whitwood	Whitwood Corp	Weedsport, N. Y																
Wichita	Wichita Falls Motor Co	Wichita Falls, Texas				1		2			3½							
Wilcox	H. E. Wilcox Motor Car Co	Minneapolis, Minn		½		1		2		3								
Willet	Willet Engine & Carbureter Co	Buffalo, N. Y			¾			2		3								
Willys	Willys-Overland Co	Toledo, O			¾													
Wilson	J. C. Wilson & Co	Detroit, Mich						2										
Witt-Will	Witt-Will Co	Washington, D. C				1		2				4						
Zimmerman	Zimmerman Mfg. Co	Auburn, Ind		½														

*Electric. **Electric industrial (indoor). †Steam.

Price Classification of 1915 Trucks

Features of the Chassis, Classified According to Capacity

TRUCKS UNDER ½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Brasie, Packet	600	$375	100	Pneu.	10.00	Fric.	Dbl chn	Price
Decatur, VI	800	630	102	Pneu.	12.08	Selec.	Sing chn	Rear spring
Handy Wagon, Jr.	500	390	65	Solid	11.25	Plan.	Dbl chn	Convertible
Handy Wagon	800	487.50	77	Solid	13.60	Plan.	Dbl chn.	Convertible
Hupmobile, HT	800	850	108	Pneu.	16.92	Selec.	Bevel	Low floor
Lambert, VI	800	900	106	Pneu.	22.50	Fric.	Sing chn	Friction drive
Metokart, 1&2	500	365	60	Pneu.	10.53	Fric.	Sing chn	Price
Overland, 81	800	850-c*	106	Pneu.	25.60	Selec.	Bevel	Standard car
Paulding, O	800	650	95	Pneu.	12.08	Selec.	Bevel	Standard car
Saxon, A2	400	395-c	96	Pneu.	11.23	Prog.	Bevel	Price
Trumbull, 15D	500	395-c	80	Pneu.	13.37	Selec.	Bevel	Price
Wagenhals	800	600-c	80	P&C	19.61	Plan.	Sing chn	3-wheeler

TRUCKS OF ½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Bauer, A	1,000	$900	100	Solid	22.50	Selec.	Dbl-red.	Double-red. drive
Best, A	1,200	750	78	Solid*.	16.20	Fric.	Dbl chn	Friction drive
Chase, S	1,000	750	98	Solid.	2-cyc.	Plan.	Dbl chn	2-cycle motor
Dart, A	1,000	845	100	Pneu.	34.28	Selec.	Bevel	Standard car
Gabriel, K	1,000	1,200	112	Pneu.	19.61	Selec.	Bevel	Standard car
Handy Wagon, Sr.	1,200	600	86	Solid.	18.10	Plan.	Dbl chn.	Convertible
IHC, M	1,000	. .	90	Solid.	16.20	Ind-c.	Dbl chn	High wheels
Kosmath, 14	1,000	850	110	Pneu.	19.61	Selec.	Bevel	Standard car
Mercury, P	1,000	. .	84	Solid.	14.50	Plan.	Dbl chn.	Air cooled
O.K., C&D	1,200	675	112	Pneu.	19.61	Selec.	Bevel	Standard car
Sternberg	1,000	850-c	88	Pneu.	12.08	Selec.	Worm	Worm drive
Vim, L&S	1,000	620	94	Pneu.	12.40	Selec.	Bevel	Price
Wilcox, T	1,000	1,000	115	Pneu.	19.61	Selec.	Bevel	Standard car

TRUCKS OF ¾-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Atterbury, AW	1,500	$1,800	118	Pneu.	19.61	Selec.	Worm	Worm drive
Anglaine, H	1,500	950	100	Solid	22.10	Selec.	Bevel	Governor
Anglaine, D	1,500	950	100	Solid	22.50	Selec.	Bevel	Governor
Bauer, B	1,500	1,150	110	Solid	22.50	Selec.	Dbl-red.	Double red. drive
Brockway, G	1,500	1,205	103	Solid	19.61	Selec.	Dbl chn.	Wood frame
Buick, C4	1,500	1,150	120	Pneu.	22.50	Selec.	Bevel	Valves in head
Chase, T	1,500	1,500	135	Solid	19.61	Selec.	Worm	Worm drive
Commerce, S	1,500	875	107	Pneu.	19.61	Selec.	Bevel	Cast radiator
Crown, A	1,500	2,000	120	Pneu.	22.50	Selec.	Worm	Worm drive
Denby, A	1,500	1,500	120	Solid	19.61	Selec.	Int-g.	Int-gear drive
Dorris, 1A4	1,500	1,950	132*	Pneu.	30.65	Selec.	Bevel	Valves in head
Fargo, E	1,500	750	100	Solid.	16.20	Fric.	Bevel	Price
Gabriel, H	1,500	1,600	126	Pneu.	22.50	Selec.	Bevel	Standard car
Geneva, B	1,500	700	96	Solid	21.10	Plan.	Dbl chn	Price
GMC, 15	1,500	1,090	122	Pneu.	19.61	Selec.	Bevel	Standard car
Independent, F	1,500	1,285	112*	Solid	19.61	Selec.	Worm	Worm drive
Jeffery, 1515	1,500	1,300	118	Pneu.	22.50	Selec.	Bevel	Standard car
Kisselkar, 1500	1,500	1,500	125	Pneu.	29.00	Selec.	Bevel	Standard car
Lambert, V2	1,500	1,125	114	Pneu*.	22.50	Fric.	Dbl chn	Friction drive
Lippard-Stew., B*	1,500	1,650	115*	Pneu.	22.50	Selec.	Bevel	French hood
Lippard-Stew., BW*	1,500	1,775	115*	Pneu.	22.50	Selec.	Worm	Worm drive
McIntyre, E	1,500	.....	120	Solid.	22.50	Selec.	Dbl chn.	Standard car
Menominee, A3	1,500	1,125	112	Solid.	22.50	Selec.	Bevel	Standard car
Moreland, 7X	1,500	1,800	126	Solid*.	22.50	Selec.	Worm	Distillate fuel
Paulding, H	1,500	950	120	Solid.	19.61	Selec.	Dbl chn	Standard car

TRUCKS OF ¾-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Republic, 1500	1,500	.....	124	Solid*	19.61	Selec.	Int-g.	Int-gear drive
Sanford, O	1,500	1,290	120	Solid*	19.61	Selec.	Int-g.	Int-gear drive
Standard-O, DX	1,500	1,700	....	Pneu.	25.60	Selec.	Worm	Worm drive
Stegeman	1,500	1,600	125	Pneu.	22.50	Selec.	Bevel	Standard car
Stewart, B	1,500	1,500	124	Pneu.	19.61	Selec.	Bevel	French hood
Studebaker, S	1,500	985	108	Pneu.	19.61	Selec.	Bevel	Price
Tiffin, A	1,500	1,600	112	Solid.	22.50	Selec.	Dbl chn.	Standard car
White, GBBE	1,500	2,100	133	Pneu.	22.50	Selec.	Bevel	Standard car
Willet, N	1,500	1,600	125	Pneu.	22.50	Selec.	Dbl-red.	Double-red. drive
Willys, 65	1,500	1,350	120	P&S	27.20	Selec.	Dbl chn	Tire equipment

TRUCKS OF 1-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Adams, A	2,000	$1,850	121*	Solid.	22.50	Selec.	Dbl chn	French hood
Armleder, B	2,000	2,200	136	Pneu.	27.20	Selec.	Bevel	High wheels
Atterbury, BW	2,000	2,100	137	Solid.	22.50	Selec.	Worm	Worm drive
Available	2,000	...	Opt.	Solid.	19.61	Selec.	Worm	Worm drive
Avery, C	2,000	1,690	128	Solid.	27.20	Selec.	Dbl chn.	Standard car
B. A. Gramm, 1	2,000	1,750	130	Solid.	22.50	Selec.	Dbl chn	Standard car
Barker, U	2,000	2,000	130	Solid.	25.60	Selec.	Worm	Worm drive
Bessemer, C	2,000	1,260	108	Solid.	19.61	Selec.	Dbl chn	Standard car
Brockway, H	2,500	1,590	112*	Solid.	22.50	Selec.	Dbl chn	Wood frame
Coleman, D	2,000	1,050	112	Solid.	22.50	Selec.	Dbl chn	Standard car
Corbitt, F	2,500	2,000	130	Solid.	22.50	Selec.	Dbl chn.	Made in South
Dart	2,000	1,400	111	Solid.	19.61	Selec.	Dbl chn.	Standard car
Dayton, U	2,000	1,800	118½	Solid.	29.00	Selec.	Dbl chn.	....
Decatur, C	2,000	1,500	Opt.	Solid*	22.50	Selec.	Int-g.	Int-gear drive
Denby, B	2,000	1,600	120	Solid.	19.61	Selec.	Int-g.	Int-gear drive
Fargo, F	2,000	1,250	130	Solid.	22.50	Selec.	Dbl-red	Double-red. drive
Flint, C	2,000	1,285*	106	Solid.	22.50	Selec.	Dbl-red	Double-red. drive
GMC, VC	2,500	1,500	126	Solid.	19.61	Selec.	Dbl chn	Cast radiator
Horner, 1	2,000	2,000	145	Solid.	27.20	Selec.	Dbl chn	French hood
Hurlburt, 1	2,000	1,500	120	Pneu.	22.50	Selec.	Worm	Worm drive
Kelly, K30	2,000	2,000	120*	Solid.	22.50	Selec.	Dbl chn.	French hood
Kisselkar, 1	2,000	1,850	140	Pneu.	32.40	Selec.	Bevel	Standard car
Koehler, 1	2,000	725	90	Solid*.	22.10	Plan.	Dbl chn.	Price
Krebs, G	2,000	1,900	118	Solid.	22.50	Selec.	Worm	Variable governor
Lambert, V3	2,000	.....	120	Solid.	26.27	Fric.	Dbl chn.	Friction drive
Lippard-Stew., H	2,000	2,000	145	Solid.	22.50	Selec.	Worm	Worm drive
Little Giant, H	2,000	1,350	110	Solid.	22.50	Selec.	Dbl chn	Motor under floor
Maccar, B	2,000	1,900	135*	Solid.	27.20	Selec.	Dbl chn	Standard car
Maccar, E	2,000	1,900	135*	Solid.	27.20	Selec.	Worm	Worm drive
Martin, R	2,000	2,050	125	Solid.	25.60	Selec.	Dbl chn	Standard car
Menominee, B3	2,000	1,400	122	Solid.	25.60	Selec.	Dbl-red.	Double-red drive
Modern, L	2,000	1,750	136	Solid*.	22.50	Selec.	Worm	Worm drive
Netco, 20	2,000	1,025	104	Solid.	19.61	Selec.	Dbl chn	Motor betw. seats
Nel. & LeMoon, E1	2,000	1,800	Opt.	Solid.	22.50	Selec.	Worm	Worm drive
Palmer-Moore, D	2,000	1,200	102	Solid.	2-cyc.	Selec.	Dbl chn	2-cycle motor
Paulding, G	2,000	1,300	120	Solid.	25.60	Selec.	Dbl chn	Standard car
Republic, 1	2,000	1,350	124	Solid.	22.50	Selec.	Dbl chn	Standard car
Roland, 1	2,000	2,000	120	Solid.	22.50	Selec.	Dbl chn	Gas-electric
Service, W	2,000	2,000	135	Solid.	22.50	Selec.	Worm	Worm drive
Signal, D	2,000	1,400	120	Solid.	22.50	Selec.	Dbl chn	Standard car
Signal, DL	2,000	1,450	144	Solid.	22.50	Selec.	Dbl chn	Standard car
Signal, F	2,000	1,500	120	Solid.	22.50	Selec.	Worm	Worm drive
Signal, FL	2,000	1,550	144	Solid.	22.50	Selec.	Worm	Worm drive
Standard-O, A	2,000	1,700	134	Solid*	25.60	Selec.	Dbl chn	Standard car
Standard-O, AK	2,000	1,900	124	Solid*.	25.60	Selec.	Worm	Worm drive
Stewart-K, C	2,000	1,100	96	Solid.	20.00	Plan.	Dbl chn	Motor under seats
Tiffin, G	2,000	2,000	128	Solid.	22.50	Selec.	Dbl chn	Standard car
Trabold, T	2,000	1,250	118	Solid.	19.61	Selec.	Worm*	Worm drive
Transit, E	2,000	2,000	120*	Solid.	32.40	Selec.	Dbl chn	Opt. motor locat'n
Velie, X	2,000	2,000	129*	Solid*.	34.28	Selec.	Dbl-red.	Double-red. drive
Wichita, A	2,000	1,650	110	Solid.	16.92	Selec.	Dbl chn	Standard car
Wilcox, L A	2,000	2,000	132	Solid*.	27.20	Selec.	Dbl chn.	Standard car

TRUCKS OF 1½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Adams, D	3,000	$2,300	121*	Solid.	27.20	Selec.	Dbl chn	French hood
Aetna, 1½	3,000	2,150	158	Solid.	25.60	Selec.	Worm	Worm drive

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind**, Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&S, *pneumatic in front, solid in rear;* P&C, *pneumatic in front, cushion in rear;* C&S, *cushion in front, solid in rear.* **Gearset Type**, Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Final Drive**, Bevel, *direct bevel;* Dbl-red, *double-reduction bevel and spur;* Int-g, *internal-gear;* Worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

TRUCKS OF 1½-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Armleder H	3,000	$2,150	Opt	Solid	22.40	Selec.	Dbl chn.	High wheels
Autocar 21F	2,000	1,650	97	Opt	18.10	Prog	Dbl-red.	Motor under
Bessemer A	2,000	1,800	136	Solid	27.20	Selec.	Dbl chn.	Standard car seat
Beck	3,000	1,600	130	Solid	27.20	Selec.	Int-g.	Int-gear drive
Chase R	3,000	2,300	Opt	Solid	22.50	Selec.	Worm.	Worm drive
Continental F	3,000	1,700	144	Solid	16.92	Selec.	Opt	Standard car
Crown B	3,000	2,500	140	Solid	25.60	Selec.	Worm.	Worm drive
DeKalb D1	3,000	1,950	134	Solid	27.20	Selec.	Dbl chn.	Standard car
Federal GH	2,000	1,800	120*	Solid	27.20	Selec.	Dbl chn	Cast radiator
Federal GW-HW	2,000	1,900	120*	Solid	27.20	Selec.	Worm.	Worm drive
Forschler 1A	2,000	2,300	124*	Solid	27.20	Selec.	Dbl chn	Double frame
Gabriel M	2,000	2,300	144	Pneu.	27.20	Selec.	Bevel	Standard car
Gramm 1½	2,000	2,000	129	Solid	22.50	Selec.	Dbl chn	Motor betw. seats
Harvey F	3,000	1,800	130	Solid	22.50	Selec.	Dbl chn	Standard car
Independent E	2,000	1,850	122*	Solid	22.50	Selec.	Dbl chn	Standard car
Indiana B	3,000	1,800	135	Solid	22.50	Selec.	Dbl chn	Standard car
Jeffery 3015	3,000	1,650	133	Solid	22.50	Selec.	Dbl chn	Standard car
Kalamazoo B	3,000	1,590	126	Solid	22.50	Selec.	Dbl chn	Standard car
Kisselkar 1½	2,000	2,100	132*	Solid	29.00	Selec.	Dbl chn	Standard car
Kleiber 1	3,000	2,000	140*	Solid	27.20	Selec.	Dbl chn.	Standard car
Lambert V4	2,000	1,900	120	Solid	32.40	Fric	Dbl chn	Friction drive
Lange C	3,000	2,250	125	Solid	32.50	Ind-c.	Dbl chn	Ind-clutch gearset
Lippard-Stew F	2,000	2,300	145*	Solid	27.20	Selec.	Worm.	Worm drive
Maccar C	3,000	2,150	150*	Solid	27.20	Selec.	Dbl chn.	Standard car
Mais C	3,000	2,730	119	Solid	25.60	Prog	Int-g.	Int-gear drive
Mais D	3,000	2,800	132	Solid	25.60	Prog	Int-g.	Int-gear drive
Martin S	2,000	2,150	121	Solid	25.60	Selec.	Dbl chn	Standard car
McIntyre A	3,000		144	Solid	27.20	Selec.	Dbl chn	Standard car
Menominee C	3,000	1,800	130	Solid	25.60	Selec.	Dbl-red.	Double-red. drive
Modern H	3,000	1,950	136*	Solid	27.20	Selec.	Dbl chn	Standard car
Modern M	3,000	2,000	136*	Solid	27.20	Selec.	Worm.	Worm drive
Moon B	2,000	1,800	125*	Solid	22.50	Selec.	Dbl chn	Standard car
Moore 1½	3,000	1,950	145	Solid	27.20	Selec.	Dbl chn.	Standard car
Moreland 1X	2,000	2,050	120	Solid	27.20	Selec.	Worm.	Distillate fuel
Nel. & LeMoon E1½	2,000	2,000	Opt	Solid	27.20	Selec.	Worm.	Worm drive
Netco C	2,000	2,250	144	Solid	27.20	Selec.	Worm.	Worm drive
New York L	3,000	2,000	129	Solid	16.92	Selec.	Dbl chn.	Standard car
Old Hickory 30W	2,000	1,900	110	Solid	22.50	Selec.	Worm.	Worm drive
Old Reliable 1½	2,000	2,250	138	Solid	22.50	Selec.	Worm.	Worm drive
Republic 1½	2,000	1,475	144	Solid	22.50	Selec.	Dbl chn.	Price
Rowe CW	2,000	2,450	144	Solid	25.60	Selec.	Worm.	Worm drive
Sandow 1½	2,000	1,900	125*	Solid	22.50	Selec.	Dbl chn	Standard car
Sanford K	2,000	1,600	106	Solid	25.60	Selec.	Dbl chn	Standard car
Selden JB	2,000	2,000	150	Solid	22.50	Selec.	Dbl chn	Standard car
Service Q	2,000	1,975	150	Solid	27.20	Selec.	Dbl chn	Standard car
Standard-O B	2,000	1,800	132*	Solid	25.60	Selec.	Dbl chn	Standard car
Standard-O BX	3,000	2,100	134*	Solid	25.60	Selec.	Worm.	Worm drive
Stegeman	2,000	2,100	150	C&S	22.50	Selec.	Dbl chn.	Chain cases
Sullivan G	2,000	1,600	129	Solid	22.50	Selec.	Dbl chn	Standard car
Universal C	3,000	1,950	132	Solid	22.50	Selec.	Worm.	Worm drive
Velie U	3,000	2,280	140	Solid	34.28	Selec.	Worm.	Worm drive
White TBC	2,000	3,000	145½	Pneu.	22.50	Selec.	Dbl-red.	Double-red. drive

TRUCKS OF 2-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Adams, E.	4,000	$2,500	140*	Solid	27.20	Selec.	Dbl chn	French hood
Armleder, E.	4,000	2,500	Opt	Solid	32.40	Selec.	Dbl chn	High wheels
Atterbury CW	4,000	2,800	153	Solid	27.20	Selec.	Worm.	Worm drive
Available	4,000	.	Opt	Solid	27.20	Selec.	Worm.	Worm drive
Avery B	4,000	2,700	128	Solid	36.15	Selec.	Dbl chn	Motor under floor
B. A. Gramm 2	4,000	2,550	146	Solid	29.00	Ind-c.	Worm.	Worm drive
Barker V	4,000	2,400	136	Solid	25.60	Selec.	Worm.	Worm drive
Bessemer D	4,000	2,300	136	Solid	27.20	Selec.	Worm.	Worm drive
Blair C1	4,000	2,850	114*	Solid	27.20	Ind-c.	Worm.	Worm drive
Brasie Twin City	4,000	1,350	104	Solid	20.00	Plan	Dbl chn	Price
Brasie Twin City	4,000	1,350	104	Solid	22.50	Selec.	Dbl chn	Price
Brockway I	4,000	1,875	120*	Solid	27.20	Selec.	Dbl chn.	Wood frame
Coleman G	4,000	2,450	124	Solid	22.50	Selec.	Dbl chn	Motor under seats
Curtis	4,000	2,750	130	Solid	27.20	Selec.	Dbl chn	Motor under floor
Dart	4,000	1,800	130*	Solid	27.20	Selec.	Dbl chn.	Standard car
Dorris 1A4	4,000	2,500	144*	Solid	30.63	Selec.	Dbl chn.	Valves in head
Duplex C	4,000	2,800	130	Solid	27.20	Selec.	Int-g.	4-wheel drive
Four Wheel Drive G	4,000	3,400	124	Solid	29.00	Selec.	Bevel-4.	4-wheel drive
Fremont-Mais O	4,000	1,700*	132*	Solid	22.50	Prog	Int-g.	Int-gear drive
Garford L	4,000	2,000	128*	Solid	36.15	Selec.	Dbl chn.	Motor betw. seats
G. A. Schacht 2	4,000	2,900	138	Solid	29.00	Selec.	Worm.	Worm drive
GMC SC	4,000	1,900	143	Solid	25.60	Selec.	Dbl chn.	Standard car
Gramm 2	4,000	2,000	128	Solid	32.40	Selec.	Dbl chn.	Motor betw. seats

TRUCKS OF 2-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Horner 2	4,000	$2,650	145	Solid	27.20	Selec.	Dbl chn	French hood
Hurlburt 2	4,000	3,000	Opt	Solid	27.20	Selec.	Worm.	Worm drive
Jeffery 4015	4,000	2,750	124	Solid	22.50	Selec.	Int-g-4	4-wheel drive
Kelly K-35	4,000	2,750	144*	Solid	22.50	Selec.	Dbl chn	French hood
Krebs 11	4,000	2,350	144*	Solid	27.20	Selec.	Worm.	Variable governor
Lambert V5	4,000	2,300	120	Solid	32.40	Fric	Dbl chn	Friction drive
Lippard-Stew G	4,000	2,600	158*	Solid	27.20	Selec.	Worm	Worm drive
Maccar F	4,000	2,400	150*	Solid	27.20	Selec.	Dbl chn	Standard car
Maccar D	4,000	2,400	150*	Solid	27.20	Selec.	Worm	Worm drive
Mais E	4,000	2,950	132	Solid	25.60	Prog	Int-g.	Int-gear drive
Mais F	4,000	3,000	145	Solid	25.60	Prog	Int-g.	Int-gear drive
Moore 2	4,000	2,500	163	Solid	32.40	Selec.	Dbl chn	Standard car
Nel. & LeMoon E2	4,000	2,250	Opt	Solid	27.20	Selec.	Worm.	Worm drive
Packard 2	4,000	2,800	120*	Solid	26.39	Prog	Dbl chn	Standard car
Paulding M	4,000	1,950	145	Solid	34.28	Selec.	Dbl chn	Standard car
Pierce-Arrow 2	4,000	3,000	150*	Solid	25.60	Selec.	Worm.	Worm drive
Reo J	4,000	1,650	130*	Solid	27.20	Selec.	Dbl chn	Knock-down rad.
Rowe DW	4,000	2,800	150	Solid	29.00	Selec.	Worm.	Worm drive
Sandow 2	4,000	2,250	125*	Solid	27.20	Selec.	Dbl chn	Standard car
Sanford L	4,000	1,910	118	Solid	27.20	Selec.	Dbl chn	Motor under floor
Sanford M	4,000	1,910	140	Solid	27.20	Selec.	Dbl chn	Standard car
Service P	4,000	2,375	150	Solid	27.20	Selec.	Dbl chn	Standard car
Service PW	4,000	2,500	160	Solid	27.20	Selec.	Worm.	Worm drive
South Bend 40	4,000	2,100	136*	Pneu*	26.30	Selec.	Dbl chn	Standard car
Speedwell SY	4,000	2,850	115	Solid	27.20	Selec.	Dbl chn	Motor under floor
Standard-O C	4,000	2,000	144*	Solid*	25.60	Selec.	Dbl chn	Standard car
Sternberg	4,000	2,800	148*	Solid	22.50	Ind-c.	Worm	Worm drive
Trabold	4,000	2,450	130	Solid	27.20	Selec.	Worm*	Worm drive
Transit F	4,000	2,850	144	Solid	32.40	Selec.	Dbl chn	Opt. motor locat'n
U. S. E	4,000	2,550	132	Solid	27.20	Ind-c.	Dbl chn	Ind.-clutch gears't
Wichita B	4,000	2,100	118	Solid	19.61	Selec.	Dbl chn	Standard car
Wilcox NA	4,000	2,500	118	Solid	29.00	Selec.	Dbl chn	Motor under floor
Willet L	4,000	2,600	144	Solid	27.20	Selec.	Dbl chn	French hood
Wilson B	4,000	1,800	130*	Solid	27.20	Selec.	Dbl chn	Standard car

TRUCKS OF 2½-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Aetna 2½	5,000	$2,400	158	Solid	34.28	Selec.	Worm.	Worm drive
Beck	5,000	1,850	130	Solid	40.00	Selec.	Int-g	Int-gear drive
Crown C	5,000	3,000	150	Solid	29.00	Selec.	Worm.	Worm drive
DeKalb D2	5,000	2,450	136	Solid	27.50	Selec.	Dbl chn	Standard car
Kisselkar 2½	5,000	2,750	144*	Solid	32.40	Selec.	Dbl chn	Standard car
Kleiber 2	5,000	2,750	150*	Solid	27.20	Selec.	Dbl chn	Standard car
Lange B	5,000	3,000	136	Solid	27.20	Ind-c.	Dbl chn	Ind.-clutch gears't
Lewis 21	5,000	2,900	144	Solid	29.00	Ind-c.	Dbl chn	Ind.-clutch gears't
Mais G	5,000	3,200	145	Solid	29.60	Prog	Int-g.	Int-gear drive
Martin E	5,000	3,000	135	Solid	27.20	Selec.	Dbl chn	Motor under floor
Moreland 2X	5,000	2,650	144	Solid	32.40	Selec.	Worm.	Distillate fuel
Stegeman	5,000	2,800	142	Solid	29.00	Selec.	Dbl chn	Chain cases
U. S. G	5,000	2,750	138	Solid	27.20	Ind-c.	Dbl chn	Ind.-clutch gears't
Velie	5,000	2,850	148*	Solid	32.40	Selec.	Dbl chn	Standard car
Vulcan 2	5,000	2,750	150*	Solid	29.90	Selec.	Dbl chn	English design

TRUCKS OF 3-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
A&B 3-T	6,000		144	Solid	42.76	Elec	Int-g-f	Gas-electric
Atterbury DW	6,000	$3,800	168	Solid	32.40	Selec.	Worm.	Worm drive
Avery A	6,000	2,500c	140	Wood	36.15	Selec.	Dbl chn	Farm truck
Avery B	6,000	3,200	128	Solid	36.15	Selec.	Dbl chn	Motor under floor
Blair B1	6,000	3,250	120*	Solid	36.15	Ind-c.	Worm.	Worm drive
Chase O	6,000	3,300	175	Solid	32.40	Selec.	Worm.	Worm drive
Coleman H	6,000	3,000	134	Solid	27.20	Selec.	Dbl chn	Motor under seat
Continental G	6,000	2,700	144	Solid	16.92	Selec.	Opt	Standard car
Crawford	6,000	3,000	144	Solid	32.40	Selec.	Dbl chn	Standard car
Curtis	6,000	3,250	130	Solid	27.20	Selec.	Dbl chn	Motor under floor
Duplex D	6,000	3,200	130	Solid	29.00	Selec.	Int-g-4	4-wheel drive
Four Wheel Drive B	6,000	4,000	124	Solid	36.15	Selec.	Bevel-4	4-wheel drive
Garford J	6,000	3,500	128*	Solid	36.15	Selec.	Dbl chn	Motor betw. seats
G. A. Schacht 3	6,000	3,200	150	Solid	29.00	Selec.	Worm.	Worm drive
Harvey H	6,000	3,000	108	Solid	29.00	Selec.	Dbl chn	Standard car
Horner 3	6,000	3,200	145	Solid	32.40	Selec.	Dbl chn	French hood
Indiana F	6,000	2,500	144	Solid	29.00	Selec.	Dbl chn	Standard car

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&S, *pneumatic in front, solid in rear;* P&C, *pneumatic in front, cushion in rear;* C&S, *cushion in front, solid in rear.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Final Drive,** Bevel, *direct bevel;* Dbl-red, *double-reduction, bevel and spur;* Int-g, *internal-gear;* Worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.*

TRUCKS OF 3-TON CAPACITY—Continued

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
Lewis 31	6,000	$3,250	144	Solid	29.00	Ind-c.	Dbl chn	Opt. motor locat'n
Locomobile 3	6,000	3,500	150*	Solid.	29.00	Selec.	Worm.	Worm drive
Main H	6,000	3,400	160	Solid.	29.00	Prog	Int-g.	Int-gear drive
McIntyre G	6,000		144	Solid	27.20	Selec.	Dbl chn	Standard
Moore 3	6,000	3,150	142	Solid	32.40	Selec.	Dbl chn	Motor under floor
Old Reliable 3	6,000	3,400	122	Solid.	29.00	Selec.	Dbl chn	Motor under floor
Packard 3	6,000	3,400	126*	Solid.	32.40	Prog	Dbl chn	Standard car
Peerless 3	6,000	3,700	131*	Solid.	32.40	Selec.	Dbl chn	Standard car
Roland 3	6,000	3,500	144	Solid	29.00	Elec	Worm.	Gas-electric
Rowe EW	6,000	3,400	156	Solid	25.60	Selec.	Worm.	Worm drive
Sandow 3	6,000	3,000	147*	Solid	32.40	Selec.	Dbl chn	Standard car
Service H	6,000	2,975	171	Solid	29.00	Selec.	Dbl chn	Standard car
Standard-D 3	6,000	2,750	144	Solid.	32.40	Prog	Worm*	Worm drive opt.
Sternberg	6,000	3,400	158*	Solid.	29.00	Ind-c.	Worm.	Worm drive
Trabold	6,000	3,300	130	Solid.	29.00	Selec.	Worm*.	Worm drive
U. S. D	6,000	3,200	141	Solid.	32.40	Ind-c.	Dbl chn	Ind.-clutch gears't
Universal A	6,000	3,400	142	Solid	25.60	Selec.	Dbl chn	Motor under floor
Ware	6,000			Solid.	25.60		Bevel	4-wheel drive
White TAD	6,000	3,700	163	Solid.	22.50	Selec.	Dbl chn	Standard car
Wilcox JA	6,000	3,250	128	Solid	29.00	Selec.	Dbl chn	Motor under floor
Willet K	6,000	2,800	144	Solid	32.40	Selec.	Dbl chn	French hood

TRUCKS OF 3½-TON CAPACITY

B. A. Gramm 3½	7,000	$3,400	158	Solid.	29.00	Ind-c.	Worm.	Worm drive
Couple-Gear H.C	7,000	4,950	144	Solid	44.20	Elec	Bevel-4	Gas-electric
GMC HU	7,000	2,500	158	Solid	40.00	Prog	Dbl chn	Standard car
Gramm 3½	7,000	4,650	140	Solid	32.40	Selec.	Dbl chn	Motor betw. seats
Hurlburt 3½	7,000	3,500	Opt	Solid	29.00	Selec.	Worm.	Worm drive
Kelly K-40	7,000	3,400	150*	Solid	32.40	Selec.	Dbl chn	French hood
King 3½	7,000	3,200	120	Solid	32.40	Ind-c.	Dbl chn	Motor under floor
Kissel Kar 3½	7,000	3,550	162	Solid.	38.25	Selec.	Dbl chn	Standard car
Kleiber 3	7,000	3,300	160*	Solid.	32.40	Selec.	Dbl chn	Standard car
M&E B	7,000	3,350	132	Solid	32.40	Selec.	Dbl chn-f	Front drive
Martin L	7,000	3,500	145	Solid	36.15	Selec.	Dbl chn	Motor under floor
Moreland 3X	7,000	3,500	168	Solid	36.15	Selec.	Worm.	Distillate fuel
Roland 3½	7,000	3,500	156	Solid	32.40	Elec	Dbl chn	Gas-electric
Royal B3½	7,000	3,400	132	Solid.	36.15	Ind-c.	Dbl chn	Motor under floor
Smith A	7,000	3,750	168	Solid	40.00	Ind-c.	Worm.	Worm drive
Standard-O C	7,000	3,200	162	Solid.	40.65	Selec.	Dbl chn	Standard car
Stegeman	7,000	3,350	155*	Solid.	32.50	Selec.	Dbl chn	Chain cases
Transit T	7,000	3,500	144	Solid	32.40	Selec.	Dbl chn	Opt. motor locat'n
Vulcan 3	7,500	3,250	156*	Solid	29.99	Selec	Dbl chn	English design
Wichita H	7,000	3,250	165	Solid	29.00	Selec.	Dbl chn	Standard car

TRUCKS OF 4-TON CAPACITY

Blair E1	8,000	$3,750	135*	Solid	36.15	Ind-c.	Worm.	Worm drive
Dayton A	8,000	2,700	136	Solid.	36.15	Selec.	Dbl chn	Motor under floor
Garford K	8,000	3,850	128*	Solid.	36.15	Selec.	Dbl chn	Motor betw. seats
Locomobile 4	8,000	3,650	150*	Solid.	29.00	Selec.	Worm.	Worm drive
Moore 4	8,000	3,500	133	Solid.	36.15	Selec.	Dbl chn	Motor under floor
Old Reliable 4	8,000	4,000	126	Solid.	36.15	Selec.	Dbl chn	Motor under floor
Packard 4	8,000	3,500	126*	Solid	32.40	Prog	Dbl chn	Standard car
Peerless 4	8,000	4,000	151*	Solid.	32.40	Selec.	Dbl chn	Standard car
South Bend 80	8,000	3,000	152	Pneu*.	44.20	Selec.	Dbl chn	Standard car
Speedwell 10Z	8,000	3,750	115	Solid.	40.00	Selec.	Dbl chn	Motor under floor
U. S. F	8,000	3,550	156	Solid.	32.40	Ind-c.	Dbl chn	Ind.-clutch gears't
Velie Z	8,000	3,350	148*	Solid.	32.40	Selec.	Dbl chn	Standard car

TRUCKS OF 4½-TON CAPACITY

Vulcan 4	9,200	$4,000	162	Solid.	29.99	Ind-c.	Dbl chn	English design

TRUCKS OF 5-TON CAPACITY

Name and Model	Capacity, Pounds	Chassis Price	Wheelbase	Tires	Motor Horsepower	Gearset Type	Final Drive	Feature
A & B 5-T	10,000		144	Solid	42.76	Elec	Int-g-4	Gas-electric
Atterbury F	10,000	$4,000	153	Solid	38.25	Selec	Dbl chn	Standard car
Avery 8	10,000	4,500	128	Solid.	44.20	Selec	Dbl chn	Motor under floor
B. A. Gramm 5	10,000	4,300	166	Solid.	40.80	Ind-c.	Dbl chn	Ind.-clutch gears't
Blair, F	10,000	4,500	135*	Solid.	36.15	Ind-c.	Worm.	Worm drive
Couple-Gear AC	10,000	5,400	144	Solid.	53.00	Elec	Bevel-4	Gas-electric
C. T.	10,000		155	Solid.	25.60	Elec	Dbl red-4	Gas-electric
GMC KU	10,000	3,000	158	Solid.	40.00	Prog	Dbl chn	Standard car
Garford D	10,000	4,500	128*	Solid.	29.00	Selec	Dbl chn.	Motor betw. seats
Gramm 5	10,000	5,350	140	Solid.	32.40	Selec	Dbl chn.	Motor betw. seat
Horner 5	10,000	4,200	156	Solid.	44.20	Selec.	Dbl chn.	French hood
Indiana K	10,000	3,200	165	Solid.	36.15	Selec	Dbl chn	Standard car
Kelly K-50	10,000	4,250	150*	Solid.	32.40	Selec	Dbl chn	French hood
Kleiber 5	10,000	4,000	170*	Solid.	40.00	Selec.	Dbl chn	Standard car
LaFrance 6	10,000	5,500	140	Solid.	18.48	Hyd	Dbl chn	Hydraulic drive
Locomobile A2	10,000	4,500	140*	Solid.	40.00	Selec.	Dbl chn	Motor under floor
M & E G	10,000	2,750	116	Solid	29.00	Selec	Dbl chn	Front drive
Moore 5	10,000	4,500	173	Solid.	44.20	Selec.	Dbl chn	Motor under floor
Moreland 5X	10,000	4,000	168	Solid	36.15	Selec	Dbl chn	Distillate fuel
Old Reliable 5	10,000	4,000	126	Solid.	36.15	Selec.	Dbl chn	Motor under floor
Packard 5	10,000	4,150	131*	Solid.	40.00	Prog	Dbl chn	Standard car
Peerless 5	10,000	4,500	151*	Solid.	32.40	Selec.	Dbl chn	Standard car
Pierce-Arrow 5	10,000	4,500	168*	Solid	38.25	Selec.	Worm.	Worm drive
Rowe GW	10,000	4,500	171	Solid.	36.15		Worm.	Worm drive
Royal A5	10,000	4,500	144	Solid.	36.15	Ind-c.	Dbl chn	Motor under floor
Service HX	10,000	4,000	173	Solid	36.15	Selec.	Dbl chn	Standard car
Stegeman	10,000	4,200	168	Solid.	32.40	Selec.	Dbl chn	Chain cases
Sternberg	10,000	4,500		Solid.	32.40	Ind-c.	Worm.	Worm drive
Transit V	10,000	4,500	144*	Solid.	32.40	Selec	Dbl chn	Opt. motor locat'n
Velie Z5	10,000	3,750	148*	Solid.	32.40	Selec.	Dbl chn	Standard car
Walter 5	10,000	4,500	114	Solid.	30.65	Selec	Int-g-4	4-wheel drive
White TCD	10,000	4,500	165	Solid	29.00	Selec	Dbl chn	Standard car

TRUCKS OF 5½-TON CAPACITY

Vulcan 5	11,000	$4,500	162	Solid	29.99	Ind-c.	Dbl chn	English design

TRUCKS OF 6-TON CAPACITY

Daimler-Amer. FV	12,000		160	Solid.	29.00	Selec.	Int-g.	German design
Four Wheel Drive M	12,000	$4,800	148	Solid.	44.20	Selec.	Bevel-4	4-wheel drive
Garford F	12,000	4,850	128*	Solid.	29.00	Selec.	Dbl chn	Motor betw. seats
Kissel Kar 6	12,000	4,350	168	Solid.	38.25	Selec.	Dbl chn	Standard car
Knox-Tractor 31	12,000	4,250	139	Solid.	40.00	Selec.	Dbl chn	3-wheeler
Locomobile AA2	12,000	4,800	140*	Solid	40.00	Selec.	Dbl chn	Motor under floor
Packard 6	12,000	4,700	141*	Solid.	40.00	Prog	Dbl chn	Standard car
Peerless 6	12,000	5,000	151*	Solid	32.40	Selec.	Dbl chn	Standard car
Smith C	12,000	4,750	168	Solid.	44.20	Ind-c.	Worm.	Worm drive
Speedwell 8X	12,000	4,400	139	Solid	40.00	Selec.	Dbl chn	Motor under floor
Sternberg	12,000	4,650	144	Solid.	36.15	Ind-c.	Dbl chn	Motor under floor
Walter 6	12,000	4,750	114	Solid.	30.65	Selec	Int-g-4	4-wheel drive

TRUCKS OF 6½-TON CAPACITY

Moreland 6X	13,000	$4,500	169	Solid.	44.20	Selec.	Dbl chn	Distillate fuel

TRUCKS OF 7-TON CAPACITY AND OVER

Knox-Tractor 32	20,000	$3,750	110	Solid.	40.00	Selec.	Dbl chn	3-wheeler
Main Tractor	16,000	2,750	84	Solid	29.00	Prog	Int-g.	Int-gear drive
Old Reliable 7	14,000	5,000	126	Solid.	36.15	Selec	Dbl chn	Motor under floor
Standard-D. 7	14,000	3,300	112	Solid.	32.40	Prog	Dbl chn	Standard car
Sternberg	14,000	4,750	144	Solid.	36.15	Ind-c.	Dbl chn	Motor under floor
Vulcan 7	15,500	6,000	156*	Solid	30.15	Prog	Dbl chn	English design
Walter 7½	15,000	5,000	141	Solid	38.25	Selec.	Int-g-4	4-wheel drive
Walter Tractor	24,000	4,500	108	Solid	38.25	Selec	Int-g-4	4-wheel drive

CAPACITIES NOT GIVEN

Bulley Tractor		3,400	72	Solid.	40.65	Selec.	Dbl chn	3-wheeler

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&S, *pneumatic in front, solid in rear;* P&C, *pneumatic in front, cushion in rear;* C&S, *cushion in front, solid in rear.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Final Drive,** Bevel, *direct bevel;* Dbl-red, *double-reduction bevel and spur;* Int-g, *internal-gear;* Worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels,* -4, *to all four wheels.*

Gasoline Motor Trucks for 1915

Specifications of 377 American Commercial Vehicle Chassis —Details and Dimensions of the Motors, Transmission Units and Equipment—Products of 143 Manufacturers

ON this and the following pages individual specifications of 377 American gasoline and gasoline electric commercial vehicle chassis are tabulated under thirty-six headings. Among these are included motor trucks, light delivery vehicles and tractors listed by 143 manufacturers for the 1915 market. In condensing this information into a single line for each chassis abbreviations were necessary, the footnote at the bottom of each page giving the full interpretation of each. However, it might be well to take up the headings to facilitate understanding of the tables.

The load capacity is the maximum amount of load it is intended to carry in regular service, in addition to the weight of the body, cab and crew.

The price of the chassis covers the chassis itself equipped with a standard seat or cab and all other equipment except the body. Some makers sell chassis only fitted with bodies, however, these being indicated by a small showing that the price covers the complete vehicle.

Wheelbase is measured between the centers of the front and rear axles along the center line of the chassis.

All tires described as solid, pneumatic, sectional or block, and cushion are made of rubber.

The diameter and width of tires is given, the former term covering the total diameter from tread to tread while the latter represents the width at the base. When a tire is specified as of a certain size, dual, this represents two tires of that size together on one rim. It should be remembered that many tires are oversize and actually exceed their rated diameter.

The most popular motor location is under the hood at the extreme front of the chassis. The two styles of hood most used are the European type, which is now often given a flare toward the dash, and the French type generally known as the Renault. The second type of motor location is under the floor of the cab, the exact position being variously determined by the different manufacturers. Trucks with this motor location are commonly referred to as being of the American type. The third type of our motor location is that in which the motor is under a hood alongside the driver's seat or in front of it, the most popular type being that in which the motor is located between the seats. Such trucks are known

				TIRES			MOTOR											
Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	Kind	SIZES IN INCHES		Location	CYLINDERS			S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear		No.	Bore in Ins.	Stroke in Ins.				Water Circulation	Radiator Type	Type	Make	Spark Advance
A & B 3-T	6,000	4,500	144	Solid	48x3½d	48x3½d	Under hood	4	5.17	4.75	42.76	Pairs	Right	Gear	Finned	Dual	Bosch	Hand
A & B 5-T	10,000	4,750	144	Solid	48x3½d	48x5d	Under hood	4	5.17	4.75	42.76	Pairs	Right	Gear	Finned	Dual	Bosch	Hand
Adams A	2,000	1,850	121*	Solid	36x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Auto
Adams D	3,000	2,300	121*	Solid	36x3½	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Auto
Adams E	4,000	2,500	140*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Eisemann	Auto
Aetna 1½	3,000	2,150	158	Solid	36x3½	36x5	Under hood	4	4.00	4.50	25.60	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Aetna 2½	5,000	2,400	158	Solid	36x4	36x3½d	Under hood	4	4.37	6.00	34.28	Pairs	Opp	Cent	Cell	Sing	Eisemann	Auto
Armleder B	2,000	2,200	136	Pneu.	40x4	39x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Sing	Bosch	Hand
Armleder H	3,000	2,150	Opt	Solid	40x4	40x6*	Under hood	4	4.50	5.00	32.40	Block	Opp	Cent	Sq-t	Sing	Bosch	Hand
Armleder E	4,000	2,500	Opt	Solid	40x4	40x7*	Under hood	4	4.50	5.00	32.40	Block	Opp	Cent	Sq-t	Sing	Bosch	Hand
Atterbury AW	1,500	1,800	118	Pneu.	35x4½	35x4½	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Atterbury BW	2,000	2,100	137	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Atterbury CW	4,000	2,800	153	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Atterbury DW	6,000	3,800	168	Solid	36x5	40x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Finned	Dual-d	Bosch	Hand
Atterbury E	10,000	4,000	183	Solid	36x5	42x6d	Under hood	4	4.87	5.50	38.25	Pairs	Opp	Cent	Finned	Dual	Bosch	Fixed
Anglaise H	1,500	950	100	Solid	36x2½	36x3	Under seat	2	5.25	4.00	22.10	Sing	Head	Thermo	Finned	Dual	Remy	Hand
Anglaise D	1,500	950	100	Solid	36x3½	36x4	Under seat	4	3.75	5.12	22.50	Block	Left	Thermo	Finned	Dual	Remy	Hand
Autocar 21F	3,000	1,650	97	Opt	34x4	34x5	Under seat	2	3.75	4.50	15.10	Sing	Right	Cent	Finned	Sing	Bosch	Fixed
Available	2,000	...	Opt	Solid	36x3	36x3½	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Available	4,000	.....	Opt	Solid	36x3½	36x6	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Avery C	2,000	1,690	128	Solid	34x3½	34x5	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Dual	Heinze	Hand
Avery B	4,000	2,700	128	Solid	36x4	36x3½d	Under floor	4	4.75	5.00	36.15	Sing	Left	Cent	Finned	Dual	Eisemann	Auto
Avery B	6,000	3,200	128	Solid	38x5	38x4d	Under floor	4	4.75	5.00	36.15	Sing	Left	Cent	Cell	Dual	Eisemann	Auto
Avery A	6,000	2,500c	140	Wood	38x5	38x4d	Betw seats	4	4.75	5.00	36.15	Sing	Left	Cent	Finned	Dual	Eisemann	Auto
Avery B	10,000	4,500	128	Solid	38x6	38x5d	Under floor	4	5.25	5.75	44.20	Pairs	Opp	Cent	Cell	Dual	Eisemann	Auto
B. A. Gramm 1	2,000	1,750	130	Solid	34x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Cell	Sing	Bosch	Hand
B. A. Gramm 2	4,000	2,550	146	Solid	36x4	36x3½d	Under hood	4	4.25	5.75	29.00	Pairs	Left	Cent	Cell	Dual	Bosch	Hand
B. A. Gramm 3½	7,000	3,400	158	Solid	36x5	40x5d	Under hood	4	4.25	5.75	29.00	Pairs	Left	Cent	Cell	Dual	Bosch	Hand
B. A. Gramm 5	10,000	4,300	168	Solid	36x6	40x6d	Under hood	6	4.12	5.50	40.80	Threes	Right	Cent	Cell	Dual	Bosch	Hand
Barker U	2,000	2,000	130	Solid	42x3½	42x5	Under hood	4	4.00	5.00	25.60	Block	Left	Thermo	Cell	Sing	Eisemann	Auto
Barker V	4,000	2,400	136	Solid	36x4	36x7	Under hood	4	4.00	5.00	25.60	Block	Left	Thermo	Cell	Sing	Eisemann	Auto

ABBREVIATIONS: General, *, *with other options*; Opt, *optional*. **Price**, -c, *complete with body*. **Tires, Kind**, Pneu, *pneumatic*; Sol-st, *solid in front, steel in rear*; P&s, *pneumatic in front, solid in rear*; P&c, *pneumatic in front, cushion in rear*; C&s, *cushion in front, solid in rear*. **Tire Sizes**, d, *dual*. **Motor Location**, Betw seats, *between seats*. **Cylinders Cast**, Sing, *singly or individually*. **Location of Valves**, Opp, *opposite, or T-head type*. Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up*. R&h, *at right and in head, L-head cylinder*; L&h, *at left and in head, L-head cylinder*; 2-cyc, *two-cycle motor, no valves*; Back, *L-head motor placed transversely with valves at rear*. **Water Circulation**, Cent, *centrifugal pump*; Gear, *gear pump*; Thermo, *Thermo-syphon circulation*; Air, *air-cooled, no water*. **Radiator Type**, Finned, *finned-tube*; Cell, *cellular or honeycomb*; Sq-t, *square-tube or flat-tube*; Zz-t, *zig-zag-tube or crimped flat-tube*. **Ignition, Type** Sing, *single*; Dual, *double*; Dual-d, *dual-double*. **Make of Magneto** (or other sparking device), Splt, *Splitdorf*; Conn, *Connecticut*; King, *Kingston*; West, *Westinghouse*; Dav-D, *Dayton-Dick*; Atw-K, *Atwater-Kent*. **Spark Advance**, Auto, *automatic*; 2-Pt, *two-point fixed, battery circuit fixed in retard, magneto in advance*. **Governor Type**, Cent, *centrifugal*; I-b, *Inner-ball*; Suct, *suction*; Hyd, *hydraulic*. **Governor Drive**, Motor, *from motor*; D-shft, *from driving shaft*; F-wheel, *from front wheel*; Gearset, *from gearset countershaft*; Duplex, *from both the motor and the driving shaft, by overrunning clutches*.

as compromise types. The fourth position for the motor is under the body, usually back of the driver's seat with the radiator in front or under the floor.

Horsepower is determined by the well known formula $H.P. = \frac{D^2N}{2.5}$ in which D is the cylinder bore and N is the number of cylinders.

Practically all four-cycle truck engines are of the poppet valve type. There are a number of two-cycle types on the market in which ports cut in the cylinder walls perform the valve functions.

Cooling is by centrifugal or gear type pump or thermo-syphon. Radiators are cellular or tubular, the tubular variety being of three kinds, having square, round or zig-zag tubes.

High tension ignition systems are of the single, dual, double and dual-double types. Single systems consist of a single set of plugs with magneto. Dual systems also have a battery and coil outfit. Double systems have two separate plugs, one for the magneto and the other for the battery. Dual-double systems are the same except that either set of plugs may be supplied by magneto or battery.

Governors are of the centrifugal, loose-ball, suction and hydraulic types. Three types of governor-drive are employed, the first, from the motor, causing the governor to control the engine according to its own speed. The second is driven from the front wheel, the driveshaft or the gearset layshaft and controls the motor in accordance with the speed of the truck. The third is known as the duplex drive, being a combination of the other two methods with overrunning clutches so that the faster of two driving shafts controls motor speed.

Spark advance is effected by a lever on the steering wheel or by means of a governor on the magneto which automatically advances and retards the spark in accordance with motor speed variations. There are also battery-coil systems provided with automatic advance which are widely used.

Lubrication is by splash, circulating-splash, splash-pressure and pressure. Fuel-injection systems are used only in two-cycle motors. They consist in the mixture of lubricant with the fuel so that the cylinders are oiled by the charge.

Cone clutches are most commonly used, a variation being the reversed-cone type. Dry disk and disk-in-oil types are widely used while contracting band and expanding shoe varieties are also represented.

Gearsets proper are of three types, sliding gear, individual clutch and planetary. The friction type of transmission is well known, the hydraulic change-gear system consisting of an oil pump and oil motors and the electric drive comprising a generator or dynamo connected with the engine and electric motors to drive the wheels being also represented.

The total gear ratio is the total reduction from the engine crankshaft to the road wheels. For example, if in high gear, the crankshaft of a truck must revolve nine times to one revolution of the road wheels, the gear ratio is 9 to 1.

Single and double chains, bevel and worm drive are well represented as are also internal gear drive and the double reduction type in which a set of spur-gears is introduced between the bevel gears and the differential. Internal gear drive consists in the use of a live jackshaft incorporated with a dead axle, and driving the wheels by spur pinions meshing with internal teeth on the brake drums.

Driving torque and the driving effort itself are taken by the springs, a torque arm, a torsion tube, or radius rods. The driving torque is sometimes taken by the extended engine sub-frame attached to the center of the axle and at two points to the frame.

MOTOR						TRANSMISSION							SPRINGS		CONTROL		Propulsion Taken By	Name and Model
GOVERNOR		SPEEDS		Carburetor Make	Lubrication	Clutch Type	GEARSET			Total Gear Ratio	Final Drive	Torque Taken By	Front	Rear	Steer	Levers		
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds	High								
....				Scheb.	Circ-spl.		Elec.	Amid		29-1	Int-gear-f.	R-r	½-Ell.	½-Ell.	Right	Right	R-r	A & S 3-T
....				Scheb.	Circ-spl.		Elec.	Amid		25-1	Int-gear-f.	R-r	½-Ell.	½-Ell.	Right	Right	R-r	A & S 5-T
Cent.	Motor.	1,300	15	Zenith.	Circ-spl.	Dry-d.	Selec.	Unit-j.	4	7½-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r	Adams A
Cent.	Motor.	1,200	13	Zenith	Circ-spl.	Dry-d.	Selec.	Unit-j.	[illegible]	7½-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r	Adams D
Cent.	Motor.	1,100	12	Zenith.	Circ-spl.	Dry-d.	Selec.	Unit-j.	3	7½-1	Dbl chn		½-Ell.	½-Ell.	Left.	Cent.	R-r	Adams E
Cent.	D-shft.	1,000	15	Scheb.	Spl-press	Dry-d.	Selec.	Unit-m.	3	-1	Top worm	Springs.	½-Ell.	¾-Ell.	Left.	Cent.	Springs	Aetna 1½
Cent.	Motor.	1,000	14	Scheb.	Spl-press	Dry-d.	Selec.	Unit-m.	3	-1	Top worm	Springs.	½-Ell.	¾-Ell.	Left.	Cent.	Springs.	Aetna 2½
....		1,300	20	Scheb.	Circ-spl	Dry-d.	Selec.	Unit-m.	3	5½-1	Bevel	T-arm.	½-Ell	Ellip.	Left	Cent.	R-r	Armleder S
....		1,300	16	Scheb.	Splash.	Wet-d.	Selec.	Unit-j.	3	[illegible]-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r	Armleder H
....		1,300	16	Scheb.	Splash.	Wet-d.	Selec.	Unit-j.	3	5½-1	Dbl chn		½-Ell	½-Ell.	Left	Cent.	R-r	Armleder E
..		1,200	22½	Strom.	Circ-spl.	Dry-d.	Selec.	Unit-m.	3	6-1	Top worm	Springs.	½-Ell	½-Ell.	Left	Cent.	Springs	Atterbury AW
Cent.	Motor.	1,200	15½	Strom.	Circ-spl.	Dry-d.	Selec.	Unit-m.	3	6½-1	Top worm	Springs.	½-Ell	½-Ell.	Left	Cent.	Springs	Atterbury BW
Cent.	Motor.	1,200	14	Strom.	Circ-spl.	Dry-d.	Selec.	Unit-m.	3	9½-1	Top worm	Springs.	½-Ell	½-Ell.	Left.	Cent.	Springs	Atterbury CW
Cent.	Motor.	1,200	12	Strom.	Circ-spl.	Dry-d.	Selec.	Unit-m.	3	10½-1	Top worm	....	½-Ell	½-Ell.	Left	Cent.	R-r	Atterbury DW
Cent.	Motor.	1,200	10	Strom.	Circ-spl.	Wet-d.	Selec.	Unit-j.	3	12-1	Dbl chn.	....	½-Ell.	½-Ell.	Right	Right	R-r	Atterbury E
L-b.	D-shft.	1,200	12	Scheb.	Circ-spl	Wet-d.	Selec.	Unit-j.	2	8-1	Bevel.	R-r	½-Ell.	½-Ell.	Right	Right	R-r	Auglaize H
L-b.	D-shft.	1,000	18	Scheb.	Circ-spl.	Wet-d.	Selec.	Unit-j.	3	7-1	Bevel.	R-r	½-Ell.	½-Ell.	Right	Right.	R-r	Auglaise L
None.	None.	..	20	Strom.	Spl-press.	Dry-p.	Prog.	Amid	3	7-1	Dbl red	Springs.	½-Ell.	Plat	Right.	Right	Springs.	Autocar 21F
Cent.	Motor.	1,000	16	Ray	Circ-spl.	Dry-d.	Selec.	Unit-m.	3	6½-1	Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs	Available
Cent.	Motor.	1,000	14	Ray.	Circ-spl.	Dry-d.	Selec.	Unit-m	3	7½-1	Top worm	Springs.	½-Ell.	½-Ell.	Left.	Cent.	Springs.	Available
Cent.	Motor.	1,200	15	Ray.	Spl-press	Dry-d.	Selec.	Unit-m	3	7½-1	Dbl chn.	....	½-Ell.	½-Ell.	Left	Cent.	R-r	Avery C
L-b.	Motor.	1,300	14½	Ray	Spl-press	Dry-d.	Selec.	Unit-j.	3	3½-1	Dbl chn		½-Ell.	½-Ell.	Right	Cent.	R-r	Avery S
Cent.	Motor.	1,300	13	Ray.	Spl-press	Dry-p.	Selec.	Unit-j.	3	3½-1	Dbl chn		½-Ell.	½-Ell.	Right	Cent.	R-r	Avery S
Cent.	Motor.	1,200	12	Ray	Spl-press	Dry-d.	Selec.	Unit-j.	3	3½-1	Dbl chn		½-Ell.	½-Ell.	Right	Cent.	R-r	Avery. A
Cent.	Motor.	1,000	10	Scheb.	Spl-press	Wet-d.	Selec.	Unit-j.	3	12½-1	Dbl chn		½-Ell.	½-Ell.	Right	Cent.	R-r	Avery S
Cent.	Motor.	1,000	16	Scheb.	Spl-press	Cone.	Selec.	Unit-j.	3	7-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r	S. A. Gramm 1
Cent.	Motor.	1,000	15	Strom.	Spl-press	Dry-d.	Ind-c.	Amid.	3	8½-1	Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs.	S. A. Gramm 2
Cent.	Motor.	1,100	12	Strom.	Spl-press	Dry-d.	Ind-c.	Amid.	4	9½-1	Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs	S. A. Gramm 3½
Cent.	Motor.	1,000	10	Strom.	Spl-press	Dry-d.	Ind-c	Amid.	4	11-1	Dbl chn		½-Ell	½-Ell.	Left.	Cent.	R-r	S. A. Gramm 5
None.	None.	1,500	27	Strom.	Spl-press	Dry-p.	Selec.	Unit-m.	4		Top worm	Springs	½-Ell.	½-Ell.	Left	Cent.	Springs	Barker U
None.	None.	1,500	20	Strom.	Spl-press	Dry-p.	Selec.	Unit-m.	4		Top worm	Springs	½-Ell.	½-Ell.	Left.	Cent.	Springs	Barker V

Carburetor Make, Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication,** Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash.* Spl-press, *splash-pressure;* Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type,** Dry-p, *dry plate;* Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil;* R-cone, *reversed cone or inverted cone;* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type,** Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual-clutch;* Fric, *friction;* Hyd, *hydraulic;* Elec, *electric.* **Gearset Location,** Amid, *amidships;* Unit-m, *unit with motor;* Unit-j, *unit with jackshaft;* Unit-a, *unit with axle;* **Unit-s,** *unit driveshaft.* **Final Drive,** Bevel, *straight bevel;* Doub-r, *double-reduction bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain;* Sing chn, *single chain;* -f, *to front wheels;* -4, *to all four wheels.* **Driving Torque,** R-r, *radius rods;* T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs,** Ellip, *elliptic;* ½-Ell, *half-elliptic;* ¼-Ell, *quarter-elliptic;* ¾-Ell, *three-quarters-elliptic;* Plat, *platform;* T-ell, *transverse elliptic,* Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames.* **Steering,** Cent, *center.* **Levers,** Cent, *center;* C&r, *gearshift center, brake right;* C&l *gearshift center brake left.* St-col, *steering column.* **Propulsion** R-r *radius rods*, T-arm *torque arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.*

Gasoline Motor Trucks for 1915 Listed

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES		Location	CYLINDERS			S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear		No.	Bore in Ins.	Stroke in Ins.				Water Circulation	Radiator Type	Type	Make	Spark Advance
Bauer A	1,000	900	100	Solid...	36x2	36x2	Under hood.	4	3.75	5.00	22.50	Block	Right	Cent..	Finned.	Sing.	Mea	Hand
Bauer B	1,500	1,150	110	Solid...	34x3	34x3½	Under hood.	4	3.75	5.00	22.50	Block	Right.	Cent...	Finned..	Sing.	Mea	Hand
Beck	3,000	1,600	130	Solid...	34x3½	38x4	Under hood.	4	4.12	5.25	27.20	Pairs.	R&H..	Gear...	Sq-t..	Dual...	Bosch..	Hand
Beck	5,000	1,850	130	Solid...	36x5	36x6	Under hood..	4	5.00	6.00	40.00	Pairs.	Opp....	Gear...	Sq-t...	Dual...	Bosch...	Hand.
Bessemer C	2,000	1,250	108	Solid...	34x3½	34x4	Under hood.	4	3.50	5.00	19.61	Block	Right.	Thermo	Finned..	Sing..	Eisemann..	Hand
Bessemer A	3,000	1,800	136	Solid...	34x4	34x5	Under hood.	4	4.12	5.25	27.20	Block	Left.	Thermo	Finned.	Sing...	Eisemann..	Hand
Bessemer D	4,000	2,300	136	Solid...	36x4	36x3½d	Under hood.	4	4.12	5.25	27.20	Block	Left	Thermo	Finned.	Sing...	Eisemann..	Hand.
Best A	1,200	750	78	Solid*	32x2*	34x2½*	Under floor	2	4.50	4.50	16.20	Sing	Opp.	Thermo	Finned.	Dual....	Remy.....	Auto...
Blair C-1	4,000	2,850	114*	Solid...	34x4	34x3½d	Betw. seats	4	4.12	5.25	27.20	Block	Left	Cent..	Sq-t..	Sing..	Bosch...	Fixed
Blair D-1	6,000	3,250	120*	Solid...	36x4	36x4d	Betw. seats	4	4.75	5.50	36.15	Pairs.	Right	Cent..	Sq-t..	Dual....	Bosch...	Fixed
Blair E-1	8,000	3,750	135*	Solid...	36x5	36x5d	Betw. seats	4	4.75	5.50	36.15	Pairs.	Right	Cent..	Sq-t..	Dual....	Bosch..	Fixed
Blair F	10,000	4,500	135*	Solid..	36x6	36x6d	Betw. seats	4	4.75	5.50	36.15	Pairs	Right	Cent..	Sq-t..	Dual...	Bosch..	Fixed.
Brasie Packet	600	375	100	Pneu.	28x3	28x3	Under hood.	4	2.50	4.00	10.00	Block.	Right	Thermo	Cell. ...	Sing...	Berling...	Hand
Brasie Twin City	4,000	1,350	104	Solid...	34x3	36x4½	Under seat..	2	5.00	5.00	20.00	Sing..	Top	Thermo	Cell...	Sing..	K.W....	Hand
Brasie Twin City	4,000	1,350	104	Solid...	34x3	36x4½	Under floor	4	3.75	4.50	22.50	Pairs.	Right	Thermo	Cell.	Sing..	K.W..	Hand
Brockway G	1,500	1,205	100	Solid...	36x2½	36x3	Under hood.	4	3.50	5.00	19.61	Block	Left	Thermo	Finned..	Sing.	Bosch..	Fixed
Brockway H	2,500	1,500	112*	Solid...	36x3	36x4	Under hood.	4	3.75	5.25	22.50	Block	Left	Cent...	Finned.	Sing...	Bosch..	Fixed
Brockway I	4,000	1,875	120*	Solid...	36x4	36x3½d	Under hood.	4	4.12	5.25	27.20	Block	Left.	Cent..	Finned..	Sing....	Bosch..	Fixed
Buick C-4	1,500	1,150	122	Pneu.	35x5	35x5	Under hood.	4	3.75	5.00	22.50	Pairs	Head.	Cent..	Finned...	Dual....	Delco	Hand
Bulley Tractor		3,400	72	Solid...	34x4	35x4d	Under hood.	4	4.37	5.50	30.63	Pairs.	Right..	Cent....	Finned.	Dual....	Remy..	Hand
Chase S	1,000	750	98	Solid...	36x2	36x2	Under hood.	3	4.12	4.00	2-cycl.	Sing.	2-cy.	Air....		Sing....	Bosch..	Fixed
Chase T	1,500	1,500	135	Solid...	36x2½	36x3½	Under hood.	4	3.50	5.00	19.61	Block	Right	Cent..	Finned...	Sing..	Bosch..	Fixed
Chase R	3,000	2,200	146*	Solid...	36x3½	36x5	Under hood.	4	3.75	5.25	22.50	Block.	Left	Cent...	Finned..	Sing..	Bosch..	Fixed
Chase O	6,000	3,300	175	Solid...	36x5	36x5d	Under hood.	4	4.50	5.50	32.40	Pairs.	Left	Cent..	Finned..	Sing.	Bosch..	Fixed
Coleman D	2,000	1,950	112	Solid...	36x3½	36x4	Under seat...	4	3.75	5.25	22.50	Block	Left..	Cent..	Z-z-t....	Sing	Bosch..	Hand
Coleman G	4,000	2,450	124	Solid...	36x4	36x3½d	Under seat...	4	3.75	5.25	22.50	Block	Left	Cent..	Z-z-t....	Sing...	Bosch..	Hand
Coleman H	6,000	3,000	134	Solid...	36x5	36x5d	Under seat...	4	4.12	5.50	27.20	Pairs.	Right.	Cent..	Z-z-t...	Sing	Bosch..	Hand.
Commerce S	1,500	875	107	Pneu.	33x4	33x4	Under hood.	4	3.50	5.00	19.61	Block	R&H.	Thermo	Finned..	Sing	Eisemann.	Fixed
Continental F	3,000	1,700	144	Solid...	36x3½	36x4	Under hood.	4	3.25	4.25	16.92	Block	Left	Cent..	Cell..	Dual.	Bosch.	Hand
Continental G	6,000	2,700	144	Solid.	36x4½	36x4	Under hood.	4	3.25	4.25	16.92	Block	Left.	Cent..	Cell....	Dual.	Bosch..	Hand
Corbitt F	2,500	2,000	130	Solid..	36x3½	40x4	Under hood.	4	3.75	5.25	22.50	Block	Left.	Cent...	Cell.	Sing	Bosch..	Hand
Couple-Gear HC	7,000	4,850	144	Solid...	36x4d	36x4d	Under floor.	4	5.25	6.00	44.20	Sing.	Opp....	Cent...	Sq-t...	Dual...	Mea..	2-pt
Couple-Gear AC	10,000	5,400	144	Solid...	36x5d	36x5d	Under floor	4	5.75	6.00	53.00	Sing	Opp..	Cent..	Sq-t....	Dual...	Mea	2-pt
Crawford	6,000	3,000	144	Solid...	37x4	37x4d	Under hood.	4	4.50	5.50	32.40	Pairs.	Left..	Cent...	Cell.	Dual...	Bosch...	Hand.
Crown A	1,500	2,000	120	Pneu.	34x4	34x4½	Under hood.	4	3.75	5.00	22.50	Block	Right	Cent..	Finned..	Sing	Bosch..	Fixed
Crown B	3,000	2,500	140	Solid...	34x3½	36x5	Under hood.	4	4.00	5.00	25.60	Block.	Right	Cent..	Finned.	Sing..	Bosch...	Fixed
Crown C	5,000	3,000	150	Solid...	34x4	36x6	Under hood.	4	4.25	5.00	29.00	Pairs..	Opp...	Cent..	Finned.	Sing.	Bosch..	Hand
Curtis	4,000	2,750	130	Solid...	36x4	36x3½d	Under floor	4	4.12	5.25	27.20	Block	Right	Thermo	Finned.	Sing..	Eisemann..	Auto...
Curtis	6,000	3,250	130	Solid...	36x4	36x4d	Under floor	4	4.12	5.25	27.20	Block	Right	Thermo	Finned.	Sing	Eisemann..	Auto...
Daimler, Amer FV	12,000	.	109½	Solid...	34x5	40x6d	Under hood.	4	4.25	5.90	29.00	Pairs.	Head.	Cent..	Cell.	Sing.	Bosch..	Fixed.
Dart A	1,000	845	100	Pneu.	32x3½	32x3½	Under hood..	4	3.62	4.00	34.28	Block	Head	Thermo	Cell.	Dual...	Briggs	Hand
Dart B	2,000	1,100	111	Solid.	37x3	37x4½	Under hood.	4	3.50	5.00	19.61	Block	Right	Thermo	Cell...	Sing...	Eisemann..	Fixed
Dart C	4,000	1,800	130*	Solid..	35x4	39x4	Under hood.	4	4.12	5.50	27.20	Block	Right	Cent..	Cell...	Sing...	Eisemann..	Fixed
Dayton U	2,000	1,800	118½	Solid...	36x4	36x3d	Under floor	4	4.25	5.00	29.00	Pairs.	Opp.	Gear..	Finned..	Dual....	Bosch..	Hand.
Dayton A	6,000	2,700	136	Solid...	36x5	36x4d	Under floor	4	4.75	5.50	36.15	Pairs	Opp..	Gear..	Finned..	Dual....	Bosch..	Hand
Decatur VI	800	630	102	Pneu.	30x3½	30x3½	Under body..	4	2.75	4.00	12.08	Block	Right	Gear..	Finned.	Sing...	Berling...	Fixed
Decatur C	2,000	1,500	113*	Solid*.	34x3½*	34x4*	Under hood..	4	3.75	5.25	22.50	Block.	Left	Cent..	Cell.	Sing....	Bosch..	Fixed
DeKalb D1	3,000	1,950	134	Solid...	34x3½	36x5	Under hood..	4	4.12	5.25	27.20	Block	Left	Cent..	Finned.	Sing.....	Eisemann..	Hand
DeKalb D2	5,000	2,450	136	Solid...	36x4	36x6	Under hood..	4	4.12	5.25	27.50	Block	Left	Cent..	Finned.	Sing.....	Eisemann.	Fixed
Denby A	1,500	1,500	120	Solid..	34x3	34x4	Under hood..	4	3.50	5.00	19.61	Block	Right	Thermo	Finned..	Sing....	Eisemann..	Fixed.
Denby B	2,000	1,600	120	Solid..	34x3½	34x5	Under hood.	4	3.50	5.00	19.61	Block	Right	Thermo	Finned...	Sing....	Eisemann..	Fixed
Dorris IA4	1,500	1,950	132*	Pneu.	36x4½	36x4½	Under hood..	4	4.37	5.00	30.64	Pairs.	Head	Cent..	Cell...	Dual...	Bosch...	Hand
Dorris IA4	4,000	2,500	144*	Solid...	36x3½	36x3½d	Under hood..	4	4.37	5.00	30.65	Pairs.	Head	Cent..	Finned..	Dual....	Bosch..	Hand
Duplex C	4,000	2,800	130	Solid..	35x4	35x4	Under hood..	4	4.12	5.50	27.20	Block	Right	Cent..	Finned...	Sing	Eisemann.	Auto...
Duplex D	6,000	3,200	130	Solid..	35x5	35x5	Under hood..	4	4.25	5.50	29.00	Block	Right	Cent..	Finned....	Sing.	Eisemann	Auto...
Fargo E	1,500	730	100	Solid...	34x2½	34x3	Under body..	2	4.50	6.00	16.20	Sing.	Head	Thermo	Z-z-t..	Dual...	Briggs	Hand
Fargo F	2,000	1,250	130	Solid...	36x3	36x3½	Under hood..	4	3.75	5.00	22.50	Block.	Right	Thermo	Finned..	Dual...	Bosch.	Hand
Federal GH	3,000	1,800	120*	Solid....	36x3½	36x5	Under hood..	4	4.12	5.25	27.20	Block	Left.	Cent...	Cell.	Sing....	Eisemann	Fixed
Federal GW-HW	3,000	1,900	120*	Solid..	36x3½	36x5	Under hood.	4	4.12	5.25	27.20	Block	Left	Cent...	Cell.....	Sing	Eisemann	Fixed
Flint C	2,000	1,285*	106	Solid*.	34x3*	35x3½*	Under hood.	4	3.75	4.50	22.50	Block	R&H	Thermo	Finned.	Dual...	Remy..	Hand
Forschler 1A	3,000	2,300	124*	Solid...	36x3½	36x3d	Under hood.	4	4.12	5.25	27.20	Block	Left...	Cent..	Sq-t	Dual...	Bosch..	Hand
Four Wheel Drive G	4,000	3,400	124	Solid...	36x4	36x4	Under seat..	4	4.25	5.00	29.00	Pairs.	Opp.	Cent...	Sq-t....	Sing..	Bosch..	Hand.
Four Wheel Drive B	6,000	4,000	124	Solid...	36x6	36x6	Under seat...	4	4.75	5.50	36.15	Pairs..	Opp	Cent...	Sq-t	Sing	Bosch..	Hand
Four Wheel Drive M	12,000	4,800	148	Solid...	38x5d	38x5d	Under seat...	4	5.25	7.00	44.20	Pairs.	Opp..	Cent...	Sq-t...	Dual...	Bosch..	Hand
Fremont-Mais O	4,000	1,700*	132*	Solid...	36x3½	36x5	Under hood.	4	3.75	5.50	22.50	Block	Right	Cent..	Finned..	Sing	Eisemann.	Fixed...

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price**, -c, *complete with body.* **Tires, Kind**, Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes**, d, *dual.* **Motor Location**, Betw seats, *between seats.* **Cylinder Cast**, Sing, *singly or individually.* **Location of Valves**, Opp, *opposite or T-head type.* Top (2-cylinder motors only) *L-head cylinder laid horizontal with valves up.* R&h *at right and in head, L-head cylinder.* L&h, *at left and in head, L-head cylinder.* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation**, Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type**, Finned, *finned-tube,* Cell, *cellular or honeycomb,* sq-t, *square-tube or flat-tube.* Z-z-t *zig-zag-tube or crimped flat-tube.* **Ignition, Type**, Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf,* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse,* Day-D, *Dayton-Deck;* Atw-K, *Atwater-Kent.* **Spark Advance**, Auto, *automatic;* **2-pt**, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type**, Cent, *centrifugal;* L-b, *lower-ball;* Suct, *suction,* Hyd, *hydraulic.* **Governor Drive, Motor**, *from motor;* D-shaft, *from driving shaft,* F-wheel, *from front wheel;* Gearset, *from geared countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

with Principal Specifications—Continued

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carburetor Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
None	None	1,500	25	Scheb.	Spl-press	Wet-d.	Selec.	Unit-m.	3	6 -1	Dbl-red	T-arm	½-Ell.	Ellip.	Left	Cent.	R-r	Bauer .A
None	None	1,500	23	Scheb.	Spl-press.	Wet-d.	Selec.	Unit-m.	3	6 -1	Dbl-red.	T-arm.	½-Ell.	Ellip.	Left	Cent.	R-r.	Bauer .B
Hyd	Motor	......	16	Strom.	Splash	Wet-d.	Selec.	Unit-m.	3		Int-gear.	Springs.	½-Ell.	½-Ell.	Left	Cent.		Beck
Hyd	Motor.	......	12	Strom.	Splash	Wet-d.	Selec.	Unit-m.	3		Int-gear.		½-Ell.	½-Ell.	Left	Cent.		Beck
None	None	......		Ray.	Spl-press	Cone.	Selec.	Unit-j.	3	6½-1	Dbl chn	....	½-Ell.	½-Ell.	Left	Cent.	R-r	Bessemer .C
None	None			Ray.	Spl-press	Cone.	Selec.	Unit-j.	3	7½-1	Dbl chn		½-Ell.	Plat	Left	Cent.	R-r	Bessemer A
Cent.	Motor	1,000	14	Ray.	Spl-press	Cone.	Selec.	Amid.	3	7½-1	Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs.	Bessemer .D
Cent.	Motor.	800	18	Marvel	Splash	None	Fric	Unit-j.	Any	6 -1	Dbl chn.	....	½-Ell.	Ellip.	Left	St-col	R-r	Best .A
Cent.	Motor.	1,100	15	S.U.	Spl-press	Cone.	Ind-c	Amid	3	7¾-1	Top worm	Sub-f.	½-Ell.	½-Ell.	Right	Right	R-r.	Blair .C-1
Cent.	Motor.	1,000	14	S.U.	Spl-press	Cone.	Ind-c	Amid	3	8¾-1	Top worm	Sub-f.	½-Ell.	½-Ell.	Right	Right	R-r.	Blair .D-1
Cent.	Motor.	1,000	13	S.U.	Spl-press	Cone.	Ind-c	Amid	3	9¾-1	Top worm	Sub-f.	½-Ell.	½-Ell.	Right	Right	R-r.	Blair .E-1
Cent.	Motor.	1,200	12	S.U.	Spl-press	Cone.	Ind-c.	Amid	3	12 -1	Top worm	Sub-f.	½-Ell.	½-Ell.	Right	Right.	R-r.	Blair .F
				Mayer	Circ-spl	None	Fric.	Unit-j.	Any		Dbl chn	....	½-Ell.	½-Ell.	Left	Left	R-r	Brasie Packet
				Scheb.	Spl-press	Wet-d.	Plan	Unit-j.	2		Dbl chn	....	½-Ell.	½-Ell.	Right		R-r	Brasie Twin City
	...	......		Scheb.	Spl-press	Wet-d.	Selec.	Unit-j.	3		Dbl chn	....	½-Ell.	½-Ell.	Right	....	R-r	Brasie .Twin City
Cent.	Motor.	1,500	18	Scheb.	Circ-spl	Cone.	Selec.	Unit-j.	3	7 -1	Dbl chn	..	Ellip	Ellip	Left	Cent.	R-r	Brockway .G
Cent.	Motor	1,200	15	Scheb.	Circ-spl	Cone.	Selec.	Unit-j.	3	8½-1	Dbl chn		½-Ell.	Plat	Left	Cent.	R-r	Brockway .H
Cent.	Motor	1,200	15	Scheb.	Circ-spl	Cone.	Selec.	Unit-j.	3	8½-1	Dbl chn.		½-Ell.	Plat	Left	Cent.	R-r	Brockway .J
Cent.	Motor.	1,800	25	Marvel	Circ-spl	Cone	Selec.	Unit-s	3	6 -1	Bevel	T-arm.	½-Ell.	Ellip.	Left	Cent.	T-arm.	Buick .C-4
Cent.	Motor	800	12	Strom	Circ-spl.	Dry-p.	Selec.	Unit-j.	3	14 -1	Dbl chn	....	½-Ell.	½-Ell.	Right	Right	R-r	Bulley Tractor
None	None	750	15	Holley	Fuel-inj	Wet-d.	Plan	Amid	2	7½-1	Dbl chn		Ellip.	½-Ell.	Left	Cent.	R-r	Chase .S
Cent.	Motor.	1,200	22	Holley	Spl-press	Dry-p.	Selec.	Unit-m.	3	6¾-1	Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs	Chase .T
Cent.	Motor.	1,200	18	Holley	Spl-press	Dry-p.	Selec.	Unit-m.	3	7½-1	Top worm	Springs.	½-Ell.	½-Ell.	Right	Cent.	Springs	Chase R
Cent.	Motor.	1,200	18	Holley.	Spl-press	Dry-p.	Selec.	Unit-m.	4	5½-1	Top worm	Springs.	½-Ell.	½-Ell.	Right	Cent.	Springs.	Chase .O
Cent.	Motor.	1,000	16	Scheb.	Spl-press	Cone.	Selec.	Unit-j.	3	6¾-1	Dbl chn	.....	Ellip.	Ellip.	Right.	Right	R-r	Coleman .D
Cent.	Motor.	1,000	14	Scheb.	Spl-press	Cone.	Selec.	Unit-j.	3	9 -1	Dbl chn	.....	Ellip.	Plat	Right.	Right	R-r	Coleman .G
Cent.	Motor.	1,000	12	Scheb.	Spl-press	Cone.	Selec.	Unit-j	3	9½-1	Dbl chn	....	Ellip.	Plat	Right	Right	R-r.	Coleman H
		2,000	25	Holley	Circ-spl	Cone.	Selec.	Unit-m.	3	6 -1	Bevel	Tor-t.	½-Ell.	½-Ell.	Left*.	Cent.	Springs	Commerce S
Cent.	Motor.	1,200	......	Strom.	Circ-spl.	Cone	Selec.	. .	3		Opt.		½-Ell.	½-Ell.	Right	Right.	R-r	Continental F
Cent.	Motor.	1,200	......	Strom.	Circ-spl.	Cone.	Selec.	.	3	..	Opt.	.....	½-Ell.	½-Ell.	Right	Right	R-r	Continental .G
Cent.	Motor.	1,100	16	Strom.	Circ-spl.	Wet-d.	Selec.	Unit-j.	3	6½-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r.	Corbitt .F
Cent.	Motor.	1,200	15	Strom.	Circ-spl.	None	Elec	Unit-m.	5	25 -1	Bevel-4	Springs.	½-Ell.	½-Ell.	Right.	Cent.	R-r	Couple-Gear .HC
Cent.	Motor	1,000	12	Strom.	Circ-spl	None	Elec	Unit-m.	5	25 -1	Bevel-4.	Springs.	½-Ell.	½-Ell.	Right.	Cent.	R-r.	Couple-Gear .AC
Cent.	Motor.	2,000	15	Strom.	Circ-spl.	Cone.	Selec.	Amid	3	.	Dbl chn.	...	½-Ell.	½-Ell.	Right	......	R-r.	Crawford
Cent.	Motor	1,050	20	Strom.	Splash	Cone.	Selec.	Amid	4		Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs.	Crown. A
Cent.	Motor	1,050	15	Strom.	Circ-spl.	Cone.	Selec.	Amid	4		Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs.	Crown. B
Cent.	Motor.	1,050	12	Strom.	Circ-spl.	Cone.	Selec.	Amid	4	.	Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs.	Crown. C
Cent.	Motor	1,500	......	Excel	Spl-press	Cone.	Selec.	Amid	3		Dbl chn		½-Ell.	½-Ell.	Right	Right	R-r	Curtis
Cent.	Motor.	1,500	......	Excel.	Spl-press	Cone.	Selec.	Amid.	3		Dbl chn	.....	½-Ell.	½-Ell.	Right	Right	R-r	Curtis
Cent.	Motor.	850	10	Daimler.	Spl-press	R-cone	Selec.	Amid	4	9½-	Int-gear.	T-arm.	½-Ell.	½-Ell.	Right	Right	R-r.	Daimler, Amer. .FV
None	None	1,400	23	Strom.	Splash	Cone.	Selec.	Unit-s	3	6 -1	Bevel	Tor-t.	½-Ell.	½-Ell.	Left	Cent.	Tor-t.	Dart .A
None	None	1,200	20	Strom.	Splash	Dry-d.	Selec.	Unit-m.	3	Opt	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r	Dart .B
None	None	1,100	15	Strom.	Splash	Cone.	Selec.	Unit-j.	3	8½-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r.	Dart .C
			16	Opt.	Circ-spl.	Wet-d.	Selec.	Unit-j.	3	9½-1	Dbl chn.	.....	½-Ell.	Plat	Left	Cent.	R-r.	Dayton .U
		...	12	Opt.	Circ-spl.	Wet-d.	Selec.	Unit-j.	3	9½-1	Dbl chn.	......	½-Ell.	Plat	Left	Cent.	R-r.	Dayton .A
None	None	......	30	Zephyr.	Circ-spl	Cone.	Selec.	Unit-s	3	5½-1	Sing chn.		½-Ell.	T-Ell	Left	Cent.	R-r	Decatur .VI
None	None	2,000	25	Ray.	Circ-spl	Dry-d.	Selec.	Unit-m.	3	7½-1	Int-gear.	Springs.	½-Ell.	½-Ell.	Right	Cent.	Springs	Decatur .C
Cent.	Motor.	800	14	Strom.	Spl-press	Cone	Selec.	Unit-j.	3	6¾-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r.	DeKalb .D1
Cent.	Motor.	750	12	Strom.	Spl-press	Cone.	Selec.	Unit-j.	3	8½-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r.	DeKalb .D2
Cent.	Motor.	1,317	18	Strom.	Spl-press	Dry-d.	Selec.	Unit-m.	3	7½-1	Int-gear	Springs	½-Ell.	½-Ell.	Left	Cent.	Springs.	Denby .A
Cent.	Motor.	1,317	18	Strom.	Circ-spl.	Dry-d.	Selec.	Unit-m.	3	7½-1	Int-gear.	Springs.	½-Ell.	½-Ell.	Left	Cent.	Springs	Denby .B
Cent.	Motor	1,375	25	Strom.	Circ-spl	Dry-d.	Selec.	Unit-m.	3	4 -1	Bevel	T-arm.	½-Ell.	Plat	Left	Cent.	Springs	Dorris .1A4
Cent.	Motor.	946	15	Strom.	Circ-spl	Dry-d.	Selec.	Unit-m.	3	6½-1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r	Dorris .1A4
Cent.	Duplex	1,400	12	Scheb.	Circ-spl	Wet-d.	Selec.	Unit-m.	3	8 -1	Int-gear-4.	Springs	½-Ell.	½-Ell.	Left	Cent.	Springs	Duplex .C
Cent.	Duplex	1,400	12	Scheb.	Circ-spl.	Wet-d.	Selec.	Unit-m.	3	8 -1	Int-gear-4.	Springs	½-Ell.	½-Ell.	Left	Cent.	Springs	Duplex .D
None	None	1,000	20	Scheb.	Splash	None	Fric	Amid	Any	4 -1	Bevel	T-arm.	½-Ell.	Plat	Left	Cent.	Springs	Fargo E
..		......	18	Ray	Circ-spl	Cone.	Selec.	Unit-m.	3	6 -1	Doub-r.	T-arm.	½-Ell.	½-Ell.	Left	Cent.	Springs	Fargo .F
Cent.	Motor	1,120	15	Strom.	Circ-spl	Cone.	Selec.	Unit-j.	3	6 -1	Dbl chn		½-Ell.	½-Ell.	Left	Cent.	R-r.	Federal .GH
Cent.	Motor.	1,190	15	Strom.	Circ-spl	Cone.	Selec.	Amid.	3	8½-1	Top worm	Springs.	½-Ell.	½-Ell.	Left	Cent.	R-r	Federal .GW-HW
Cent.	Motor.	1,100	20	Marvel	Circ-spl.	Cone.	Selec.	Amid.	3	7 -1	Doub-r.	T-arm.	½-Ell.	½-Ell.	Left	Cent.	T-arm.	Flint .C
Cent.	Motor	1,200	15	Carter	Spl-press	Cone.	Selec.	Unit-j.	3	.....	Dbl chn	.	Comb.	Comb.	Left	Cent.	R-r.	Forschler .1A
Cent.	Motor.	1,000	14	Strom.	Spl-press	Wet-d.	Selec.	Amid.	3	9¾-1	Bevel-4.	T-arm.	½-Ell.	Plat	Right	Right.	Springs	Four Wheel Drive. G
Cent.	Motor.	1,000	14	Strom.	Spl-press	Wet-d.	Selec.	Amid	3	9 -1	Bevel-4.	T-arm	½-Ell.	Plat	Right	Right	Springs	Four Wheel Drive. B
Cent.	Motor.	1,000	10	Strom.	Spl-press	Wet-d	Selec.	Amid	3	12¾-1	Bevel-4.	T-arm	½-Ell.	Plat	Right	Right	Springs	Four Wheel Drive .M
None	None	......	......	Holley	Circ-spl	Cone.	Prog.	Unit-m.	3	8 -1	Int-gear.	Springs.	½-Ell.	½-Ell.	Right	Cent.	Springs	Fremont-Mais ... O

Carburetor Make. Strom, *Stromberg*. Scheb, *Schebler*; Ray, *Rayfield*; Excel, *Excelsior*; King, *Kingston*; B-Z, *Breeze-Zephyr*. **Lubrication.** Splash, *non-circulating or simple splash*; Circ-spl, *circulating-splash*, Spl-press, *splash-pressure*. Fuel-inj, *fuel injection, oil mixed with fuel*; Pressure, *pressure feed, no splash*. **Clutch Type,** Dry-p, *dry plate*, Dry-d, *dry multiple disk*, Wet-d, *wet disk or disk-in-oil*, R-cone, *reversed cone, or inverted cone*. Exp-s, *expanding shoe*; Cont-b, *contracting band*. **Gearset Type,** Prog, *progressive sliding gear*, Selec, *selective sliding gear*; Plan, *planetary*, Ind-c, *constant-mesh individual-clutch*; Fric, *friction*; Hyd, *hydraulic*, Elec, *electric*. **Gearset Location,** Amid, *amidships*, Unit-m, *unit with motor*; Unit-j, *unit with jackshaft*, Unit-a, *unit with axle*; Unit-s, *unit driveshaft*. **Final Drive,** Bevel, *bevel gear*, Double-r, *double-reduction, bevel and spur*; Int-g, *internal gear*; Top worm, *worm gear with worm on top*. Dbl chn, *double chain*; Sing chn, *single chain*, -f, *to front wheels*, -4, *to all four wheels*. **Driving Torque,** R-r, *radius rods*; T-arm, *torque-arm*, Tor-t, *torsion tube*, Sub-f, *sub-frame*. **Springs,** Ellip, *elliptic*; ½-Ell, *half-elliptic*, ¼-Ell, *quarter-elliptic*, ¾-Ell, *three-quarters-elliptic*; Plat, *platform*; T-ell, *transverse elliptic*, Cant, *cantilever*; Comb *combination of half-elliptic and elliptic on double frames*. **Steering,** Cent, *center*. **Levers,** Cent, *center*; C&r, *gearshift center, brake right*, C&l, *gearshift center, brake left*. St-col, *steering column*. **Propulsion** R-r, *radius rods*, T-arm, *torque arm*; Tor-t, *torsion tube*, Sub-f, *sub-frame*.

Gasoline Motor Trucks for 1915 Listed

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES		Location	CYLINDERS			S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear		No.	Bore in Ins.	Stroke in Ins.				Water Circulation	Radiator Type	Type	Make	Spare Advance
Gabriel. K	1,000	1,200	112	Pneu.	32x4	32x4	Under hood	4	3.50	5.00	19.61	Block	R&H	Cent	Z-z-t	Sing	Bosch	Fixed
Gabriel. H	1,500	1,600	126	Pneu.	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	L&H	Cent	Z-z-t	Sing	Bosch	Hand
Gabriel. M	3,000	2,300	144	Pneu.	36x5	36x5d	Under hood	4	4.12	5.25	27.20	Block	L&H	Cent	Z-z-t	Sing	Bosch	Hand
Garford. L	4,000	3,000	128*	Solid	36x5	40x3½d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford. J	6,000	3,500	128*	Solid	36x5	40x4d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford. K	8,000	3,850	128*	Solid	36x5	40x5d	Betw. seats	4	4.25	5.25	36.15	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford. D	10,000	4,500	128*	Solid	36x6	40x6d	Betw. seats	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
Garford. F	12,000	4,850	128*	Solid	36x6	40x7d	Betw. seats	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Dual	Bosch*	Hand
GASchacht. 2	4,000	2,800	138	Solid	38x3½	40x3½d	Under hood	4	4.25	5.50	29.00	Block	R&H	Cent	Cell.	Sing	Eisemann	Hand
GASchacht. 3	6,000	3,200	150	Solid	38x4	40x4d	Under hood	4	4.25	5.50	29.00	Block	R&H	Cent	Cell.	Sing	Eisemann	Hand
Geneva. B	1,500	700	96	Solid	34x2	36x2½	Under hood	2	5.12	4.50	21.10	Sing	.....	Gear	Finned	Sing	Opt	Fixed
GMC. 15	1,500	1,090	122	Pneu.	35x5	35x5	Under hood	4	3.50	5.00	19.61	Block	Right	Cent	Finned	Sing	Eisemann	Hand
GMC. VC	2,500	1,500	126	Solid	34x3	36x5	Under hood	4	3.50	5.25	19.61	Block	Right	Cent	Finned	Sing	Bosch	Hand
GMC. SC	4,000	1,900	143	Solid	34x4	36x3½d	Under hood	4	4.00	6.00	25.60	Block	Right	Cent	Finned	Sing	Bosch	Hand
GMC HU	7,000	2,500	158	Solid	36x5	42x5d	Under hood	4	5.00	5.00	40.00	Pairs	Left	Cent	Finned	Double	Mea	Hand
GMC. KU	10,000	3,000	158	Solid	36x6	42x6d	Under hood	4	5.00	5.00	40.00	Pairs	Left	Cent	Finned	Double	Mea	Hand
Gramm. 1½	3,000	2,600	120	Solid	34x3½	38x5	Betw. seats	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm. 2	4,000	3,600	128	Solid	36x4	36x3½d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm. 3½	7,000	4,600	140	Solid	36x5	36x5d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Gramm. 5	10,000	5,350	140	Solid	36x5	40x6d	Betw. seats	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Harvey. F	3,000	1,800	130	Solid	34x3½	38x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Z-z-t	Sing	Eisemann	Auto
Harvey. H	6,000	3,000	168	Solid	36x5	40x5d	Under hood	4	4.25	5.50	29.00	Block	Left	Cent	Z-z-t	Sing	Eisemann	Auto
Horner. 1	2,000	2,000	145	Solid	34x3½	34x4	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Horner. 1½	3,000	2,250	145	Solid	36x4	36x5	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Horner. 2	4,000	2,650	145	Solid	36x4	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Gear	Finned	Dual	Bosch	Hand
Horner. 3	6,000	3,200	145	Solid	36x5	40x4d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Finned	Dual	Bosch	Hand
Horner. 5	10,000	4,200	156	Solid	38x6	42x6d	Under hood	4	5.25	5.75	44.20	Pairs	Opp	Gear	Finned	Dual	Bosch	Hand
Hupmobile. HT	800	850	106	Pneu.	33x4	33x4	Under hood	4	3.25	5.50	16.92	Block	Left	Thermo	Cell.	Sing	Bosch	Hand
I. H. C. M	1,000	.....	90	Solid	42x2	42x2	Under seat	2	4.50	5.00	16.20	Sing	Head	Cent	Finned	Dual	Heinze	Hand
Independent. F	1,500	1,285	112*	Solid	36x3	36x3	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Z-z-t	Sing	Mea	Hand
Independent. E	3,000	1,850	122*	Solid	36x3½	36x5	Under hood	4	3.75*	5.25	22.50	Block	Left	Cent	Z-z-t	Sing	Mea	Hand
Indiana. B	3,000	1,900	135	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Dual	Bosch	Hand
Indiana. F	6,000	2,500	144	Solid	36x4	36x3½d	Under hood	4	4.25	5.25	29.00	Sing	Left	Cent	Finned	Dual	Bosch	Hand
Indiana. K	10,000	3,200	165	Solid	36x5	40x4d	Under hood	4	4.75	5.00	36.15	Sing	Left	Cent	Finned	Dual	Bosch	Hand
Jeffery. 1515	1,500	1,300	118	Pneu.	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Sq-t	Dual	Remy	Hand
Jeffery. 3015	3,000	1,650	130	Solid	34x3½	34x5	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Sq-t	Dual	Remy	Hand
Jeffery. 4015	4,000	2,750	124	Solid	36x5	36x5	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Z-z-t	Dual	Bosch	Hand
Kalamazoo. B	3,000	1,590	126	Solid	37x3½	37x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Z-z-t	Sing	Bosch	Hand
Kelly. K-30	2,000	2,000	120*	Solid	36x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Cell.	Sing	Eisemann	Auto
Kelly. K-35	4,000	2,750	144*	Solid	36x4	36x4d	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Cell.	Sing	Eisemann	Auto
Kelly. K-40	7,000	3,400	150*	Solid	38x5	38x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Cell.	Sing	Eisemann	Auto
Kelly. K-50	10,000	4,250	150*	Solid	38x6	40x6d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Cell.	Sing	Eisemann	Auto
King. 3½	7,000	3,200	120	Solid	36x5	36x5d	Under floor	4	4.50	5.50	32.40	Pairs	Left	Cent	Z-z-t	Dual	Bosch	2-pt
Kisselkar. 1500	1,500	1,500	125	Pneu.	35x4½	35x4½	Under hood	4	4.25	5.25	29.00	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar. 1	2,000	1,850	140	Pneu.	37x5	37x5	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar. 1½	3,000	2,100	132*	Solid	34x3½	38x5	Under hood	4	4.25	5.25	29.00	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar. 2½	5,000	2,750	144*	Solid	36x4	38x4d	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar. 3½	7,000	3,350	162	Solid	36x5	40x5d	Under hood	4	4.87	5.00	38.25	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kisselkar. 6	12,000	4,350	168	Solid	36x6	40x6d	Under hood	4	4.87	5.00	38.25	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Kleiber. 1½	3,000	2,000	140*	Solid	36x3½	36x5d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber. 2	5,000	2,750	150*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber. 3	7,000	3,300	160*	Solid	36x4½	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Z-z-t	Dual	Bosch*	Hand*
Kleiber. 5	10,000	4,000	170	Solid	36x5	40x6d	Under hood	4	5.00	5.75	40.00	Pairs	Opp	Cent	Z-z-t	Dual	Bosch*	Hand*
Knox Tractor 31	12,000	3,250	139	Solid	34x5	36x5d	Under hood	4	5.00	5.50	40.00	Sing	Head	Cent	Cell.	Dual-d	Bosch	Hand
Knox Tractor 32	20,000	3,750	140	Solid	34x5	38x6d	Under hood	4	5.00	5.50	40.00	Sing	Head	Cent	Cell.	Dual-d	Bosch	Hand
Koehler. 1	2,000	725	90	Solid	36x2½	36x2½	Under body	2	5.25	4.00	22.10	Sing	Top	Thermo	Finned	Sing	.....	Fixed
Kosmath. 1½	1,000	650	110	Pneu.	32x3½	34x4	Under hood	4	3.50	4.00	19.61	Pairs	Right	Cent	Finned	Sing	Eisemann	Fixed
Krebs. G	2,000	1,900	118	Solid	34x3½	34x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Auto
Krebs. H	4,000	2,350	141*	Solid	36x4	36x6	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Auto
LaFrance. 6	10,000	5,500	140	Solid	36x5	38x6d	Under hood	4	5.50	6.00	48.45	Pairs	Opp	Cent	Cell.	Dual	Bosch	Fixed
Lambert. V1	800	900	106	Pneu.	30x3½	31x4	Under hood	4	3.75	4.50	22.50	Pairs	Right	Cent	Cell.	Sing	Bosch	Fixed
Lambert. V2	1,500	1,125	114	Pneu.*	33x4*	33x4½*	Under hood	4	3.75	4.50	22.50	Pairs	Right	Cent	Cell.	Sing	Bosch	Fixed
Lambert. V3	2,000		120	Solid	36x4	36x3½	Under hood	4	4.06	4.50	26.27	Block	Left	Cent	Cell.	Dual	Briggs	Hand
Lambert. V4	3,000	1,900	120	Solid	36x4½	36x4	Under hood	4	4.50	5.00	32.40	Pairs	Left	Cent	Cell.	Dual	Briggs	Hand
Lambert. V5	4,000	2,200	120	Solid	36x4	36x5	Under hood	4	4.50	5.00	32.40	Pairs	Left	Cent	Cell.	Dual	Briggs	Hand
Lange. C	3,000	2,250	125	Solid	36x3½	38x4	Under hood	4	3.75	5.25	22.50	Block	Left	Thermo	Sq-t	Double	Conn	Hand
Lange. B	5,000	3,000	136	Solid	36x4	38x6	Under hood	4	4.12	5.25	27.20	Block	Left	Thermo	Sq-t	Double	Conn	Hand
Lewis. 21	5,000	2,900	144	Solid	34x3½	36x3½d	Under hood*	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Lewis. 31	6,000	3,250	144	Solid	36x4	36x5d	Under hood*	4	4.25	5.00	29.00	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
Lewis. 51	10,000	4,400	144*	Solid	36x6	38x6d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand

ABBREVIATIONS: General. *, *with other options,* Opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic.* Sol-st, *solid in front, steel in rear;* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear.* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinder Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type;* Top (2-cylinder motors only). *L-head cylinder laid horizontal with valves up,* R&h, *at right and in head, L-head cylinder,* L&h, *at left and in head, L-head cylinder;* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump,* Gear, *gear pump,* Thermo, *thermo-syphon circulation;* Air, *air-cooled, no water.* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honeycomb,* Sq-t, *square-tube or flat-tube,* Z-z-t *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto** (or other sparking device), Split, *Splitdorf;* Conn, *Connecticut,* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick,* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* L-b, *loose-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive,** Motor, *from motor;* D-shft *from driving shaft;* F-wheel, *from front wheel,* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

with Principal Specifications — Continued

MOTOR						TRANSMISSION							SPRINGS		CONTROL		Propulsion Taken By	Name and Model
GOVERNOR		SPEEDS		Carburetor Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers		
Type	Drive	Motor in R.p.m.	Truck in M.p.h				Type	Location	Speeds									
....	....	....	30	Opt	Spl-press	Cone.	Selec	Unit-m	3	4 -1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel K**
	....	....	35	Strom	Spl-press	Cone.	Selec	Amid	3	4½-1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel H**
....	....	....	20	Strom	Spl-press	Cone.	Selec	Amid	4	8 -1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	**Gabriel M**
Cent	Motor	1,140	14½	Own	Spl-press	Cone.	Selec	Unit-j	3	9½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford L**
Cent.	Motor	1,140	12½	Own	Spl-press	Cone.	Selec	Unit-j	3	10¾	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford J**
Cent	Motor	1,140	10½	Own	Spl-press	Cone.	Selec	Unit-j	3	12½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford K**
Cent	Motor	1,140	10½	Own	Spl-press	Cone.	Selec	Unit-j	4	13½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford D**
Cent.	Motor	1,140	8½	Own	Spl-press	Cone.	Selec	Unit-j	4	15½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Garford F**
Cent	Motor	1,000	15	Scheb.	Spl-press	Cone	Selec	Amid	3	7½-1	Top-worm	T-arm	½-Ell	Plat	Left	Cent	R-r	**GASchacht 2½**
Cent	Motor	1,000	12	Scheb.	Spl-press	Cone.	Selec	Amid	3	9¾-1	Top worm	T-arm	½-Ell	Plat	Left	Cent	R-r	**GASchacht 1**
.	.	....	18	Scheb.	Spl-press	Wet-d.	Plan	Unit-j	2	8 -1	Dbl chn		½-Ell	Ellip	Right	Right	R-r	**Geneva B**
xct	Motor	1,150	20	Marvel	Spl-press	Cone.	Selec	Amid	3	6 -1	Bevel	R-r	½-Ell	Ellip	Left	Cent	R-r	**GMC 15**
Cent	Motor	1,130	14	King	Spl-press	Cone.	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**GMC VC**
ent	Motor	900	12	King	Spl-press	Cone.	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**GMC SC**
ent.	Motor	800	11	Marvel	Spl-press	Wet-d.	Prog.	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**GMC HU**
Cent	Motor	800	8½	Marvel	Spl-press	Wet-d.	Prog.	Unit-j	3	12 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**GMC KU**
Cent	Motor	....	......	Opt	Circ-spl	Cone.	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Gramm 1½**
ent	Motor	....	......	Opt	Circ-spl	Cone.	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Gramm 2**
ent	Motor.	....	......	Opt	Circ-spl	Cone	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Gramm 3½**
Cent	Motor	....	......	Opt	Circ-spl	Cone.	Selec	Unit-j	3	......	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Gramm 5**
-b.	Motor	1,000	16	Holley	Circ-spl	Cone.	Selec	Unit-j	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Harvey F**
-b.	Motor	900	10	Holley	Circ-spl	Cone.	Selec	Unit-j	4	10¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Harvey H**
Cent.	Motor	1,200	19	Strom	Circ-spl	Dry-d	Selec	Amid	3	6½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner 1**
ent	Motor.	1,200	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	7 -1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner 1½**
ent	Motor.	1,200	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	9½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner 2**
nt	Motor	1,140	12	Strom	Circ-spl	Dry-d	Selec	Amid	3	9½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner 3**
nt	Motor	1,000	10	Strom	Circ-spl	Dry-d	Selec	Amid	3	13½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	**Horner 5**
Cent	Motor	1,500	20	Zenith	Circ-spl	Dry-d	Selec	Unit-m	3	4 -1	Bevel	Tor-t	½-Ell	Plat	Right	Cent	Tor-t	**Hupmobile HT**
...	.....	......	.....	Scheb.	Spl-press	Cont-b.	Ind-c	Unit-m	2	9½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	**I. H. C M**
Cent	Motor	1,350	18	Zephyr	Circ-spl	Dry-d	Selec	Unit-m	3	7½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Independent F**
ent	Motor	1,200	15	Zephyr	Circ-spl	Cone.	Selec	Unit-j	3	11½-1	Dbl chn		½-Ell	Plat	Right	Right	R-r	**Independent E**
-b	D-shft	1,200	17½	Scheb.	Circ-spl	Dry-d	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Indiana B**
-b	D-shft	1,200	15½	Scheb.	Circ-spl	Dry-d	Selec	Unit-j	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Indiana F**
-b.	D-shft	1,200	14½	Scheb.	Circ-spl	Dry-d	Selec	Unit-j	3	9¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Indiana K**
nt	Motor	1,100	22	Strom	Spl-press	Dry-p	Selec	Amid	3	4 -1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Tor-t	**Jeffery 1515**
nt	Motor.	1,100	15	Strom	Spl-press	Dry-p	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Jeffery 3015**
nt	Motor	1,100	14½	Strom	Spl-press	Dry-p	Selec	Amid	4	7¾-1	Int-g.	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Jeffery 4015**
ent	D-shft	1,600	15	Scheb.	Circ-spl	Cone.	Selec	Unit-j	3	.....	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kalamazoo B**
-b	Motor	1,200	15	Breeze	Pressure	Cone.	Selec	Amid	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kelly K-30**
	Motor.	1,200	11½	Breeze	Pressure	Cone	Selec	Amid	3	11½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kelly K-35**
	Motor	900	9½	Ray	Pressure	Cone.	Selec	Amid	3	11 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kelly K-40**
-b.	Motor	900	8½	Ray	Pressure	Cone.	Selec	Amid	3	12½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kelly K-50**
Cent	Motor	950	12	Scheb.	Circ-spl	Dry-d	Ind-c	Unit-j	3	8½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**King 3½**
nt	Motor.	1,200	25	Strom	Circ-spl	Cone.	Selec	Amid	2	5 -1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	**Kisselkar 1500**
	Motor	1,200	25	Strom	Circ-spl	Cone.	Selec	Amid	4	4½-1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	**Kisselkar 1**
	Motor.	1,200	15	Strom	Circ-spl	Cone.	Selec	Unit-j	4	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar 1½**
	Motor.	1,200	12	Strom	Circ-spl	Cone.	Selec	Unit-j	4	10 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar 2½**
nt	Motor.	1,200	11	Strom	Circ-spl	Cone.	Selec	Unit-j	4	11 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar 3½**
nt.	Motor.	1,200	10	Strom	Circ-spl	Cone	Selec	Unit-j	4	12¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Kisselkar 6**
nt	Motor.	1,200	18	Scheb*	Circ-spl	Wet-d.	Selec	Unit-j	3	7 -1*	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Kleiber 1**
	Motor.	1,200	16	Scheb*	Circ-spl	Wet-d.	Selec	Unit-j	3	9½-1*	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Kleiber 2**
	Motor	1,100	14	Scheb*	Circ-spl	Wet-d	Selec	Unit-j	3	9 -1*	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Kleiber 3**
nt	Motor	1,000	12	Scheb*	Circ-spl	Wet-d.	Selec	Unit-j	3	9½-1*	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	**Kleiber 5**
nt	Motor.	1,100	12	Strom	Pressure	Dry-p.	Selec	Amid	3	11 -1	Dbl chn		½-Ell	Cant	Right	Cent	R-r	**Knox Tractor 31**
nt	Motor	1,100	10½	Strom	Pressure	Dry-p.	Selec	Unit-j	3	12½-1	Dbl chn		½-Ell	Cant	Right	Cent	R-r	**Knox Tractor 32**
		....	20	King	Splash	Cone.	Plan	Unit-j	2	8 -1*	Dbl chn		½-Ell	Ellip	Left	Cent	R-r	**Koehler 1**
		1,100	25	Holley	Splash	Cone.	Selec	Unit-m	3	4 -1	Bevel	R-r.	½-Ell	Ellip	Left	..	R-r	**Kosmath 14**
nt	Motor.	1,025	15	Scheb.	Circ-spl	Cone.	Selec	Amid	3	6¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Krebs G**
nt	Motor	1,100	15	Scheb.	Circ-spl	Cone.	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	**Krebs H**
nt	Motor.	1,200	12	Scheb.	Spl-press	None	Hyd.	Unit-j	Any	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**LaFrance 6**
		.	.....	Excel	Spl-press	None	Fric	Amid	Any	3½-1	Sing chn		½-Ell	Ellip	Right	Right	R-r	**Lambert V1**
				Excel	Spl-press	None	Fric	Amid	Any	6 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Lambert V2**
				Scheb.	Spl-press	None	Fric	Amid	Any	6 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Lambert V3**
	Motor	800	10	Scheb.	Spl-press	None	Fric	Amid	Any	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Lambert V4**
	Motor.	800	9	Scheb.	Spl-press	None	Fric	Amid	Any	10¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	**Lambert V5**
	Motor	1,250	18	Strom	Circ-spl	Wet-d	Ind-c	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Lange C**
	Motor	1,250	15	Strom	Circ-spl	Wet-d.	Ind-c	Unit-j	3	9¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	**Lange B**
	Motor	1,200	14	Ray	Spl-press	Wet-d	Ind-c	Amid	3	8 -1	Dbl chn		½-Ell	Plat	Right	Right	R-r	**Lewis 21**
	Motor.	1,200	12	Ray	Spl-press	Wet-d.	Ind-c	Amid	3	8¾-1	Dbl chn		½-Ell	Plat	Right	Right	R-r	**Lewis 31**
	Motor	1,000	10	Ray	Spl-press	Wet-d.	Ind-c	Amid	3	11¼-1	Dbl chn		½-Ell	Plat	Right	Right	R-r	**Lewis 51**

arburetor **Make**, Strom, *Stromberg;* Scheb, *Schebler;* Ray, *Rayfield;* Excel, *Excelsior;* King, *Kingston;* B-Z, *Breeze-Zephyr.* **Lubrication**, Splash, *non-circulating or simple splash;* Circ-spl, *circulating-splash;* Spl-press, *splash-pressure*, Fuel-inj, *fuel injection, oil mixed with fuel;* Pressure, *pressure feed, no splash.* **Clutch Type**, Dry-p, *dry plate*, Dry-d, *dry multiple disk;* Wet-d, *wet disk or disk-in-oil*, R-cone, *ed cone or inverted cone.* Exp-s, *expanding shoe;* Cont-b, *contracting band.* **Gearset Type**, Prog, *progressive sliding gear;* Selec, *selective sliding gear;* Plan, *planetary;* Ind-c, *constant-mesh individual clutch;* *ction*, Hyd, *hydraulic*, Elec, *electric.* **Gearset Location**, Amid *amidships*, Unit-m, *unit with motor*, Unit-j, *unit with jackshaft*, Unit-x, *unit with axle;* **Unit-s**, *unit driveshaft.* **Final Drive**, Bevel, *bevel*, Double-r, *double-reduction, bevel and spur;* Int-g, *internal gear;* Top worm, *worm gear with worm on top;* Dbl chn, *double chain*, Sing chn, *single chain*, -4, *to front wheels*, -4, *to all four wheels.* **Driving** *thrust*, R-r, *radius rods*, T-arm, *torque-arm;* Tor-t, *torsion tube;* Sub-f, *sub-frame.* **Springs**, Ellip, *elliptic;* ½-Ell, *half-elliptic;* ¼-Ell, *quarter-elliptic*, ¾-Ell, *three-quarters-elliptic*, Plat, *platform;* T-ell, *transverse* *elliptic*, Cant, *cantilever;* Comb, *combination of half-elliptic and elliptic on double frames.* **Steering**, Cent, *center.* **Levers**, Cent, *center*, C&r, *gearshift center, brake right;* C&l, *gearshift center, brake left*, St-col, *steering column.* **Propulsion**, R-r, *radius rods;* T-arm, *torque arm*, Tor-t, *torsion tube*, Sub-f *sub-frame.*

Gasoline Motor Trucks for 1915 Listed

				TIRES			MOTOR											
					SIZES IN INCHES			CYLINDERS						COOLING		IGNITION		
Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	Kind	Front	Rear	Location	No.	Bore in Ins.	Stroke in Ins.	S.A.E. H.P.	Cylinders Cast	Valves Placed	Water Circulation	Radiator Type	Type	Make	Spark Advance
Lippard-Stew. B*	1,500	1,650	115*	Pneu.	35x4½	35x4½	Under hood.	4	3 75	5 25	22 50	Block	Left.	Cent..	Finned.	Sing ...	Eisemann..	Fixed
Lippard-Stew. BW*	1,500	1,775	115*	Pneu.	35x4½	35x4½	Under hood.	4	3 75	5 25	22 50	Block	Left	Cent..	Finned.	Sing ..	Eisemann	Fixed
Lippard-Stew. H	2,000	2,000	145	Solid...	36x3	36x5	Under hood.	4	3 75	5 25	22 50	Block	Left...	Cent..	Finned.	Sing...	Eisemann..	Fixed
Lippard-Stew. F	3,000	2,300	145*	Solid...	36x3½	36x3d	Under hood.	4	4 12	5 25	27 20	Block	Left....	Cent..	Finned.	Sing..	Eisemann.	Fixed
Lippard-Stew. G	4,000	2,600	155*	Solid...	36x4	36x4d	Under hood.	4	4 12	5 25	27 20	Block	Left.	Cent..	Finned.	Sing ...	Eisemann.	Fixed
Little Giant 17	2,000	1,350	110	Solid...	37x3	37x3½	Under floor	4	3 75	4 50	22 50	Block	Right	Thermo	Finned.	Dual....	King...	Hand
Locomobile A2	10,000	4,500	140*	Solid...	40x6	40x6d	Under floor	4	5 00	6 00	40 00	Pairs	Opp.	Cent...	Cell.	Dual...	Bosch..	Hand
Locomobile AA2	12,000	4,800	140*	Solid...	40x7	40x7d	Under floor	4	5 00	6 00	40 00	Pairs	Opp	Cent..	Cell..	Dual...	Bosch..	Hand
M & E B	7,000	3,500	152	Solid ..	36x6	36x5d	Under hood.	4	4 50	5 50	32 40	Block	Right	Cent..	Sq-t.....	Double...	Bosch..	Hand
M & E G	10,000	2,750	116	Sol-st	36x5d	40x6	Under hood.	4	4 25	5 25	29 00	Pairs.	Right	Cent..	Sq-t.....	Double...	Bosch..	Hand
Maccar B	2,000	1,900	138*	Solid..	36x4	36x5	Under hood.	4	4 12	5 25	27 20	Block	Left .	Cent..	Finned.	Dual...	Eisemann..	Hand
Maccar E	2,000	1,900	138*	Solid..	36x4	36x5	Under hood.	4	4 12	5 25	27 20	Block	Left	Cent..	Finned.	Dual...	Eisemann..	Hand
Maccar C	3,000	2,150	150*	Solid..	36x4	36x6	Under hood.	4	4 12	5 25	27 20	Block	Left	Cent..	Finned.	Dual...	Eisemann.	Hand
Maccar F	4,000	2,300	150*	Solid	36x4	36x4d	Under hood.	4	4 12	5 25	27 20	Block	Left...	Cent..	Finned	Dual..	Eisemann..	Hand
Maccar D	4,000	2,400	150*	Solid..	36x4	36x4d	Under hood.	4	4 12	5 25	27 20	Block	Left....	Cent..	Finned.	Dual...	Eisemann..	Hand
McIntyre E	1,500		120	Solid...	34x3	34x3½	Under hood.	4	3 75	5 00	22 50	Block	Right	Thermo	Cell.	Sing	Bosch..	Hand
McIntyre A	3,000		144	Solid...	34x3½	36x4d	Under hood.	4	4 12	5 25	27 20	Block	Left	Thermo	Cell	Sing	Bosch..	Hand
McIntyre G	6,000		144	Solid...	36x4	36x4d	Under hood.	4	4 12	5.25	27 20	Block	Left..	Thermo	Cell.	Sing.	Bosch..	Hand
Mais C	3,000	2,750	119	Solid...	37x4	37x5	Under hood.	4	4 00	5 25	25 60	Block	Opp.	Cent..	Cell.	Sing	Eisemann..	Auto...
Mais D	3,000	2,500	112	Solid...	37x4	37x5	Under hood.	4	4 00	5 25	25 60	Block	Opp..	Cent...	Cell.	Sing	Eisemann.	Auto...
Mais E	4,000	2,950	132	Solid.	37x4	37x4d	Under hood	4	4 00	5 25	25 60	Block	Opp	Cent..	Cell.	Sing	Eisemann..	Auto...
Mais F	4,000	3,000	145	Solid..	37x4	37x4d	Under hood.	4	4 00	5 25	25 60	Block	Opp	Cent..	Cell.	Sing	Eisemann..	Auto...
Mais G	5,000	3,200	145	Solid...	37x5	37x4d	Under hood.	4	4 31	5 25	29 69	Block	Opp..	Cent..	Cell.	Sing	Eisemann..	Auto...
Mais H	6,000	3,400	160	Solid...	37x5	37x5d*	Under hood.	4	4 31	5 25	29 69	Pairs.	Opp.	Cent..	Cell.	Sing	Eisemann..	Auto...
Mais [illegible]	10,000	2,750	84	Solid...	37x4	37x7	Under hood.	4	4 31	5 25	29 69	Block	Opp..	Cent..	Cell.	Sing	Eisemann..	Auto...
Martin R	2,000	[illegible]	105	Solid...	36x3½	36x4	Under hood.	4	4 00	5 00	25 60	Block	Left .	Cent..	Finned.	Dual...	Remy..	Hand
Martin S	3,000	2,150	121	Solid...	36x3½	40x4	Under floor	4	4 00	5 00	25 60	Block	Left	Cent..	Finned.	Dual...	Remy..	Hand.
Martin E	5,000	3,000	135	Solid...	[illegible]	40x3½d	Under floor	4	4 25	5 00	27 20	Pairs	Opp	Cent..	Finned..	Dual...	Remy..	Hand
Martin L	7,000	3,500	145	Solid...	36x5	40x4d	Under floor	4	4 75	5 50	36 15	Pairs	Opp....	Cent..	Finned.	Dual...	Remy..	Hand.
Menominee A3	1,500	1,125	112	Solid...	33x3½	33x3½	Under hood	4	3 75	4 50	22 50	Pairs.	Left ..	Cent.	Finned.	Dual...	Bosch..	Hand
Menominee B3	2,000	1,400	122	Solid...	34x3½	34x4	Under hood	4	4 00	5 00	25 60	Pairs	Left.	Thermo	Finned.	Dual...	Bosch..	Hand
Menominee C	3,000	1,800	130	Solid...	36x4	36x5	Under hood.	4	4 00	5 00	25 60	Pairs.	Left ...	Thermo	Finned.	Dual...	Bosch..	Hand.
Mercury P	1,000	...	84	Solid...	38x2	40x2	Under floor	2	4 25	4 00	14 50	Sing	Opp....	Air	.....	Dual...	Remy..	Fixed
Modern L	2,000	1,750	136	Solid*..	36x3½	36x3½	Under hood	4	3 75	5 25	22 50	Block.	Right ..	Cent..	Cell.	Dual...	Bosch..	Hand
Modern H	3,000	1,950	136*	Solid...	36x4	36x5*	Under hood.	4	4 12	5 25	27 20	Block	Right	Cent.	Cell.	Dual...	Bosch..	Hand
Modern M	3,000	2,000	136*	Solid...	36x4	36x5*	Under hood.	4	4 12	5 25	27 20	Block	Right	Cent..	Cell..	Dual...	Bosch..	Hand.
Moon B	3,000	1,800	125*	Solid...	36x3½	36x4	Under hood.	4	3.75	5 25	22 50	Block	Left ..	Gear..	Cell..	Dual...	Remy..	Hand
Moore 1½	3,000	1,950	145	Solid...	37x3½	37x4	Under hood.	4	4 12	5 25	27 20	Block	Left..	Cent..	Sq-t	Dual....	Bosch..	Hand
Moore 2	4,000	2,500	163	Solid...	37x4	37x3½d	Under hood.	4	4 50	5 50	32 40	Pairs.	Left	Cent..	Sq-t .	Dual...	Bosch...	Hand
Moore 3	6,000	3,150	142	Solid...	37x5	37x4d	Under floor	4	4 50	5 50	32 40	Pairs.	Left.	Cent..	Sq-t	Dual...	Bosch..	Hand
Moore 4	8,000	3,500	153	Solid..	37x5	37x5d	Under floor	4	4 75	5 50	36 15	Pairs.	Opp .	Cent..	Sq-t	Dual...	Bosch..	Hand
Moore 5	10,000	4,500	175	Solid...	37x6	42x6d	Under floor	4	5 25	7 00	44 20	Pairs..	Opp	Cent..	Sq-t	Dual...	Bosch..	Hand
Moreland 7X	1,500	1,600	126	Solid*..	34x3½	34x3½	Under hood.	4	3 75	5 25	22 50	Block	Left..	Cent..	Finned.	Sing	West	Hand
Moreland 1X	3,000	2,050	120	Solid..	34x3½	34x5	Under floor	4	4 12	5 25	27 20	Block.	Left .	Cent..	Finned.	Sing..	West.	Hand
Moreland 2X	5,000	2,650	144	Solid...	34x4	34x4d	Under floor	4	4 50	5 50	32 40	Pairs.	Left.	Cent..	Finned.	Sing..	West.	Hand
Moreland 3X	7,000	3,500	168	Solid...	36x5	36x5d	Under floor.	4	4 75	5 75	36 15	Pairs.	Left..	Cent..	Finned.	Sing....	West.	Hand
Moreland 5X	10,000	4,000	168	Solid...	36x6	40x6d	Under floor	4	4 75	6 75	36 15	Pairs.	Left..	Cent..	Finned.	Sing..	West.	Hand
Moreland 6X	13,000	4,500	168	Solid.	36x5	40x6d	Under floor.	4	5 25	7 00	44 20	Pairs.	Opp.	Cent..	Finned.	Sing	Bosch..	Hand
Motokart 1&2	500	365	69	Pneu.	26x2½	26x2½	Under seat.	2	3.62	4 00	10 53	Sing....	Head ..	Thermo	Sq-t	Sing	None.	Hand
Natco 20	2,000	1,025	104	Solid...	36x3½	36x3½	Betw seats	4	3.50	5 00	19 61	Block	Right	Thermo.	Finned.	Sing	U & H..	Fixed
Nelson&LeM. E1	2,000	1,800	Opt	Solid...	36x3	36x4	Under hood.	4	3 75	5 25	22 50	Block	L&H.	Cent..	Finned..	Dual..	Bosch..	Fixed
Nelson&LeM. E1½	3,000	2,000	Opt...	Solid...	36x4	36x5	Under hood.	4	4 12	5 25	27 20	Block	L&H.	Cent..	Finned.	Dual...	Bosch...	Hand
Nelson&LeM. E2	4,000	2,250	Opt...	Solid...	36x4	36x6	Under hood.	4	4 12	5 25	27 20	Block	L&H.	Cent..	Finned..	Dual...	Bosch...	Hand
Natco C	3,000	2,250	144	Solid....	36x3½	36x5	Under hood.	4	4 12	5.25	27 20	Block.	Left..	Cent..	Finned..	Sing	Eisemann..	Fixed
New York L	3,000	2,000	129	Solid...	36x3½	36x5	Under hood.	4	3 75	5 25	22 50	Block	Left.	Cent..	Sq-t .	Sing	Bosch....	Fixed
O. K. C&D	1,200	875	112	Pneu....	33x4	33x4	Under hood	4	3 50	5 00	19 61	Block.	R&H ..	Thermo	Z-s-t....	Sing	Bosch....	Fixed
Old Hickory 30W	3,000	1,900	110	Solid....	33x3½	33x4	Under floor	4	3 75	5 00	22 50	Block..	Right	Thermo	Z-s-t.....	Dual.....	Heinze....	Hand.
Old Reliable 1½	3,000	2,250	138	Solid....	34x3½	36x6	Under hood	4	3 75	5 00	22 50	Block	Left...	Cent...	Sq-t	Sing*...	Bosch..	Hand
Old Reliable 2	4,000	2,750	120	Solid....	34x4	36x4d	Under floor	4	4 25	5 00	29 00	Pairs.	Opp...	Cent..	Sq-t ...	Sing*...	Bosch....	Hand
Old Reliable 3	6,000	3,400	122	Solid....	34x5	40x5d	Under floor.	4	4 25	5 00	29 00	Pairs.	Opp .	Cent..	Sq-t	Sing*	Bosch...	Hand
Old Reliable 4	8,000	4,000	126	Solid..	36x5	36x5d	Under floor	4	4 75	5 50	36 15	Pairs.	Opp	Cent...	Sq-t	Sing*..	Bosch..	Hand
Old Reliable 5	10,000	4,500	126	Solid..	36x6	36x6d	Under floor	4	4 75	5 50	36 15	Pairs	Opp.	Cent..	Sq-t...	Sing*..	Bosch..	Hand
Old Reliable 7	14,000	5,000	126	Solid...	36x6	40x7d	Under floor	4	4 75	6 75	36 15	Pairs.	Left	Cent..	Sq-t .	Sing*..	Bosch..	Hand
Overland 81	800	850-c*	106	Pneu .	33x4	33x4	Under hood.	1	4 00	4 50	25 60	Sing	Left....	Thermo.	Sq-t..	Sing...	Split.	Hand
Packard 2	4,000	2,800	120*	Solid...	34x3½	34x4d	Under hood	4	4 06	5 12	26 39	Pairs.	Opp....	Cent....	Cell.	Sing..	Eisemann..	Auto...
Packard 3	6,000	3,400	126*	Solid...	36x4	36x5d	Under hood	4	4 50	5 50	32 40	Pairs.	Opp ..	Cent....	Cell.	Sing....	Eisemann..	Auto...
Packard 4	8,000	3,550	126*	Solid....	36x5	40x5d	Under hood	4	4 50	5 50	32 40	Pairs	Opp ..	Cent..	Cell.	Sing...	Eisemann..	Auto...
Packard 5	10,000	4,150	144*	Solid..	36x6	40x6d	Under hood	4	5 00	5 50	40 00	Pairs.	Opp	Cent..	Cell.	Sing...	Eisemann..	Auto...
Packard 6	12,000	4,300	144*	Solid .	36x6	42x7d	Under hood.	4	5 00	5 50	40 00	Pairs	Opp ..	Cent..	Cell.	Sing	Eisemann..	Auto...
Palmer-Moore D	2,000	1,300	102	Solid...	36x2½	36x3	Under hood..	3	4 00	4 00		Sing....	2-cy..	Thermo	Finned.	Sing..	Bosch....	Fixed
Paulding O	600	650	95	Pneu.	30x3	31x3½	Under hood.	4	2 75	4 00	12 08	Block	R&H	Thermo	Finned.	Dual...	Day-D..	Hand

ABBREVIATIONS: General, *, *with other options;* Opt, *optional.* **Price,** -c, *complete with body.* **Tires, Kind,** Pneu, *pneumatic;* Sol-st, *solid in front, steel in rear.* P&s, *pneumatic in front, solid in rear;* P&c, *pneumatic in front, cushion in rear;* C&s, *cushion in front, solid in rear.* **Tire Sizes,** d, *dual.* **Motor Location,** Betw seats, *between seats.* **Cylinder Cast,** Sing, *singly or individually.* **Location of Valves,** Opp, *opposite, or T-head type.* Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up,* R&h, *at right and in head, L-head cylinder;* L&h, *at left and in head, L-head cylinder,* 2-cyc, *two-cycle motor, no valves;* Back, *L-head motor placed transversely with valves at rear.* **Water Circulation,** Cent, *centrifugal pump;* Gear, *gear pump;* Thermo, *thermo-syphon circulation.* Air, *air-cooled, no water.* **Radiator Type,** Finned, *finned-tube;* Cell, *cellular or honeycomb;* Sq-t, *square-tube or flat-tube;* Z-s-t, *zig-zag-tube or crimped flat-tube.* **Ignition, Type,** Sing, *single;* Doub, *double;* Dual-d, *dual-double.* **Make of Magneto (or other sparking device),** Split, *Splitdorf;* Conn, *Connecticut;* King, *Kingston;* West, *Westinghouse;* Day-D, *Dayton-Dick;* Atw-K, *Atwater-Kent.* **Spark Advance,** Auto, *automatic;* 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance.* **Governor Type,** Cent, *centrifugal;* Lds, *lone-ball;* Suct, *suction;* Hyd, *hydraulic.* **Governor Drive, Motor,** *from motor;* D-s, *from driving shaft;* F-wheel, *from front wheel;* Gearset, *from gearset countershaft;* Duplex, *from both the motor and the driving shaft, by overrunning clutches.*

with Principal Specifications — Continued

MOTOR						TRANSMISSION							SPRINGS		CONTROL		Propulsion Taken By	Name and Model
GOVERNOR		SPEEDS		Carburetor Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers		
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
nt..	Motor..	1,230	25	Opt...	Spl-press	Cone..	Selec..	Amid	3	5½-1	Bevel	T-arm..	½-Ell.....	½-Ell...	Left	Cent..	Springs.	Lippard-Stew. B*
nt.	Motor.	1,230	25	Opt...	Spl-press	Cone.	Selec..	Amid	3	6 -1	Top worm	T-arm..	½-Ell..	½-Ell...	Left	Cent..	Springs	Lippard-Stew BW*
nt	Motor.	1,134	18	Opt ..	Spl-press	Cone.	Selec...	Amid.	3	6½-1	Top worm	Springs.	½-Ell...	½-Ell .	Left	Cent..	Springs.	Lippard-Stew H
nt	Motor..	1,300	18	Opt...	Spl-press	Cone.	Selec...	Amid..	3	7½-1	Top worm	Springs.	½-Ell...	½-Ell .	Left	Cent..	Springs.	Lippard-Stew F
nt .	Motor..	1,295	15	Opt....	Spl-press	Cone.	Selec...	Amid...	3	9½-1	Top worm	Springs	½-Ell...	½-Ell..	Left	Cent..	Springs.	Lippard-Stew .. G
		1,200	12	Holley	Circ-spl	Wet-d..	Selec...	Unit-j...	3	7¼-1	Dbl chn	...	½-Ell...	½-Ell..	Left..	Cent..	R-r ..	Little Giant .. H
ng .	Motor..	900	10½	Own	Spl-press	Dry-d..	Selec...	Unit-j...	4	10½-1	Dbl chn	.....	½-Ell..	½-Ell..	Right	Right	R-r ..	Locomobile. A2
ng	Motor..	900	10½	Own	Spl-press	Dry-d..	Selec...	Unit-j...	4	10½-1	Dbl chn		½-Ell..	½-Ell..	Right	Right.	R-r...	Locomobile.. AA2
			15	Strom...	Circ-spl	Wet-d.	Selec...	Unit-j...	3	12 -1	Dbl chn-f.	......	½-Ell..	½-Ell..	Left	Cent..	R-r	M&E.. B
			10	Strom...	Circ-spl	Wet-d.	Selec...	Unit-m...	3	14 -1	Dbl chn-f.		½-Ell..	½-Ell..	Right	Right	R-r	M&E. G
nt	Motor	1,000	14	Strom...	Circ-spl	Dry-d..	Selec...	Unit-m. .	3	7¼-1	Dbl chn		½-Ell..	Plat	Left	Cent...	R-r	Maccar B
nt	Motor	1,000	16	Strom...	Circ-spl	Dry-d .	Selec...	Unit-m...	3	6½-1	Top worm	Springs.	½-Ell...	½-Ell..	Left	Cent..	Springs.	Maccar E
	Motor	1,000	12	Strom...	Circ-spl	Dry-d..	Selec...	Unit-m...	3	6¾-1	Dbl chn	..	½-Ell...	Plat	Left	Cent...	R-r	Maccar C
nt	Motor	1,000	12	Strom...	Circ-spl	Dry-d...	Selec...	Unit-m...	3	8 -1	Dbl chn		½-Ell..	Plat	Left	Cent...	R-r	Maccar F
nt	Motor	1,000	14	Strom...	Circ-spl	Dry-d...	Selec...	Unit-m...	3	8 -1	Top worm	Springs	½-Ell..	½-Ell..	Left..	Cent...	Springs	Maccar.. D
	None	1,500	15	Scheb. ..	Circ-spl	Cone.	Selec...	Amid	3	..	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	McIntyre E
	Motor	1,500	12	Strom...	Circ-spl	Dry-d...	Selec...	Unit-m...	3		Dbl chn		½-Ell..	½-Ell..	Right	Cent..	R-r	McIntyre A
	Motor	1,500	6	Strom...	Circ-spl	Dry-d...	Selec...	Unit-m...	3		Dbl chn		½-Ell..	½-Ell..	Right	Cent..	R-r	McIntyre G
	Gearset.	1,150	15	Ray ..	Circ-spl	Exp-s	Prog. .	Unit-m...	3		Int-g. ..	Tor-t	½-Ell..	½-Ell..	Left	Left.	R-r	Mais C
	Gearset.	1,150	15	Ray	Circ-spl	Exp-s	Prog.	Unit-m...	3		Int-g.	Tor-t	½-Ell..	½-Ell	Left	Left	R-r	Mais D
	Gearset	1,150	15	Ray	Circ-spl	Exp-s	Prog. ..	Unit-m..	3		Int-g	Tor-t	½-Ell..	½-Ell	Left	Left.	R-r	Mais E
	Gearset	1,150	15	Ray ..	Circ-spl	Exp-s	Prog.	Unit-m...	3		Int-g.	Tor-t.	½-Ell	½-Ell	Left	Left	R-r.	Mais F
	Gearset	1,250	12	Ray ..	Circ-spl	Exp-s	Prog.	Unit-m...	3	...	Int-g.	Tor-t..	½-Ell..	½-Ell..	Left	Left.	R-r .	Mais G
	Gearset..	1,250	12	Ray	Circ-spl	Exp-s	Prog.	Unit-m...	3		Int-g.	Tor-t	½-Ell..	½-Ell .	Left	Left.	R-r	Mais H
	Gearset.	.		Ray .	Circ-spl	Exp-s	Prog..	Unit-m..	3		Int-g.	Tor-t .	½-Ell..	½-Ell..	Left	Left	R-r	Mais... ...Tractor
	None	.		Strom...	Pressure..	Dry-d...	Selec...	Unit-m...	3	6½-1	Dbl chn		½-Ell..	½-Ell .	Left	Cent..	R-r ..	Martin. R
	None			Strom...	Pressure..	Wet-d.	Selec...	Unit-j...	3	9 -1	Dbl chn		½-Ell..	½-Ell	Right	Right	R-r	Martin S
t	Motor.	1,000	13½	Strom...	Pressure...	Wet-d.	Selec...	Unit-j...	3	9 -1	Dbl chn	. .	½-Ell .	½-Ell	Right	Right	R-r ...	Martin .E
nt	Motor.	1,000	13	Strom...	Pressure...	Wet-d.	Selec...	Unit-j...	3	9½-1	Dbl chn		½-Ell.	½-Ell..	Right	Right	R-r.	Martin L
nt	Motor.	1,400	20	Strom...	Spl-press	Wet-d.	Selec...	Unit-m ..	3	5¾-1	Bevel	Tor-t	½-Ell..	Plat	Right	Cent..	R-r	Menominee A3
nt..	F-wheel	1,200	16	Strom...	Spl-press	Dry-d...	Selec...	Unit-m...	3	7 -1	Doub-r...	T-arm..	½-Ell	Plat .	Right	Cent..	R-r	Menominee B3
nt ..	F-wheel	1,400	14	Strom...	Spl-press	Dry-p...	Selec...	Unit-m...	3		Doub-r ..	T-arm..	½-Ell..	Plat	Right	Cent..	R-r	Menominee .C
		1,000	15	Own	Spl-press	Wet-d..	Plan..	Unit-m ...	2	8 -1	Dbl chn		Ellip.	Ellip..	Right	Right	R-r	Mercury P
nt	Motor	1,230	18	Scheb.	Spl-press	Dry-d...	Selec...	Unit-m...	3	6¾-1	Top worm	Springs.	½-Ell.	½-Ell..	Left	Cent..	R-r	Modern.........L
nt	Motor.	1,200	16	Scheb.	Spl-press	Cone.	Selec...	Unit-j...	3	9 -1	Dbl chn	Blank..	½-Ell .	½-Ell .	Left	Cent..	R-r	Modern........ H
nt .	Motor.	1,200	16	Scheb..	Spl-press	Dry-d...	Selec....	Unit-m...	3	8 -1	Top worm	Springs.	½-Ell..	½-Ell..	Left.	Cent..	R-r	Modern........ M
				Strom...	Circ-spl ..	Cone.	Selec....	Amid	3	7 -1	Dbl chn		½-Ell..	½-Ell..	Left...	Cent..	R-r	Moon ..... B
nt	Motor	1,000	18 11	Scheb.	Spl-press	Cone...	Selec...	Unit-j....	3	6¾-1	Dbl chn		½-Ell..	½-Ell..	Left .	Cont..	R-r	Moore 1½
nt	Motor	1,000	17 4	Scheb.	Spl-press	Cone..	Selec...	Unit-j....	3	6¾-1	Dbl chn		½-Ell..	½-Ell..	Left .	Cent.	R-r	Moore 2
	Motor	1,000	14	Scheb.	Spl-press	Cone..	Selec...	Unit-j....	3	6¼-1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	Moore ... 3
t	Motor	1,000	12	Scheb.	Spl-press	Cone..	Selec....	Unit-j....	3	8½-1	Dbl chn.		½-Ell..	½-Ell..	Right	Right	R-r	Moore 4
	Motor.	950	10	Scheb.	Spl-press	Cone..	Selec....	Unit-j....	4	9½-1	Dbl chn		½-Ell..	½-Ell..	Right.	Right	R-r.	Moore . 5
		1,500	20	Master..	Circ-spl	Dry-d...	Selec....	Unit-m....	3	6 -1	Top worm	R-r	½-Ell..	½-Ell..	Right.	Cent..	R-r	Moreland 7X
		1,300	18	Master..	Circ-spl	Dry-d...	Selec....	Unit-m....	3	6¾ 1	Top worm	R-r	½-Ell..	½-Ell..	Right	Cent..	R-r	Moreland 1X
nt.	Motor.	1,100	15	Master ..	Circ-spl	Dry-d...	Selec....	Unit-m....	3	6¾-1	Top worm	Springs.	½-Ell .	½-Ell..	Right	Cent..	R-r	Moreland 2X
	Motor.	950	12	Master..	Circ-spl	Dry-d...	Selec....	Amid .	4	10½-1	Top worm	Springs.	½-Ell..	½-Ell..	Right	Cent..	R-r	Moreland 3X
	Motor	950	10	Master..	Circ-spl .	Dry-d...	Selec...	Unit-j....	4	12 -1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	Moreland 5X
nt	Motor	900	8	Master..	Pressure...	Cont-b..	Selec...	Unit-j...	4	12 -1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	Moreland 6X
		1,400	28		Splash .	None..	Fric ...	Amid....	Any		Sing chn...		½-Ell..	½-Ell..	Left. .	Cent...	R-r	Motokart 1&2
	None	1,100	15	Zenith	Pressure...	Cone...	Selec...	Unit-j...	3	6½-1	Dbl chn-f .		½-Ell..	½-Ell..	Left..	Cent...	R-r.	Natco 20
	Motor.	950	17	Ray	Circ-spl	Dry-d...	Selec...	Unit-m...	3	6½-1	Top worm	Springs.	½-Ell..	½-Ell..	Right	Cent..	Springs.	Nelson&LeM E1
	Motor	950	15	Ray	Circ-spl	Dry-d...	Selec...	Unit-m...	3	6½-1	Top worm	Springs.	½-Ell	½-Ell..	Right	Cent..	Springs	Nelson&LeM. E1½
	Motor.	950	15	Ray....	Circ-spl...	Dry-d...	Selec...	Unit-m...	3	7½-1	Top worm	Springs.	½-Ell..	½-Ell..	Right	Cent..	Springs.	Nelson&LeM. E2
	D-shft		15	Zenith ..	Circ-spl..	Dry-d...	Selec...	Unit-m...	3	7½-1	Top worm	Springs.	½-Ell..	½-Ell..	Left ...	Cent .	Springs.	Natco.... C
	Motor	1,000	18	Strom...	Spl-press.	Cone. .	Selec....	Unit-j...	3	3½-1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	New York L
				Strom....	Circ-spl	Cone. ..	Selec....	Unit-m...	3	5 -1	Bevel	R-r	½-Ell....	Ellip..	Left .	Cent...	R-r	O. K....... C&D
nt..	Motor	1,265	16	Holley....	Spl-press	Cone...	Selec...	Unit-m...	3	7½-1	Top worm	Springs.	½-Ell..	½-Ell..	Left ..	Left. .	Springs.	Old Hickory.. 30W
		1,600	16	Carter	Spl-press	Dry-d...	Selec....	Unit-m ...	3	7½-1	Top worm	Springs.	½-Ell..	½-Ell...	Right	Cent..	Springs	Old Reliable 1½
		1,400	15	Strom....	Spl-press	Wet-d.	Selec....	Unit-j...	3	6½-1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	Old Reliable 2
		1,400	14	Strom....	Spl-press	Wet-d.	Selec...	Unit-j...	3	7½-1	Dbl chn		½-Ell...	½-Ell..	Right	Right	R-r	Old Reliable.... 3
	D-shft.	1,400	14	Strom....	Spl-press	Wet-d.	Selec...	Unit-j...	3	7½-1	Dbl chn	.	½-Ell..	½-Ell..	Right	Right	R-r	Old Reliable 4
	D-shft.	1,400	12	Strom....	Spl-press	Wet-d.	Selec...	Unit-j..	3	8½-1	Dbl chn		½-Ell..	½-Ell..	Right.	Right	R-r	Old Reliable 5
	D-shft..	1,000	10	Carter	Spl-press	Wet-d.	Selec...	Unit-j...	3	8½-1	Dbl chn	..	½-Ell..	½-Ell..	Right	Right	R-r ..	Old Reliable 7
				Scheb. ...	Circ-spl...	Cone..	Selec...	Unit-x	3	3¾-1	Bevel	Tor-t...	½-Ell..	¾-Ell..	Left	Cent..	Tor-t...	Overland . 81
	Motor .	1,000	14	Own	Splash ...	Dry-p...	Prog. ..	Unit-j...	3	8½-1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	Packard 2
	Motor	1,000	12	Own	Splash ...	Dry-p...	Prog.	Unit-j...	3	11 -1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	Packard 3
	Motor.	1,000	12	Own	Splash ...	Dry-p...	Prog...	Unit-j...	3	12 -1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	Packard 4
	Motor.	1,000	8½	Own	Splash....	Dry-p...	Prog.	Unit-j...	3	11½-1	Dbl chn		½-Ell..	½-Ell..	Right	Right	R-r	Packard . 5
	Motor.	1,000	8½	Own .	Splash....	Dry-p...	Prog.	Unit-j...	3	11½-1	Dbl chn		½-Ell..	½-Ell....	Right	Right	R-r	Packard .6
		1,400	20	Own .	Fuel-inj...	Dry-d...	Selec...	Unit-j...	3	6½-1	Dbl chn		½-Ell..	½-Ell...	Right	Cent..	R-r	Palmer-Moore. D
		1,300	25	Zephyr..	Circ-spl	Cone....	Selec...	Unit-m...	3		Bevel .	Tor-t	½-Ell..	½-Ell..	Right	Cent..	Tor-t	Paulding .... O

buretor **Make**, Strom, *Stromberg*; Scheb, *Schebler*; Ray, *Rayfield*; Excel, *Excelsior*; King, *Kingston*; B-Z, *Breeze-Zephyr*. **Lubrication**, Splash, *non-circulating or simple splash*; Circ-spl, *circulating-*
sion, Spl-press, *splash-pressure*, Fuel-in, *fuel injection, oil mixes with fuel*; Pressure, *pressure feed, no splash*. **Clutch Type**, Dry-p, *dry plate*; Dry-d, *dry multiple disk*; Wet-d, *wet disk or disk-in-oil*; R-cone,
reverse cone or inverted cone. Exp-s, *expanding shoe*; Cont-b, *contracting band*. **Gearset Type**, Prog, *progressive sliding gear*; Selec, *selective sliding gear*. Plan, *planetary*; Ind-c, *constant-mesh individual-clutch*;
friction, Hyd, *hydraulic*, Elec, *electric*. **Gearset Location**, mid, *amidships*; Unit-m, *unit with motor*, Unit-j, *unit with jackshaft*. Unit-x, *unit with axle*; Unit-s, *unit driveshaft*. **Final Drive**, Bevel,
bevel. Double-r, *double-reduction, bevel and spur*, Int-g, *internal gear*. Top worm, *worm gear with worm on top*, Dbl chn, *double chain*, Sing chn, *single chain*; -f, *to front wheels*; -4, *to all four wheels*. **Driving**
Torque, R-r, *radius rods*, T-arm, *torque-arm*; Tor-t, *torsion tube*, Sub-f, *sub-frame*. **Springs**, Ellip, *elliptic*; ½-Ell, *half-elliptic*; ¼-Ell, *quarter-elliptic*; ¾-Ell, *three-quarters-elliptic*; Plat, *platform*; T-ell, *transverse*
type, Cant, *cantilever*; Comb, *combination of half-elliptic and elliptic on double frames*. **Steering**, Cent, *center*. **Levers**, Cent, *center*; C&r, *gearshift center, brake right*; C&l, *gearshift center, brake left*;
St-col, *steering column*. **Propulsion**, R-r, *radius rods*; T-arm, *torque arm*; Tor-t, *torsion tube*; Sub-f, *sub-frame*.

Gasoline Motor Trucks for 1915 Listed

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES		Location	CYLINDERS			S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear		No.	Bore in Ins.	Stroke in Ins.				Water Circulation	Radiator Type	Type	Make	Spark Advance
Paulding H	1,500	950	120	Solid	36x2½	36x3	Under hood	4	3.50	5.00	19.61	Block	R&H	Thermo	Finned	Dual	Day-D	Hand
Paulding G	2,000	1,300	120	Solid	36x3	36x3½	Under hood	4	4.00	5.25	25.60	Block	R&H	Thermo	Finned	Dual	Day-D	Hand
Paulding M	4,000	1,950	145	Solid	36x4	36x4d	Under hood	4	4.62	5.25	34.25	Block	R&H	Gear	Finned	Dual	Day-D	Hand
Peerless 3	6,000	3,700	151*	Solid	36x5	40x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 4	8,000	4,000	151*	Solid	36x5	40x5d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 5	10,000	4,500	151*	Solid	36x6	42x6d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Peerless 6	12,000	5,000	151*	Solid	36x6	42x7d	Under hood	4	4.50	6.50	32.40	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Pierce-Arrow 2	4,000	3,000	150*	Solid	36x4	36x4d	Under hood	4	4.00	5.50	25.60	Pairs	Opp	Cent	Finned	Sing	Bosch	Hand
Pierce-Arrow 5	10,000	4,500	168*	Solid	36x5	40x6d	Under hood	4	4.87	6.00	38.25	Pairs	Opp	Cent	Finned	Dual	Bosch	Hand
Reo J	4,000	1,650	130*	Solid	36x4	36x3½d	Under hood	4	4.12	4.50	27.20	Pairs	R&H	Cent	Finned	Dual	Nat'l	Hand
Republic 1500	1,500	....	124	Solid*	35x3*	35x3½*	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Republic 1	2,000	1,350	124	Solid	35x3	35x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Republic 1½	3,000	1,475	144	Solid	35x3½	35x5*	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Roland 1	2,000	2,000	120	Solid	34x3½	36x4	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Roland 3	6,000	3,500	144	Solid	36x5	36x5d	Under hood	4	4.25	6.75	29.00	Pairs	Right	Cent	Finned	Dual	Eisemann	Auto
Roland 3½	7,000	3,500	156	Solid	36x5	40x5d	Under hood	4	4.50	6.75	32.40	Pairs	Right	Cent	Finned	Dual	Eisemann	Auto
Rowe CW	3,000	2,450	144	Solid	34x3½	36x3d	Under hood	4	4.00	5.00	25.60	Block	......	Thermo	Sq-t	Dual	Bosch	Hand
Rowe DW	4,000	2,800	150	Solid	36x4	36x4d	Under hood	4	4.25	5.00	29.00	Pairs	......	Cent	Sq-t	Dual	Bosch	Hand
Rowe EW	6,000	3,400	156	Solid	36x5	40x5d	Under hood	4	4.00	5.50	25.60	Pairs	......	Cent	Sq-t	Dual	Bosch	Hand
Rowe GW	10,000	4,500	171	Solid	36x6	40x6d	Under hood	4	4.75	5.50	36.15	Pairs	......	Cent	Sq-t	Dual	Bosch	Hand
Royal B3½	7,000	3,400	132	Solid	36x5	40x5d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Cell	Dual	Bosch	Fixed
Royal AS	10,000	4,500	138	Solid	36x6	40x6d	Under floor	4	4.75	5.50	36.15	Pairs	Opp	Cent	Cell	Dual	Bosch	Fixed
Sandow 1½	3,000	1,900	125*	Solid	36x3	36x4	Under hood	4	3.75	5.25	22.50	Block	L&H	Gear	Cell	Sing	Bosch	2-pt
Sandow 2	4,000	2,250	125*	Solid	36x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	L&H	Gear	Cell	Sing	Bosch	2-pt
Sandow 3	6,000	3,000	147*	Solid	36x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	L&H	Gear	Cell	Dual	Bosch	2-pt
Sanford O	1,500	1,290	120	Solid*	36x3*	36x3½*	Under hood	4	3.50	5.12	19.61	Block	Right	Thermo	Finned	Sing	Split	Fixed
Sanford K	3,000	1,660	106	Solid	36x3½	36x3½	Under floor	4	4.00	4.50	25.60	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Sanford L	4,000	1,910	118	Solid	36x3½	36x4	Under floor	4	4.12	5.00	27.20	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Sanford M	4,000	1,910	140	Solid	36x3½	36x5	Under hood	4	4.12	5.00	27.20	Pairs	Left	Cent	Finned	Dual	Bosch	Hand
Saxon A2	400	395-c	96	Pneu.	28x3	28x3	Under hood	4	2.62	4.00	11.23	Block	Left	Thermo	Cell	Sing	Atw-K	Auto
Selden JB	3,000	2,000	150	Solid	36x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Fixed
Service W	2,000	2,000	135*	Solid	36x3½	36x5	Under hood	4	3.75	5.50	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Service O	3,000	1,975	150	Solid	36x3½	36x5	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service P	4,000	2,375	150	Solid	36x4	40x3½d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service PW	4,000	2,500	160	Solid	36x4	36x4d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service H	6,000	2,975	171	Solid	36x5	40x5d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Cell	Sing	Eisemann	Hand
Service HX	10,000	4,000	175*	Solid	36x6	40x6d	Under hood	4	4.75	6.75	36.15	Block	Right	Cent	Cell	Dual	Eisemann	Hand
Signal D	2,000	1,400	120	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal DL	2,000	1,450	144	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal F	2,000	1,500	120	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Signal FL	2,000	1,550	144	Solid	34x3	36x4	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Finned	Sing	Eisemann	Fixed
Smith A	7,000	3,750	168	Solid	36x5	36x5d	Under hood	4	5.00	5.75	40.00	Pairs	Opp	Cent	Finned	Doub	Eisemann	Hand
Smith C	12,000	4,750	168	Solid	36x6	40x6d	Under hood	4	5.25	5.75	44.20	Pairs	Opp	Cent	Finned	Doub	Eisemann	Hand
South Bend 40	4,000	2,000	136*	Pneu*	36x4½*	36x4½*	Under hood	4	4.00	5.00	25.60	Pairs	Opp	Cent	Sq-t	Dual	Bosch	Hand
South Bend 80	8,000	3,000	152	Pneu*	39x6*	39x6*	Under hood	4	5.25	7.00	44.20	Pairs	Opp	Cent	Sq-t	Dual*	Bosch*	Hand
Speedwell 8Y	4,000	2,850	115	Solid	36x4	36x3½d	Under floor	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Speedwell 10Z	8,000	3,750	115	Solid	36x5	36x5d	Under floor	4	5.00	5.00	40.00	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Speedwell 8X	12,000	4,400	130	Solid	36x6	36x6d	Under floor	4	5.00	5.00	40.00	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Standard-D 3	6,000	2,750	144	Solid	36x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Sing	Eisemann	Fixed
Standard-D 7	14,000	3,300	112	Solid	40x6	40x6d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Sing	Eisemann	Fixed
Standard-O DX	1,500	1,700	....	Pneu.	34x4½	34x4½	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-s-t	Sing	Eisemann	Hand
Standard-O A	2,000	1,700	134	Solid*	36x4*	36x4	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-s-t	Sing	Eisemann	Fixed
Standard-O AX	2,000	1,900	124*	Solid*	36x4*	36x4	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-s-t	Sing	Eisemann	Hand
Standard-O B	3,000	1,800	134*	Solid*	37x4½*	36x4½	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-s-t	Sing	Eisemann	Fixed
Standard-O BX	3,000	2,100	134*	Solid*	37x4½*	36x5	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-s-t	Sing	Eisemann	Fixed
Standard-O C	4,000	2,000	144*	Solid*	37x5*	36x5*	Under hood	4	4.00	4.50	25.60	Pairs	Right	Cent	Z-s-t	Sing	Eisemann	Fixed
Standard-O CX	7,000	3,200	162	Solid	36x5	36x5d	Under hood	4	4.37	6.00	30.65	Pairs	Right	Cent	Z-s-t	Sing	Eisemann	Hand
Stegeman	1,500	1,600	125	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	3,000	2,100	150	C&S	34x3½	36x5	Under hood	4	3.75	5.25	22.50	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	5,000	2,800	142*	Solid	34x3½	36x3½dh	Under hood	4	4.25	5.25	29.00	Block	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	7,000	3,350	155*	Solid	36x4	40x4dh	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Stegeman	10,000	4,200	168	Solid	36x6	40x6dh	Under hood	4	4.50	6.75	32.40	Pairs	Left	Cent	Sq-t	Sing	Eisemann	Auto
Sternberg	1,000	850-c	88	Pneu.	30x4	30x4	Under hood	4	2.75	4.00	12.08	Block	Right	Thermo	Sq-t	Sing	Eisemann	Hand
Sternberg	4,000	2,800	148*	Solid	36x5	36x3½d*	Under hood	4	3.75	5.75	22.50	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	6,000	3,400	158*	Solid	36x6	36x4d*	Under hood	4	4.25	5.25	29.00	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	10,000	4,500	....	Solid	38x6	40x6d	Under hood	4	4.50	5.75	32.40	Pairs	Right	Cent	Cell	Sing	Eisemann	Auto
Sternberg	12,000	4,600	144	Solid	38x6	42x6d	Under floor	4	4.75	6.75	36.15	Pairs	Right	Cent	Sq-t	Dual	Eisemann	Auto
Sternberg	14,000	4,750	144	Solid	38x7	42x7d	Under floor	4	4.75	6.75	36.15	Pairs	Right	Cent	Sq-t	Dual	Eisemann	Auto
Stewart-B	1,500	1,500	124	Pneu.	34x4½	34x4½	Under hood	4	3.50	5.00	19.61	Block	Right	Thermo	Cell	Sing	Bosch	Fixed
Stewart-K C	2,000	1,100	96	Solid	36x3	36x3	Under seat	2	5.00	5.50	20.00	Sing	Head	Cent	Finned	Dual	King	Hand
Studebaker 5	1,500	865	108	Pneu.	34x4½	34x4½	Under hood	4	3.50	5.00	19.61	Block	Left	Cent	Finned	Dual	....	Hand
Sullivan G	3,000	1,600	120	Solid	36x3	36x4	Under hood	4	3.75	4.50	22.50	Block	Right	Thermo	Finned	Sing	Bosch	Fixed
Tiffin A	1,500	1,600	112	Solid	34x3	34x3	Under hood	4	3.75	4.50	22.50	Block	Right	Thermo	Finned	Sing	Bosch	Hand

ABBREVIATIONS: General, *, *with other options*; Opt, *optional*. **Price**, -c, *complete with body*. **Tires, Kind**, Pneu, *pneumatic*; Sol-st, *solid in front, steel in rear*; P&s, *pneumatic in front, solid in rear*; P&c, *pneumatic in front, cushion in rear*; C&s, *cushion in front, solid in rear*. **Tire Sizes**, d, *dual*. **Motor Location**, Betw seats, *between seats*. **Cylinder Cast**, Sing, *singly or individually*. **Location of Valves**, Opp, *opposite, or T-head type*; Top (2-cylinder motors only), *L-head cylinder laid horizontal with valves up*. R&h, *at right and in head, L-head cylinder*. L&h, *at left and in head, L-head cylinder*; 2-cyc, *two-cycle motor, no valves*; Back, *L-head motor placed transversely with valves at rear*. **Water Circulation**, Cent, *centrifugal, pump*; Gear, *gear pump*, Thermo, *thermo-syphon circulation*; Air, *air-cooled, no water*. **Radiator Type**, Finned, *finned-tube*. Cell, *cellular or honeycomb*; Sq-t, *square-tube or flat-tube*; Z-s-t, *zig-zag-tube or crimped flat-tube*. **Ignition, Type**, Sing, *single*; Doub, *double*; Dual-d, *dual-double*. **Make of Magneto** (or other sparking devices), Split, *Splitdorf*; Conn, *Connecticut*; King, *Kingston*; West, *Westinghouse*; Day-D, *Dayton-Dick*; Atw-K, *Atwater-Kent*. **Spark Advance**, Auto, *automatic*; 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance*. **Governor Type**, Cent, *centrifugal*; L-b, *loose-ball*; Suct, *suction*; Hyd, *hydraulic*. **Governor Drive**, Motor, *from motor*; D-shft *from driving shaft*, F-wheel, *from front wheel*; Gearset, *from gearset countershaft*; Duplex, *from both the motor and the driving shaft, by overrunning clutches*.

with Principal Specifications — Continued

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carbureter Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
				Scheb.	Circ-spl	Cone.	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Paulding H
		1,800	30	Scheb.	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	Plat	Right	Cent	R-r	Paulding G
				Scheb.	Circ-spl	Dry-d	Selec		3		Dbl chn		½-Ell	Plat	Right	Cent	R-r	Paulding M
Cent	Motor	925	14½	Peerless	Splash	Cone.	Selec	Amid	4	7½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Peerless 3
Cent	Motor	925	12½	Peerless	Splash	Cone.	Selec	Amid	4	8½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Peerless 4
Cent	Motor	925	10½	Peerless	Splash	Cone.	Selec	Amid	4	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Peerless 5
Cent	Motor	925	10	Peerless	Splash	Cone.	Selec	Amid	4	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Peerless 6
Cent	Motor	1,050	16	Own	Pressure	Cone.	Selec	Amid	3		Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Pierce-Arrow 2
Cent	Motor	950	14	Own	Pressure	Cone.	Selec	Amid	3		Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Pierce-Arrow 5
Hyd	Motor	1,200	12	Holley	Circ-spl	Dry-d	Selec	Amid	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Reo J
Suct	Motor	1,050	18	Strom	Spl-press	Dry-d	Selec	Unit-m	3	6½-1	Int-g.	Springs	½-Ell	½-Ell	Left	Cent	Springs	Republic 1500
Suct	Motor	1,000	15	Strom	Spl-press	Cone.	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Republic 1
Suct	Motor	1,000	15	Strom	Spl-press	Cone.	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Republic 1½
None	None	1,500	18	G&A	Circ-spl	None	Elec	Amid	2		Dbl chn		½-Ell	½-Ell	Left	Left	R-r	Roland 1
Cent	Motor	900	12	G&A	Circ-spl	None	Elec	Amid	2		Top worm	Springs	Ellip	Ellip	Left	Left	Springs	Roland 3
Cent	Motor	900	12	G&A	Circ-spl	None	Elec	Amid	2		Dbl chn		½-Ell	½-Ell	Left	Left	R-r	Roland 3½
	Motor			Ray	Pressure	Dry-d	Selec		3		Top worm	Springs	½-Ell	½-Ell	Right	R&C		Rowe CW
	Motor			Ray	Pressure	Dry-d	Selec				Top worm	Springs	½-Ell	½-Ell	Right	R&C		Rowe DW
	Motor			Ray	Pressure	Dry-d	Selec				Top worm	Springs	½-Ell	½-Ell	Right	R&C		Rowe EW
				Ray	Pressure	Wet-d.			2		Top worm	Springs	½-Ell	½-Ell	Right	R&C		Rowe GW
L-b.	Motor	900	15	Strom	Pressure	Wet-d	Ind-c	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Royal B3½
L-b.	Motor	900	12	Strom	Pressure	Wet-d.	Ind-c	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Royal A5
Cent	Motor			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Sandow 1½
Cent	Motor			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Sandow 2
Cent	Motor			Strom	Circ-spl	Dry-d.	Selec	Unit-m	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Sandow 3
		1,100	15	Muir	Circ-spl	Dry-d	Selec	Unit-m	3	7-1	Int-g.	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sanford O
Cent		1,100	16	Scheb.	Circ-spl	Wet-d.	Selec	Unit-m	3	7-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Sanford K
Cent	Motor	1,100	14	Scheb.	Circ-spl	Wet-d.	Selec	Unit-m	3	7-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Sanford L
Cent	Motor	1,100	14	Scheb.	Circ-spl	Dry-d	Selec	Unit-m	3	7-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Sanford M
		1,600	40	Mayer	Splash	Dry-p	Prog	Unit-x	2	4½-1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Tor-t	Saxon A2
Cent*	Motor	1,150	16	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Selden JB
Cent*	Motor	1,000	16	Strom	Spl-press	Cone.	Selec	Amid	3	6½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Service W
Cent*	Motor	1,000	14	Strom	Spl-press	Cone.	Selec	Unit-j	3	8-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Service Q
Cent*	Motor	1,000	12	Strom	Spl-press	Cone.	Selec	Unit-j	3	9-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Service P
Cent*	Motor	1,000	14	Strom	Pressure	Cone.	Selec	Amid	3	7½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Service PW
Cent*	Motor	1,000	11	Strom	Spl-press	Cone.	Selec	Unit-j	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Service H
Cent	Motor	870	12	Strom	Spl-press	Cone	Selec	Unit-j	4	6½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Service HX
Suct	Motor	1,200	15	Strom	Circ-spl	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Signal D
Suct	Motor	1,200	12	Strom	Circ-spl	Cone.	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Signal DL
Suct	Motor	1,200	15	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Signal F
Suct	Motor	1,200	12	Strom	Circ-spl	Dry-d	Selec	Unit-m	3	6½-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Signal FL
Suct	Motor	900	12	Strom	Circ-spl	Dry-d.	Ind-c	Unit-e	3	8½-1	Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Tor-t	Smith A
Suct	Motor	1,000	9	Strom	Circ-spl	Dry-d	Ind-c	Unit-e.	3	8½-1	Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Tor-t	Smith C
Suct	F-wheel	1,800	25	Strom	Spl-press	Wet-d	Selec	Unit-j	3	4-1	Dbl chn		½-Ell	½-Ell	Opt	Opt	R-r	South Bend 40
Suct	F-wheel	1,400	30	Strom	Spl-press	Wet-d.	Selec	Unit-j	3*	4-1	Dbl chn		½-Ell	½-Ell	Right	R&C	R-r	South Bend 30
Cent	Motor	1,100	15	Scheb.	Circ-spl	Cone.	Selec	Amid	3	9½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Speedwell 8Y
Cent	Motor	1,200	12	Scheb.	Circ-spl	Cone.	Selec	Amid	3	10½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Speedwell 10Z
Cent	Motor	1,200	10	Scheb.	Circ-spl	Cone	Selec	Amid	3	10½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Speedwell 8X
Suct	Motor	1,200	12	Strom	Circ-spl	Dry-d	Prog	Unit-m	3	9-1	T-worm*	T-arm*	½-Ell	½-Ell	Left	Cent	Springs*	Standard-D 3
Suct	Motor	1,200	10	Strom	Circ-spl	Dry-d	Prog	Unit-m	3		Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Standard-D 7
L-b.	Motor			Strom	Circ-spl	Dry-d	Selec	Amid	3	5¾-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Standard-O DX
L-b.	Motor	1,250	15	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Standard-O A
L-b.	Motor	1,250	15	Strom	Circ-spl	Dry-d.	Selec	Amid	3	6½-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Standard-O AX
L-b.	Motor	1,250	15	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Standard-O B
L-b.	Motor	1,250	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	7½-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Standard-O BX
L-b.	Motor	1,250	15	Strom	Circ-spl	Dry-d	Selec	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Standard-O C
L-b.	Motor	1,000	14	Scheb.	Circ-spl	Dry-d	Selec	Amid	3	8½-1	Top worm	Springs	½-Ell	½-Ell	Right	Cent	Springs	Standard-O CX
Cent	Motor	1,100	20	Carter	Spl-press	Dry-d	Selec	Unit-m	3	6-1	Bevel	R-r	½-Ell	½-Ell	Left	Cent	R-r	Stegeman
Cent	Motor	1,100	15	Carter	Spl-press	Dry-d	Selec	Unit-m	3	8-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Stegeman
Cent	Motor	1,100	13	Carter	Spl-press	Dry-d	Selec	Unit-m	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Stegeman
Cent	Motor	1,100	12	Carter	Spl-press	Dry-d	Selec	Unit-m	3	11½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Stegeman
Cent	Motor	1,100	10	Carter	Spl-press	Dry-d	Selec	Unit-m	3	14½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Stegeman
None	None	1,500	19		Spl-press	Cone.	Selec	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sternberg
Cent	Motor	1,020	14	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sternberg
Cent	Motor	1,020	13	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sternberg
Cent	Motor	1,000	11	Holley	Circ-spl	Dry-p	Ind-c	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Sternberg
Cent	Motor	950	10	Holley	Circ-spl	Wet-d.	Ind-c	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Sternberg
Cent	Motor	950	10	Holley	Circ-spl	Wet-d.	Ind-c	Amid	3		Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Sternberg
Cent	Motor		30	Zenith	Circ-spl	Dry-d	Selec	Unit-m	3	5½-1	Bevel	T-arm	½-Ell	½-Ell	Left	Cent	Springs	Stewart-B
		600	15	Scheb.	Spl-press	Wet-d.	Plan	Unit-m	2		Dbl chn		½-Ell	½-Ell	Left		R-r	Stewart-K C
			20	Scheb.	Circ-spl	Cone.	Selec	Unit-x	3	4½-1	Bevel	T-arm	½-Ell	Ellip	Left*	Cent*	R-r	Studebaker 5
Cent	Motor	1,350	15	Holley	Circ-spl	Cone.	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	Plat	Left	Cent	R-r	Sullivan G
None	None			Breeze	Circ-spl	Cone.	Selec	Unit-j	3	6½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Tiffin A

Carbureter Make. Strom, *Stromberg*; Scheb, *Schebler*; Ray, *Rayfield*; Excel, *Excelsior*; King, *Kingston*; B-Z, *Breeze-Zephyr*. **Lubrication.** Splash, *non-circulating or simple splash*; Circ-spl, *circulating-splash*; Spl-press, *splash-pressure*; Fuel-inj, *fuel injection, oil mixed with fuel*; Pressure, *pressure feed, no splash*. **Clutch Type.** Dry-p, *dry plate*; Dry-d, *dry multiple disk*; Wet-d, *wet disk or disk-in-oil*; R-cone, *reversed cone or inverted cone*; Exp-s, *expanding shoe*; Cont-b, *contracting band*. **Gearset Type.** Prog, *progressive sliding gear*; Selec, *selective sliding gear*; Plan, *planetary*; Ind-c, *constant-mesh individual-clutch*; Fric, *friction*; Hyd, *hydraulic*; Elec, *electric*. **Gearset Location.** Amid, *amidships*; Unit-m, *unit with motor*; Unit-j, *unit with jackshaft*; Unit-x, *unit with axle*; Unit-e, *unit driveshaft*. **Final Drive.** Bevel, *direct bevel*; Doub-r, *double-reduction, bevel and spur*; Int-g, *internal gear*; Top worm, *worm gear with worm on top*; Dbl chn, *double chain*; Sing chn, *single chain*; -f, *to front wheels*; -4, *to all four wheels*. **Driving torque** R-r, *radius rods*; T-arm, *torque-arm*; Tor-t, *torsion tube*; Sub-f, *sub-frame*. **Springs.** Ellip, *elliptic*; ½-Ell, *half-elliptic*; ¼-Ell, *quarter-elliptic*; ¾-Ell, *three-quarters-elliptic*; Plat, *platform*; T-ell, *transverse elliptic*; Cant, *cantilever*; Comb, *combination of half-elliptic and elliptic; on double frames*. **Steering.** Cent, *center*; St-col, *steering column*. **Levers.** Cent, *center*; C&r, *gearshift center, brake right*; C&l, *gearshift center, brake left*; **Propulsion.** R-r, *radius rods*; T-arm, *torque arm*; Tor-t, *torsion tube*; Sub-f, *sub-frame*.

Gasoline Motor Trucks for 1915 Listed

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase in Inches	TIRES			MOTOR											
				Kind	SIZES IN INCHES		Location	CYLINDERS			S.A.E. H.P.	Cylinders Cast	Valves Placed	COOLING		IGNITION		
					Front	Rear		No.	Bore in Ins.	Stroke in Ins.				Water Circulation	Radiator Type	Type	Make	Spark Advance
Tiffin G	2,000	2,000	128	Solid	36x3½	36x4	Under hood	4	3.75	4.25	22.50	Block	Left	Cent	Finned	Sing	Bosch	Hand
Tiffin M	4,000	2,700	140	Solid	36x4	30x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Finned	Sing	Bosch	Hand
Trabold T	2,000	1,250	118	Solid	36x3	38x3½	Under hood	4	3.50	5.00	19.61	Block	Right	Cent	Cell	Dual	Briggs	Hand
Trabold	4,000	2,450	130	Solid	36x4	38x3½d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Cell	Dual	West	Hand
Trabold	6,000	3,300	130	Solid	36x4	38x4d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Cell	Dual	West	Hand
Trumbull 15D	500	395-c	80	Pneu	28x3	28x3	Under hood	4	2.87	4.00	13.37	Block	Right	Thermo	Finned	Sing	Split	Fixed
Universal C	3,000	1,950	132	Solid	34x3½	34x5	Under hood	4	3.75	5.25	22.50	Block	Right	Thermo	Finned	Sing	Eisemann	Hand
Universal A	6,000	3,400	132	Solid	36x5	36x4d	Under floor	4	4.00	5.50	25.60	Pairs	Opp	Cent	Cell	Dual	Eisemann	Hand
U. S. E	4,000	2,550	132	Solid	34x3½	36x3½d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. G	5,000	2,750	138	Solid	34x4	36x4d	Under hood	4	4.12	5.25	27.20	Block	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. D	6,000	3,200	144	Solid	34x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
U. S. F	8,000	3,550	156	Solid	34x5	36x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Hand
Velie X	2,000	2,000	129*	Solid*	36x3½*	36x4	Under hood	4	4.62	5.25	34.23	Pairs	Left	Cent	Cell	Dual	Bosch	Fixed
Velie U	3,000	2,250	140	Solid	36x4	36x5*	Under hood	4	4.62	5.25	34.23	Pairs	Left	Cent	Sq-t	Dual	Bosch	Fixed
Velie	5,000	2,850	148*	Solid	36x4	36x4½	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Dual	Bosch	Fixed
Velie Z	8,000	3,350	148*	Solid	36x5	40x5d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Dual	Bosch	Fixed
Velie Z5	10,000	3,750	148*	Solid	36x6	40x6d	Under hood	4	4.50	5.50	32.40	Pairs	Left	Cent	Cell	Dual	Bosch	Fixed
Vim L&F	1,000	620	94	Pneu	30x3½	30x3½	Under hood	4	3.00	4.50	14.40	Block	Right	Thermo	Finned	Sing	Atw-K	Hand
Vulcan 2	5,000	2,750	150*	Solid	36x4	30x3½d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell	Dual-d	Bosch	Hand
Vulcan 3	7,500	3,250	156*	Solid	36x5	38x4d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell	Dual-d	Bosch	Hand
Vulcan 4	9,200	4,000	162	Solid	35x5	35x5d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell	Dual-d	Bosch	Hand
Vulcan 5	11,500	4,500	162	Solid	36x6	36x6d	Under hood	4	4.33	5.50	29.99	Pairs	Left	Thermo	Cell	Dual-d	Bosch	Hand
Vulcan 7	15,500	6,000	156*	Solid	36x7	42x7d	Under hood	4	4.75	5.50	36.13	Pairs	Left	Gear	Cell	Dual-d	Bosch	Hand
Wagenhals	800	600-c	80	P&C	30x3	34x4½	Under hood	4	3.50	3.37	19.61	Pairs	Back	Gear	Finned	Dual		Hand
Walter S	10,000	4,500	144	Solid	40x6	40x5d	Under hood	4	4.37	6.00	30.63	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter 6	12,000	4,750	144	Solid	40x6	40x5d	Under hood	4	4.37	6.00	30.63	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter 7½	15,000	5,000	144	Solid	40x6	40x6d	Under hood	4	4.37	6.00	30.63	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Walter Tractor	24,000	4,500	108	Solid	40x4d	40x4d	Under hood	4	4.37	6.00	30.63	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Ware	6,000			Solid			Under hood	4	4.00	5.50	25.60	Pairs		Gear			Mea	
White GBBE	1,500	2,100	133½	Pneu	34x4½	34x4½	Under hood	4	3.75	5.12	22.50	Block	Right	Cent	Cell	Sing	Bosch	Hand
White TBC	3,000	3,000	145½	Pneu	36x4½	36x3½d	Under hood	4	3.75	5.12	22.50	Block	Right	Cent	Cell	Sing	Bosch	Hand
White TAD	6,000	3,700	163	Solid	36x5	40x5d	Under hood	4	3.75	5.12	22.50	Block	Left	Cent	Cell	Sing	Bosch	Hand
White TCD	10,000	4,500	165	Solid	36x5	40x6d	Under hood	4	4.25	6.37	29.00	Block	Left	Cent	Cell	Sing	Bosch	Hand
Wichita A	2,000	1,650	110	Solid	34x3	34x4	Under hood	4	3.25	5.00	16.92	Block	L&H	Thermo	Cell	Sing	Bosch*	Hand
Wichita B	4,000	2,100	118	Solid	34x3½	34x3d	Under hood	4	3.50	5.00	19.61	Block	L&H	Thermo	Cell	Sing	Bosch*	Hand
Wichita H	7,000	3,250	165	Solid	36x5	36x5d	Under hood	4	4.25*	6.75	29.00*	Pairs	L&H	Cent	Cell	Dual	Bosch	Hand
Wilcox T	1,000	1,000	115	Pneu	33x4	33x4	Under hood	4	3.50	5.00	19.61	Block		Thermo	Z-a-t	Sing	Mea	Hand
Wilcox LA	2,000	2,000	132	Solid*	36x3½*	36x5½*	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Z-a-t	Sing	Mea	Hand
Wilcox NA	4,000	2,500	118	Solid	36x4	36x3½d	Under floor	4	4.25	5.00	29.00	Pairs		Cent	Z-a-t	Dual	Bosch	Hand
Wilcox JA	6,000	3,250	128	Solid	36x5	36x4d	Under floor	4	4.25	5.00	29.00	Pairs		Cent	Z-a-t	Dual	Bosch	Hand
Willet M	1,500	1,600	125	Pneu	34x4½	34x4½	Under hood	4	3.75	5.25	22.50	Block	Right	Cent	Finned	Sing	Eisemann	Auto
Willet L	4,000	2,600	144	Solid	36x4	36x4dh	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Finned	Sing	Eisemann	Auto
Willet K	6,000	2,800	144*	Solid	36x4	36x4dh	Under hood	4	4.50	5.25	32.40	Pairs	Left	Cent	Finned	Sing	Eisemann	Auto
Wilson B	4,000	1,800	130*	Solid	37x3½	37x5	Under hood	4	4.12	5.25	27.20	Block	Right	Cent	Finned	Sing	Eisemann	Fixed
Willys 65	1,300	1,350	120	P&S	34x4½	36x3½	Under hood	4	4.12	4.50	27.20	Sing	Left	Thermo	Finned	Dual	Split	Hand

Received Too Late to Classify

Handy Wagon, Jr	500	397	65	Solid	34x1½	34x1½	Under body	2	3.75	3.75	11.25	Sing	R&H	Air		Sing	None	Hand
Handy Wagon	800	437.50	77	Solid	34x1½	34x1¾	Under body	2	4.12	3.75	13.60	Sing	R&H	Air		Sing	None	Hand
Handy Wagon, Sr	1,200	600	86	Solid	34x1¾	34x2	Under body	2	4.75	4.75	18.10	Sing	R&H	Air		Sing	Briggs	Hand
Hurlburt 1	2,000	1,500	120	Pneu	34x4½	34x4½	Under hood	4	3.75	4.50	22.50	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Hurlburt 2	4,000	3,000	Opt	Solid	36x4	36x4d	Under hood	4	4.12	5.50	27.20	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Hurlburt 3½	7,000	3,500	Opt	Solid	36x5	36x5d	Under hood	4	4.25	5.50	29.00	Block	Right	Cent	Finned	Dual	Eisemann	Auto
Locomobile 3	6,000	3,500	150*	Solid	36x5	36x5½	Under hood	4	4.25	6.00	29.00	Pairs	Opp	Cent	Cell	Dual	Eisemann	Hand
Locomobile 4	8,000	3,600	160*	Solid	36x5	36x6d	Under hood	4	4.25	6.00	29.00	Pairs	Opp	Cent	Cell	Dual	Eisemann	Hand
C. T Tractor	10,000	4,750	155	Solid	36x4d	36x5d	Under seats	4	4.00	6.00	25.60	Sing	R&h	Cent	Sq-t	Sing	Mea	2-pt
Transit E	2,000	2,000	120*	Solid	36x4	36x3½d	Betw seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit F	4,000	2,500	144	Solid	36x4	36x4d	Betw seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit T	7,000	3,500	144	Solid	36x5	36x5d	Betw seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Transit V	10,000	4,500	144*	Solid	36x6	40x6d	Betw seats*	4	4.50	5.50	32.40	Pairs	Left	Cent	Sq-t	Sing	Mea	Hand
Dispatch 1	1,200	900	120	Pneu	36x3½	36x3½	Under hood	4	3.75	5.00	22.50	Block	Left	Thermo	Cell	Dual	Bosch	Hand
Morton 1½	3,000			Solid	34x4	38x5	Under seat	4	3.75	5.25	22.50	Pairs	Opp		Cell	Dual	Bosch	Hand
Morton 2	4,000		140	Solid	36x5	38x6		4	4.50	5.50	30.65	Pairs		Cent		Dual	Bosch	Hand
Morton 2½	5,000		140	Solid	36x5	38x6	Under seat	4	4.50	5.50	30.65	Pairs		Cent	Cell	Dual	Bosch	Hand
Morton 3	6,000		112	Solid					4.75	6.75								
Morton 3½	7,000			Solid	38x6	40x6d		4	5.00	5.75	40.00	Pairs	Opp		Cell		Bosch	Hand
Morton 5	10,000			Solid	38x7	42x7d		4	5.25	5.75	42.20	Pairs	Opp		Cell	Dual	Bosch	Hand
Morton 6	12,000		140	Solid					5.30	7.00								
Morton Tractor	20,000		108	Solid	40x6	40x6dh		4	5.30	7.00	43.45	Sing			Cell	Dual	Split	Hand

ABBREVIATIONS: General, *, *with other options*; Opt, *optional*. **Price**, -c, *complete with body*. **Tires, Kind**, Pneu, *pneumatic*; Sol-st, *solid in front, steel in rear*; P&S, *pneumatic in front, solid in rear*; P&C, *pneumatic in front, cushion in rear*; C&S, *cushion in front, solid in rear*. **Tire Sizes**, d, *dual*. **Motor Location**, Betw seats, *between seats*. **Cylinder Cast**, Sing, *singly or individually*. **Location of Valves**, Opp, *opposite, or T-head type*. Two (2-cylinder motors only), *L-head cylinder laid horizontal with valves up*; R&h, *at right and in head, L-head cylinder*; L&h, *at left and in head, L-head cylinder*; 2-cyc, *two-port motor, no valves*; Back, *L-head motor placed transversely with valves at rear*. **Water Circulation**, Cent, *centrifugal pump*; Gear, *gear pump*; Thermo, *thermo-syphon circulation*; Air, *air-cooled, no water*. **Radiator Type**, Finned, *finned-tube*; Cell, *cellular or honeycomb*; Sq-t, *square-tube or flat-tube*; Z-a-t, *zig-zag-tube or crimped flat-tube*. **Ignition, Type**, Sing, *single*; Doub, *double*; Dual-d, *dual-double*. **Make of Magneto** (or other sparking device), Split, *Splitdorf*; Conn, *Connecticut*; King, *Kingston*; West, *Westinghouse*; Day-D, *Dayton-Dick*; Atw-K, *Atwater-Kent*. **Spark Advance**, Auto, *automatic*; 2-pt, *two-point fixed, battery circuit fixed in retard, magneto in advance*. **Governor Type**, Cent, *centrifugal*; L-b, *loose-ball*; Suct, *suction*; Hyd, *hydraulic*. **Governor Drive**, Motor, *from motor*; D-sh't, *from driving shaft*, F-wheel, *from front wheel*. Geared, *from geared countershaft*. Duplex, *from both the motor and the driving shaft, by overrunning clutches*.

with Principal Specifications — Concluded

MOTOR						TRANSMISSION							SPRINGS		CONTROL			
GOVERNOR		SPEEDS		Carburetor Make	Lubrication	Clutch Type	GEARSET			Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
Type	Drive	Motor in R.p.m.	Truck in M.p.h.				Type	Location	Speeds									
None	None			Scheb	Circ-spl	Cone	Selec	Unit-j	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Tiffin G
None	None			Scheb	Circ-spl	Cone	Selec	Unit-j	3	8½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Tiffin M
None	None			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold T
None	None			Strom	Circ-spl	Dry-p	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold
None	None			Strom	Circ-spl	Dry-d	Selec	Unit-m	3		Top worm*		½-Ell	½-Ell	Left		R-r	Trabold
None	None		50	B-Z	Circ-spl	Cone	Selec	Unit-x	3	3¾-1	Bevel	Tor-t	1-½ Ell	Cant	Left	Cent	Tor-t	Trumbull 15D
Cent	Motor	1,050	15	Breeze	Circ-spl	Dry-p	Selec	Unit-m	3	7½-1	Top worm	R-r	½-Ell	½-Ell	Left	Cent	R-r	Universal C
Cent	Motor	1,000	11½	Breeze	Circ-spl	Dry-d	Selec	Unit-j	3	10½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Universal A
Cent	Motor	1,143	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. E
Cent	Motor	1,143	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	8 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. G
Cent	Motor	1,092	15	Strom	Circ-spl	Cone	Ind-c	Amid	3	7¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. D
Cent	Motor	1,092	12	Strom	Circ-spl	Cone	Ind-c	Amid	3	9 -1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	U. S. F
Suct	Motor	900	18	Strom	Circ-spl	Dry-p	Selec	Amid	3	7½-1	Doub-r	T-arm	½-Ell	½-Ell	Left	Cent	T-arm	Velie X
Suct	Motor	1,000	17	Strom	Circ-spl	Dry-p	Selec	Amid	3	7¾-1	Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Velie U
Cent	Motor	1,000	15	Strom	Circ-spl	Dry-d	Selec	Amid	3	8½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie
Cent	Motor	1,000	12	Strom	Circ-spl	Dry-p	Selec	Amid	3	10 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie Z
Cent	Motor	1,000	8	Strom	Circ-spl	Dry-p	Selec	Amid	3	12 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Velie ZS
			25	Carter	Splash	Cone	Selec	Unit-m	3	4½-1	Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Springs	Vim L&P
		1,250	16	Strom	Circ-spl	Cone	Selec	Unit-j	3	7¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 2
		1,250	16	Strom	Circ-spl	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 3
		1,250	14	Strom	Circ-spl	Cone	Ind-c	Unit-j	3	9½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 4
		1,250	14	Strom	Circ-spl	Cone	Ind-c	Unit-j	3	9¾-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 5
Cent	Motor	1,250	13½	Strom	Circ-spl	Cone	Prog	Unit-j	4	11½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Vulcan 7
None	None	1,800	30	Marvel	Circ-spl	Wet-d	Plan	Unit-m	2	6 -1	Sing chn		½-Ell	½-Ell	Cent	None	R-r	Wagenhals
Cent	Motor	1,000	14	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 5
Cent	Motor	1,000	12	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 6
Cent	Motor	1,000	10	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter 7½
Cent	Motor	1,000	10	Zenith	Circ-spl	Cone	Selec	Unit-m	4		Int-g4	Springs	½-Ell	½-Ell	Left	Cent	Springs	Walter Tractor
Cent	Motor	1,100				Wet-d			4		Bevel-4			Plat		Right		Ware
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Bevel	Springs	½-Ell	½-Ell	Left	C&l	R-r	White GBBE
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Doub-r	Springs	½-Ell	½-Ell	Left	C&l	R-r	White TBC
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Dbl chn		½-Ell	½-Ell	Left	C&l	R-r	White TAD
None	None			White	Spl-press	Wet-p	Selec	Amid	4		Dbl chn		½-Ell	½-Ell	Left	C&l	R-r	White TCD
		1,800	20	Strom	Circ-spl	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wichita A
None	None	1,800	20	Strom	Circ-spl	Cone	Selec	Unit-j	3	8½-1	Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wichita B
Cent	Motor	1,500	11	Strom	Circ-spl	Cone	Selec	Unit-j	3	9½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Wichita H
Cent	Motor	1,100			Circ-spl	Dry-d	Selec	Unit-m			Bevel	Tor-t	½-Ell	½-Ell	Left	Cent	Tor-t	Wilcox T
Cent	Motor	1,100	16		Circ-spl	Cone	Selec	Unit-j	3		Dbl chn		½-Ell	½-Ell	Right	Cent	R-r	Wilcox LA
Cent	Motor	1,100	14		Circ-spl	Cone	Selec	Unit-j			Dbl chn		Ellip	½-Ell	Right	Right	R-r	Wilcox NA
Cent	Motor	1,100	13		Circ-spl	Cone	Selec	Unit-j			Dbl chn		Ellip	½-Ell	Right	Right	R-r	Wilcox JA
		1,004	20	Zenith	Spl-press	Cone	Selec	Amid	3	6½-1	Doub-r	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Willet M
		945	15	Zenith	Spl-press	Cone	Selec	Amid	3	6½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Willet L
		945	15	Zenith	Spl-press	Cone	Selec	Amid	3	6¾-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Willet K
Cent	Motor	1,000	15	Marvel	Pressure	Cone	Selec	Unit-j	3	7½-1	Dbl chn		½-Ell	½-Ell	Left	Cent	R-r	Wilson B
Cent	Motor	1,150	18	Scheb	Circ-spl	Cone	Selec	Unit-j	3	6½-1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Willys 65

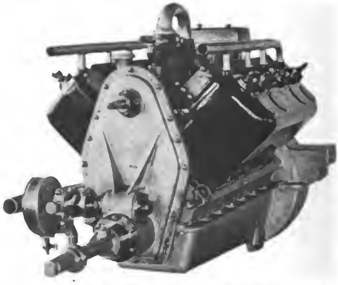
Received Too Late to Classify

Type	Drive	Motor in R.p.m.	Truck in M.p.h.	Carburetor Make	Lubrication	Clutch Type	Gearset Type	Gearset Location	Speeds	Total Gear-Ratio in High	Final Drive	Torque Taken By	Front	Rear	Steer	Levers	Propulsion Taken By	Name and Model
				King	Splash	Dry-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon, Jr.
				King	Splash	Wet-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon
				King	Splash	Wet-d	Plan	Unit-m	2	7½-1	Dbl chn		Ellip	Ellip	Right	Right	R-r	Handy Wagon, Sr.
Cent	Motor	1,250	18	Flech	Spl-press	Dry-d	Selec	Unit-m	3		Top worm	Springs	½-Ell	½-Ell	Left	Cent	Springs	Hurlburt 1
Cent	Motor	1,250	16	Flech	Spl-press	Cone	Selec	Amid	3		Top worm	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Hurlburt 2
Cent	Motor	1,250	13	Flech	Spl-press	Cone	Selec	Amid	3		Top worm	Tor-t	½-Ell	½-Ell	Left	Cent	R-r	Hurlburt 3½
Cent	Motor	1,150	12*	Own	Pressure	Cone	Selec	Amid	4	10-1	Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Locomobile 3
Cent	Motor	1,150	12*	Own	Pressure	Cone	Selec	Amid	4	10-1	Top worm	T-arm	½-Ell	½-Ell	Right	Right	R-r	Locomobile 4
Cent	Motor	1,350	13	Strom	Circ-spl	None	Elec	Unit-m	2	20½-1	Doub-r	Springs	½-Ell	½-Ell	Left		R-r	C. T. Tractor
Cent	Motor	1,200	15	Ray	Splash	Wet-d	Selec	Unit-j	3	7 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit E
Cent	Motor	1,200	14	Ray	Splash	Wet-d	Selec	Unit-j	3	9 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit F
Cent	Motor	1,200	12	Ray	Splash	Wet-d	Selec	Unit-j	3	10 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit T
Cent	Motor	1,200	10½	Ray	Splash	Wet-d	Selec	Unit-j	3	13 -1	Dbl chn		½-Ell	½-Ell	Right	Right	R-r	Transit V
Suct	Motor	1,500	25	Ray	Press	None	Fric	Amid	5		Dbl chn		Ellip	Ellip	Right	Cent	R-r	Dispatch L
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 1½
L-b	Motor			Carter	Spl-press	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 2
L-b	Motor			Strom*	Spl-press	Wet-d	Selec		3		Top worm	Tor-t	½-Ell	½-Ell	Right	Right	Springs	Morton 2½
							Selec		4		Top worm-4							Morton 3
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 3½
Cent	Motor			Carter	Circ-spl	Wet-d	Selec		3		Top worm		½-Ell	½-Ell	Right	Right		Morton 5
							Selec		4		Top worm-4							Morton 6
			14		Spl-press	Wet-d	Selec		3		Top worm							Morton Tractor

Carburetor Make, Strom, *Stromberg*; Scheb, *Schebler*; Ray, *Rayfield*; Excel, *Excelsior*; King, *Kingston*; B-Z, *Breeze-Zephyr*. **Lubrication**, Splash, *non-circulating or simple splash*; Circ-spl, *circulating-splash*; Spl-press, *splash-pressure*; Fuel-inj, *fuel injection, oil mixed with fuel*. Pressure, *pressure feed, no splash*. **Clutch Type**, Dry-p, *dry plate*, Dry-d, *dry multiple disk*; Wet-d, *wet disk or disk-in-oil*; R-cone, *reverse cone*; [illegible] *or inserted cone*; Exp-s, *expanding shoe*, Cont-b, *contracting band*. **Gearset Type**, Prog, *progressive sliding gear*; Selec, *selective sliding gear*; Plan, *planetary*; Ind-c, *constant-mesh individual-clutch*; Fric, *friction*; Hyd, *hydraulic*; Elec, *Electric*. **Gearset Location**, Amid, *amidships*; Unit-m, *unit with motor*; Unit-j, *unit with jackshaft*; Unit-x, *unit with axle*; Unit-s, *unit driveshaft*. **Final Drive**, Bevel, *bevel gear*; Doub-r, *double-reduction, bevel and spur*, Int-g, *internal gear*; Top worm, *worm gear with worm on top*; Dbl chn, *double chain*, Sing chn, *single chain*, -4, *to front wheels*; -4, *to all four wheels*. **Driving Torque**, R-r, *radius rods*; T-arm, *torque-arm*; Tor-t, *torsion tube*; Sub-f, *sub-frame*. **Springs**, Ellip, *elliptic*; ½-Ell, *half-elliptic*; ¼-Ell, *quarter-elliptic*; ¾-Ell, *three-quarters-elliptic*; Plat, *platform*; T-ell, *transverse elliptic*; Cant, *cantilever*; Comb, *combination of half-elliptic and elliptic on double frames*. **Steering**, Cent, *center*. **Levers**, Cent, *center*; C&r, *gearshift center, brake right*; C&l, *gearshift center, brake left*; St-col, *steering column*. **Propulsion**, R-r, *radius rods*; T-arm, *torque arm*; Tor-t, *torsion tube*, Sub-f *sub-frame*.

Herschell-Spillman Eight-Cylinder Motor

Uses Staggered Cylinders and Side-by-Side Connecting-Rods



Three-quarter end view of Herschell-Spillman motor, showing cylinder arrangement and drive of transverse pump shaft

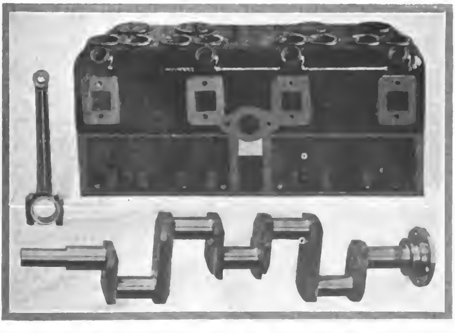
THE latest eight-cylinder motor to be announced is that recently developed by the Herschell-Spillman Co., North Tonawanda, N. Y., which while not exhibited at New York, has been completed by the factory and is now undergoing its bench test. This latest eight is a conventional V-type with two-block cylinders mounted at 90 degrees, and having intake and exhaust valves on the one side so that a single camshaft within the crankcase serves for both sets of valves. The motor has cylinders 3 by 5, giving an S. A. E. rating of 28.4 horsepower, but which has shown 48 horsepower at 1,000 revolutions per minute under test.

The Herschell-Spillman eight differs from the eights already announced in several features of design, the most important being that the yoke end connecting-rod is not used, but the connecting rods for opposite cylinders are standard I-beam types which fit side by side on the crankpin, two connecting-rods attaching in this relation on each crankpin. This feature of design means that the four cylinders constituting one block are not directly opposite to the four forming the other block, but are staggered slightly, so that the cylinder block on the left is 1 9-16 inch forward of the block on the right. This arrangement makes the overall length of the motor practically the same amount longer, but permits of mounting the connecting rods side by side as stated and also allows of using a camshaft with sixteen cams, instead of eight cams as generally used where cylinder groups are exactly opposite. Using separate cams allows of any variation in timing.

The Herschell-Spillman company has established a record in the development of this motor in that but 4.5 weeks elapsed from the time it was laid out on paper until the completed job was on the testing block. Building eights is not entirely new with this company in that 6 years ago it built its first eight-cylinder V-type motor with 7 1-4 by 7-inch cylinders for racing motor boat use.

In its eight for motor cars the overall length is 34 5-16 inches and the overall width 27 inches. The motor is made to take a gearbox as a unit and has the S. A. E. bell housing 16 1-8 inch diameter to which the gearbox bolts. It is designed for three-point support. Two rigid crankcase arms in the flywheel plane and a trunnion support at the forward end. No effort has been made to reduce weight, but as compared with a six-cylinder of the same piston displacement it weighs approximately 213 pounds less. With complete aluminum crankcase the weight is 550 pounds and with cast-iron crankcase 660 pounds.

The general layout of the motor does not deviate far from the conventional. In the V between the cylinder blocks, the carbureter is located in front and mounted sufficiently high to leave the valves accessible. At the rear is the battery coil ignition system, the illustration showing the Delco equipment combining ignition, starting and lighting. In front is a short transverse shaft carrying the double water pump on the left, but when separate systems are used the generator can be driven from the opposite end of this cross-shaft and the starter motor located under the left cylinder and bolted to the rear crankcase where it drives by pinion to the steel gear ring bolted to the flywheel. In such a case the starter pinion can be controlled manually, electro-magnetically, or by the Bendix drive. The camshaft lies in the top of the crankcase directly above the crankshaft and is driven by spiral gears. Directly above the camshaft is the shaft driving the ignition system, also driven by spiral spur gear.



Cylinder casting for Herschell-Spillman eight and drop-forged connecting rod—three-bearing crankshaft

The crankshaft is a three-bearing type, with all main journals 2 inches in diameter, and the crankpins 1.875-inch diameter. The crankshaft bearing lengths are, rear 3.75, center 3, and front 3. All crankpins are 3.125 inches long.

Connecting-rods are I-beam forgings 11 inches center to center. The lower bushings are 1 9-16 inches long and are die cast, the connecting-rod caps being held by two nickel steel .5-inch bolts. The two connecting-rod ends attaching to each crankshaft are a close running fit. The wristpin is a .875-inch tubing surrounded by a phosphor-bronze bushing, which is anchored in one piston boss by one set screw.

Pistons Have Three Rings

Pistons are cast iron 4.5 inches long, and carry three 3-16-inch rings well above the wristpin. The top ring is a leak-proof type and the other two are eccentric rings with spliced joint. The piston with its three rings weighs 1 1-2 pounds. Below the rings the piston is perfectly plain, and has a clearance on top of .008 inch and at the bottom .003 inch.

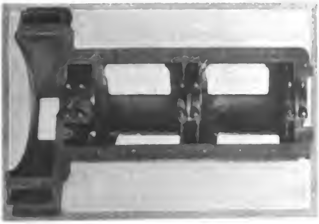
Valves are conventional bevel seated types giving an opening of 1 3-8 inch in the clear. The heads are 3.5 per cent. nickel-steel electrically welded to the carbon steel stems, which are hardened at their lower ends. The lift is 11-32 inch. Camshaft is 1 3-16 inch tube with a 3-4 opening through it and having sixteen integral cams. It is supported on three bearings, the front 4 inches long, the center 2 5-8 and the rear 2 1-4. All three bearings have soft cast-iron bushings, the end bushings not split but the center one split.

Double Water Pump

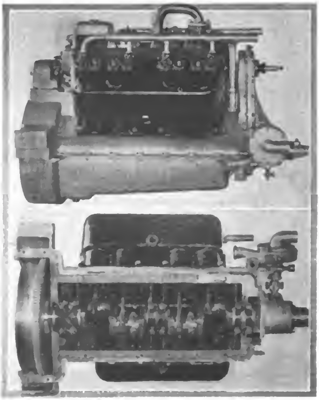
Particular attention has been given to water circulation which is maintained by double centrifugal pump, containing a double runner, which literally means a double pump, one portion maintaining circulation in one-cylinder block and the other in the opposite block. The pump has two discharges and separate pipes connect with each cylinder block. The return water circuit is taken at four points out of each cylinder block, these openings being opposite each exhaust valve, and the size of these openings has been determined experimentally with the thought of maintaining constant temperature at all four openings in order to keep the temperature the same at all four exhaust valves. In the cylinder casting each cylinder bore is entirely surrounded by water, there being 1-2-inch jacket space between the first and second and third and fourth cylinder bores. Intake and exhaust valve seatings are entirely surrounded by water and the jackets extend to a point 1-2-inch below the top of the piston when at the bottom of its stroke.

Pressure Oil Feed

The oiling system is a pressure one, without splash in the crankcase and with the oil pressure regulated between a minimum of 10 and a maximum of 40 pounds. The gear pump is located in the crankcase well on the bottom of a vertical shaft which takes its drive through 45-degree spirals from the camshaft. Oil is delivered through a longitudinal hole in the crankcase extending from front to rear and thence by three branches to the three bearings of the crankshaft and camshaft. The crankshaft is drilled with 1-4-inch opening and the oil delivered by centrifugal force to the lower connecting-rod bearings and thence through a steel tube attached to the connecting-rod, it reaches the wrist-pin bushing through a hole on the top, the oil being thus fed on the slack side of the wrist-pin journal. A blow-off valve allows of the discharge of oil to the timing gears at front which are submerged well above the cross shaft, the overflow from these finding its way back into the crankcase. At 1,000 revolutions per minute the oil pressure is 18 pounds, and at 2,600 revolutions per minute, 40 pounds.



The bearing-carrying portion of the crankcase with main bearing caps in place



Side view of engine and bottom half of crankcase removed, exposing the crankshaft and lower connecting-rod bearings

Firing Order, 1, 3, 4, 2

Timing is practically the same as in other eights. The explosion of the cylinder on the right being followed by that on the left. The order of firing in the right hand group is 1, 3, 4, 2. From this the complete firing for the eight cylinders is known.

Valve Actuation

Valve actuation is one of the delicate matters in an eight. In other words extreme accuracy must be kept in mind in the valve mechanism starting with the single camshaft and reaching the valves. The camshaft operates each lifter rod through a short lever, one end of which is hinged and the other bearing upon the lower end of the valve lifter rod. The lifters carry the usual nut and lock nut for adjustment. In the timing care must be taken to see that the center of the camshaft is exactly the same distance from the external face of the crankcase at each side where the cylinder blocks are attached, otherwise any variation here would interfere with the delicacy of the timing

The Automobile

PUBLISHED WEEKLY

Vol. XXXII Thursday, January 14, 1915 No. 2

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
231-241 West 39th Street, New York City

BRANCH OFFICES
Chicago—910 South Michigan Avenue Detroit—505 Free Press Building
Boston—1035 Old South Building Cleveland—516-517 Swetland Building

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

ADVERTISING
T. B. Van Alstyne, Advertising Manager
W. I. Ralph B. Mathewson Louis R. Smith
Howard L. Spohn H. H. Gill James P. Hunting
F. B. Barnett, Cleveland C. H. Gurnett, Chicago Chas. Anthony, Detroit
Guy W. Motz, Cleveland F. J. Robinson, Chicago

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Under Par

WHILE much good has resulted from the midwinter meeting of the Society of Automobile Engineers and much valuable information placed on record in the Transactions, it is still to be regretted that the average of the papers presented was below the high standard that this society has accustomed us to. Some of the papers were the best that could be expected; some were scarcely suited at all for presentation to an engineering society, but were more suitable for an automobile club; and one or two others were not suited because they presented but the conceptions of individual makers, who seemed to see nothing but merit in their own product and nothing but imperfections in those of their rivals. Such papers have no place in the open sessions of a great engineering society.

Every commendation must be given to those papers, which, while not dogmatic in any degree, were highly constructive in that they tended to engender a new line of thought among the members. Such papers exhibit a value in that they impress on members the magnitude of certain fields of research and are as potent by their negative as positive aspect. It is highly desirable that everyone at times be emphatically impressed with what is known as well as what has been developed. Whetting the appetite is decidedly necessary. In the end it is the advancement of certain causes that must be taken as the criterion of success and frequently those papers that are most severely criticized result in greatest good, in that the author has dared to explore certain channels in which others feared to navigate.

Rubber Embargo

THE embargo placed on crude by the British government and which for some weeks has seriously threatened the American situation is considerably improved by the note from London that rubber makers can receive shipments of crude by furnishing adequate guarantees of not exporting to belligerents opposed to Britain. London controls the rubber market of the world, and as more than 50 per cent. of the crude used in American tires comes from the rubber plantations of the East Indies through British brokers and in British bottoms, it is not surprising that London would take every step to safeguard its own interests as well as preventing this commodity reaching its belligerent opponents.

This acute situation is due solely to the necessity of rubber in the present war, rubber and gasoline being almost as necessary adjuncts of the army in the field as ammunition and supplies. For the present the tire situation in this country is clarified and there is little if any danger of higher prices or any shortages. The present controversy has, if nothing more, made it clear that Brazil Para is a minor factor in tires, and not the only gum used as has been so generally advertised at times. The plantation gum from the East comes to our makers in a much purer state than Para and is a major factor in our tire industry.

The Owner's Influence

TWO years ago one of the reasons advanced why motor truck shows were not required was that mechanical development in the truck would be practically stationary and that at that time the engineering advancement was far in advance of the science of application and operation. Contrast this with the renewed engineering development of the truck made during the past year, because the last 12 months have witnessed many new truck announcements, announcements by companies that 2 years ago imagined that their truck was the eventual type.

The enclosed type of drive has been one of the biggest spurs to progress. The last 2 years have proved that private owners are quick to realize superiorities in one form of drive over another. This has come to the ear of the truck engineer and the numerous worm-driven models are but re-echoes of the demands of the truck owner.

And so it has ever been; the ultimate consumer, while he may not be an engineer, while he may not be able to advance a single engineering reason why enclosed drive may be superior to exposed drive, still in the practical working out of different types, he sees differences, and these are enough.

S.A.E. Winter Session Produces Six New Standards

K. W. Zimmerschied, General Motors Co., chairman during portion of meeting

Fifteen Papers Discussed—Move Made to Hold But One Meeting a Year—Summer Session to Be on Great Lakes Steamship—Divisions of Standards Committee Report Favorable Progress

W. G. Wall, National Motor Vehicle Co., presided during part of the session

NEW YORK, Jan. 9—The annual midwinter meeting of the Society of Automobile Engineers which concluded its work last night may be the last midwinter session that the society will hold, due to the poor attendance, which is largely explained by so many of the members finding it impossible to attend because of work connected with the show as well as factory duties. A motion was made that this would be the last midwinter meeting but lack of a quorum prevents its being carried. This question must be brought up at the Summer meeting. At some of the sessions the attendance was not over a score. The total registration for 3 days was 313. On the last day, however, attendance was considerably improved, approximating 60, although the papers and discussions warranted an attendance of 200.

In spite of the poor attendance the session will go on record as being one in which much was accomplished particularly in adoption of six new standards, all of which had been all thrashed out by the work of the standards committee during the past year and it remained for but a mere form to make them standards. All of these six standards apply to manufacturing methods. The use of horizontal carbureters resulted in adopting a vertical flange for these side-outlet carbureters as they have been designated, this being a particularly timely work on the part of the standards committee. The work of standardizing pneumatic tires started last summer materialized by the adoption of nine standard tire sizes with an equal number of over sizes; standard dimensions of pins for use of yoke and rod ends in such places as steering connections, brakes, etc., were adopted. Heretofore steel specifications have been listed only by their chemical specifications, but at the meeting standard physical requirements were adopted, so that when makers are giving requisitions for any steel they can use either one or the other, but not both. Further up-to-dateness with the work of the standards committee was evidenced by standardizing the nomenclature for cantilever springs, and in addition spring fittings, including clips, bolts, offsets, etc., were standardized.

Two Recommended Practices

Although the society did not go on record as standardizing along other lines two standard reports were accepted as recommended practice for manufacturers to follow. One of these related to a standard basis upon which to measure the speed and mileage of electric vehicles. This allows the practice of discharge rate of batteries under detailed conditions of load and road surface, and this basis of comparison is intended to serve the same purpose in the electric vehicle field that the horsepower formula does in the gasoline vehicle field. It gives a definite basis of comparison.

The problem of reaching some standard form in the manufacture of side frame members for passenger cars, which has been before the society for several years, progressed in that it was passed as recommended practice, that a definite table furnished by the division should be used in laying out the dimensions for the drop of frames and radii of curvatures at the frame ends and at the drop. The other divisions reported progress.

The ball and roller bearing division has drawn up a list of ball and roller bearing sizes which will be sent out to the different manufacturers for approval, the standards exchange division has gotten up a set of specifications for bell housing for unit power plants, to definitely outline the shapes of clutch and gearbox housing for all sizes of motors, the commercial car wheels division is working on an increase in the felloe band dimensions for greater stiffness; the lock washers which are under the control of the division especially in charge of this work are under course of being arranged so that the same lock washer may be used for bolts and nuts of different shapes. The research division is marking time just at the present moment to await the reports that the government is about to issue on a formula dealing with the destructive properties of different types of vehicles. The electrical equipment division has reported progress in adopting a set of standards for the insulation and installation of grounded and insulated return starting and lighting systems.

Next Meeting on Great Lakes

The report on the time and place of the 1915 summer meeting as a result of the mail canvass of the society made by the council showed that the meeting would be held some time in June on a Great Lakes steamer. The votes on the subject were as follows: For June, 144; July, 73; August, 62; September, 22; no date, 145. As regards the place the votes were 32 for San Francisco; 112 for a place in the Great Lake region and 251 for on board a Great Lakes steamer.

The council also states in its report that the trip will be a fairly economical one, the entire cost not exceeding $35 to $40. The itinerary will be such as to include more of the scenic beauties of the lakes than on the previous trips and the membership will be canvassed early with a desire to finding out as soon as possible the attendance to be expected.

In response to a question by one of the members as to whether or not there will be a representation of the society at the engineers' congress to be held in connection with the Panama-Pacific exhibit it developed that the society will probably have some exhibit in the way of an exhibition testing plant if financial support by the exposition authorities can be arranged for.

In place of the annual banquet, two informal dinners were held on Wednesday and Thursday evenings at Bustanoby's. This offered the members an opportunity to get together and renew their acquaintanceships. The idea worked out very

Men who took a prominent part in the S. A. E. discussions: Left to right, A. L. McMurtry; Henry Souther, Ferro company; J. G. Perrin; A. D. Libby, Splitdorf company; A. B. Browne; Howard Marmon, Nordyke & Marmon, and Joseph Anglada

well as the restaurant was filled both evenings by the society members who would not otherwise have had an opportunity of conversing with one another.

The largest attendance was present for the reading of a paper on eight-cylinder motor design by H. G. Chatain. The paper was based on experiences with three eight-cylinder motors built some years ago and the discussion which followed it was the general consensus of opinion that eight-cylinder V-type motors could be made more accessible by mounting the cylinders at 45 degrees to each other instead of 90 as done at present, and by arranging the exhaust on top of the cylinders instead of at the side. The oiling of the eight was also discussed and the consensus of opinion was that if the pressure system was used the oiling impulses must be timed so as to reach the cylinders at the proper point in the stroke. If splash is used the quantity of oil must be large enough to assure an adequate supply reaching each cylinder. In view of the extra amount of oil thrown to the cylinders the best type of piston ring must be employed to avoid carbon.

Malleable Iron Castings Discussed

The proper use and methods of manufacture of malleable iron castings proved one of the apexes in the session. At present American makers by machining the casting remove the skin which is the toughest part of the casting, thereby weakening it, the reason for this being that the carbon content of American malleable castings varies from the center to the exterior of the section. The European malleable is much more constant throughout its section in carbon content and hence the removal of the skin is not so serious.

The solution suggested by discussion is to eliminate as much of the machining operation as is possible by keeping the casting close to its finished size, and to improve the quality of the material itself by laboratory research work.

A step towards popularizing worm-gearing was suggested in a paper by C. T. Myers on the manufacture of worm gearing by a new process. According to this paper the manufacturing cost of the straight type of worm can be cut in half. The discussion brought out that there was no material difference in efficiency between the straight and Hindley or hour-glass shaped worms. The ease of adjustment of the straight type of worm was another point brought out by the discussion. It was stated that the worm had to be aligned in but two planes and that this once accomplished, the adjustment is fixed for the life of the worm.

A method by which automobiles can be tested in a manner which will give all the good results of road-testing with none of its objections was presented by A. B. Browne and E. H. Lockwood. The discussion on this paper showed that there is a considerable interest in the adoption of a straight efficiency test for motor cars. The results of this test will give the rating of the entire car in efficiency instead of by horsepower. The efficiency factor will mean the fraction of the work put into the motor with the fuel as compared to that exerted at the rear wheel. The reports of the miscellaneous and frame sections divisions as reported in THE AUTOMOBILE for January 7, were accepted as standard.

Iron and Steel Reports

New Addition Lists Physical Properties of Steels—Two Silico-Manganese Steels

THE report of the iron and steels division is a lengthy one, but has been adopted without discussion. It covers the physical properties of the S. A. E. steel. As pointed out in the last issue of THE AUTOMOBILE:

The notes and instructions following the chemical specifications are not to be considered in any way a part of these specifications. They are added solely for the information of the user of the steels and for the guidance of the purchaser in the selection of proper steels for his different purposes. They should not be incorporated in the specification when ordering steel. This is especially true of the physical characteristics. Where possible, specific data are given on the physical properties which can be expected with the most widely used heat treatments.

The materials specified in detail as S. A. E. steels include the most important ones available to the builder of automobiles.

The results of physical tests, whether tension tests or otherwise, are largely dependent upon the mass and form of the specimen tested. This is particularly true of heat-treated steels. For the foregoing reason, all results of physical tests are comparative, and in order to make the comparison a proper one a uniform test specimen must be used.

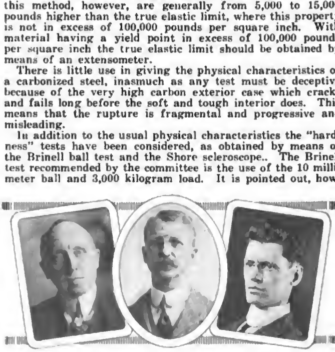
The committee therefore decided that recommended practice should be the use of the S. A. E. standard test specimen, this specimen to be treated approximately in its finished form, leaving only sufficient stock for finish grinding after the treatment is completed, say .020 inch on the diameter.

The figures for physical characteristics refer to those obtained on specimens prepared from sections common in automobile use, that is, bars from 1 inch round up to 1 1-2 inches round. The high yield points may be obtained with severe heat treatments, and the lower yield points with treatments less severe.

The yield point is specified rather than the elastic limit. The yield point is measured by the drop of the testing machine beam and furnishes the most ready and widely used measure of the so-called elastic limit; results obtained by this method, however, are generally from 5,000 to 15,000 pounds higher than the true elastic limit, where this property is not in excess of 100,000 pounds per square inch. With material having a yield point in excess of 100,000 pounds per square inch the true elastic limit should be obtained by means of an extensometer.

There is little use in giving the physical characteristics of a carbonized steel, inasmuch as any test must be deceptive because of the very high carbon exterior case which cracks and fails long before the soft and tough interior does. This means that the rupture is fragmental and progressive and misleading.

In addition to the usual physical characteristics the "hardness" tests have been considered, as obtained by means of the Brinell ball test and the Shore scleroscope.. The Brinell test recommended by the committee is the use of the 10 millimeter ball and 3,000 kilogram load. It is pointed out, how-



Left to right, C. E. Davis; R. McA. Lloyd and E. R. Hall, Goodyear company, took a part in the debates ever, that the Brinell test must not be used on soft steels less than 1-2 inch thick, or on areas small enough to permit the depressions to flow toward the edges of the specimen. With hard steels, where the depth of the depression and the flow of metal are less, material as thin as 1-4 inch may be so tested. The Brinell test may be fairly made on surfaces that are free from scale and smooth.

The Shore test (scleroscope) must be used only on surfaces that have been carefully polished and free from all tool marks, file marks or grinding scratches. The test specimen should also be of such mass or be held in such manner as to give the greatest possible freedom from deflection when struck by the hammer.

Data sheets on the physical properties will soon be issued.

Vertical Carbureter Flange

Same Dimensions as for Horizontal Type—Bolts to Be in Vertical Plane

THE report of the carbureter fittings division was that some time ago certain manufacturers of automobile motors of the block type requested that steps be taken to standardize the method of locating the position of the connecting flange on side-outlet carbureters, in order to avoid the confusion which now exists.

This has been carefully considered by the carbureter fittings division, and after much correspondence between the members and with those most concerned, engine builders and carbureter manufacturers, we recommend the adoption of the present standard flange dimensions and contour, with the bolts placed in a *vertical* plane, for carbureters of the side-outlet type.

Flared Tube Union Fittings

It has been found in actual practice that the tolerance now specified for the union nut bore (dimensions *M*, S. A. E. Data Sheet 35a, Volume I) is not sufficient for practical screw machine manufacturing and hence was recommended that it be increased from .002 inch to .005 inch for all sizes.

The revised dimensions for *M* would be as follows:

	1/4"	5/16"	3/8"	7/16"	1/2"
M Bore, female part	0.255	0.317	0.380	0.442	0.505
	0.260	0.322	0.385	0.447	0.510

Owing to the demand for S. A. E. standard flared tube unions and fittinga in sizes larger than those now listed, we recommend the addition of 5-8-inch and 3-4-inch sizes.

This report was adopted without discussion.

Nine Tire Sizes Standard

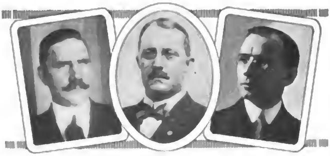
Pleasure Car Wheels Division Adopts Much-Debated List—Nine Oversizes Also

IN its last report the pleasure car wheels division drew up a set of tire sizes as a suggestion for standard. This matter has been further considered in conjunction with the Clincher Automobile Tire Manufacturers' Assn. and the following table of standard tire and rim sizes has been accepted:

Rim and Tire Sizes	Tire Over Sizes	Tire Seat Diameter
30 x 3	31 x 3½	24"
30 x 3½	31 x 4	23"
32 x 3½	33 x 4	25"
32 x 4	33 x 4½	24"
34 x 4	35 x 4½	26"
34 x 4½	35 x 5	25"
36 x 4½	37 x 5	27"
36 x 5	37 x 5½	26"
38 x 5½	39 x 6	27"

It will be noted that the above tire sizes are so-called even sizes. They are recommended as the only tire sizes from which manufacturers shall take their equipment. When such are used as initial equipment, they will allow the consumer to use oversize tires at his pleasure, on the rims with which his car is already equipped, thereby giving him more carrying capacity, easier riding qualities, increased tire life, etc. The tire manufacturers will manufacture oversize tires in every case for the above even sizes, and we recommend that these oversize tires shall not be used in any case as initial equipment by a vehicle manufacturer. They shall be strictly and absolutely consumers' tires.

The 36 by 5-inch rim will be a rim identical in section with the present 4 1-2 inch or F section rim, except that its width between flanges will be half way between the present 4 1-2 inch or F section rim and 5 1-2 inch or G section rim. Its tire seat diameter will be the same as the present 36 by 5-inch (26 inches) and the rim will receive any 36 by 5-inch tire at present on the market or manufactured. The extra width permits the use of an oversize 37 by 5 1-2-inch tire very much better than did the old 36 by 5-inch narrow width rim.



Lars G. Nilson, Nilson-Miller company; W. P. Kennedy and Russell Huff, Packard company, who took part in the discussions

This brings us down to nine regular tire sizes with nine oversizes, eighteen different tires in all, these tires including over 83 per cent. of tires in use at the present day. This constitutes a considerable reduction of sizes when it is noted that at present upwards of fifty tire sizes are manufactured by the larger tire companies.

Mr. Wall opened the discussion with the statement that the recommendations thus presented embodied one of the most important questions ever brought before the society and that the reduction of sizes and the settling of regular and oversize tires would be of advantage to both car user and car and tire maker. He called attention to the addition of the 36 by 5-inch tire to the list since the presentation of this report to the summer meeting.

Mr. Jehle said that it was to be hoped that tire makers will not permit car makers to equip with anything but the regular sizes of tires, leaving the oversizes to be obtained by the owner who will have increased the weight of the car and thus necessitated a larger size. Mr. Hall stated that it was the belief of the committee that that will be the ultimate result.

The report was adopted as read.

Electric Vehicle Reports

Formulas Submitted as Suitable for Rating Speed and Mileage—Research Report

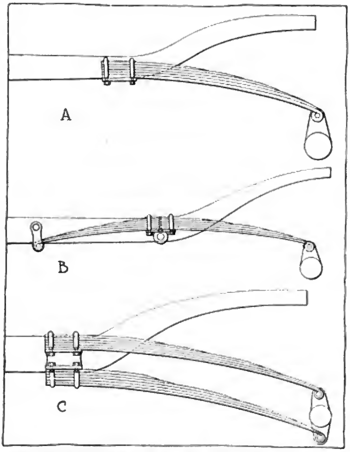
COKER CLARKSON, general manager of the Society, read the report of the electric vehicle division, which was digested in last week's issue of THE AUTOMOBILE.

R. McA. Lloyd announced that his belief was that the report should be referred back to the committee because, in his opinion, it was not well worked out in many particulars. He referred particularly to that section which recommended a standard rating for electric vehicle performance. "It would be just as good to standardize miles per gallon," he said. "It would not give a fair rating and would also be misleading. I suggest that this portion be dropped from the report. I also do not agree with the proposed standard type of nameplate. It does not seem right to tell a company what they should put on the nameplates of their motors. Furthermore, I do not think any purchasing agent would buy tires for his vehicles on the tests recommended in these specifications. I do not think it is necessary to say how many cells should be recommended."

Mr. Lloyd expressed his belief that it would harm the prestige of the Society to adopt reports of this nature in a hurried manner. "We are judged more on what we do not do than what we really do," he said.

W. P. Kennedy said: "As I am the only member of this committee present the load of the defense of this report is put upon my shoulders. This report has been made up by the best electrical engineers in the business. In the matter of nameplates the recommended form is to show what a nameplate should contain, and, as regards ratings, all batteries are rated by hour rates. To get a standard we stipulate what the discharge rate should be, and after due deliberation by the committee the 5-hour rate was decided upon."

C. B. Whittelsey, factory manager of the Hartford Rubber Works, expressed his belief that to recommend the rebound tire test incorporated in the report is dangerous practice. He said that he did not believe tire makers had any means



Three types of cantilevers for which a standard nomenclature has been adopted

of making a good test on account of the impracticability of controlling the hammer. If the hammer is not upright the rebound is different and would, therefore, leave out reference to this instrument in this report.

E. R. Hall stated that he concurs with Mr. Whittelsey, and believes that accurate results cannot be secured with the method of testing referred to in the report. The different styles of treads would affect the rebound and throw the results out of alignment. J. R. C. Armstrong, electrical engineer of the General Vehicle Co., stated that the results desired were merely to secure a possibility of interchanging. K. W. Zimmerschied stated that it was merely recommended practice and not standardization and, therefore, would establish a step in the right direction. With the various suggestions the report was accepted as recommended practice.

Prof. David L. Gallup read the report of the research division which is working on a horsepower taxation formula. He stated that the consensus of opinion of the members of the research division was that it would be too expensive to go into the large amount of work necessary in the drawing up of this formula. In view of the fact that the United States Government is now conducting work along the same line and that the reports of the Government investigators will be available to the members of the division after they are completed, the division is now holding off until they get these reports. It is desired when the formula is arranged to include such factors of the motor capacity, tires, wheels, gear ratio, horsepower, speed, number cylinders nonskid devices and the other factors which make up or enter into road-destroying calculation. The report, as submitted, was accepted.

Springs Report Adopted

Standard Nomenclature for Cantilevers—Bushings, Bolts, Widths, Brackets and Clips Standardized

THE cantilever spring is not mentioned in the nomenclature of the previous reports of the springs division. As this type of spring is in considerable use at the present time, it is recommended that the following names, as applied to the several forms of cantilever springs shown in the illustrations, be adopted: *A*, one-quarter elliptic cantilever; *B*, half-elliptic cantilever; *C*, double one-quarter elliptic cantilever.

A standard test for the parallelism of eyes and master leaf is recommended as follows:

"Eyes of main leaves to be parallel and square, within specified limits, to the main leaf and parallel to each other. The test to be made by inserting two 3 foot bars in the eyes, the ends not to be more than 3-8 inch out of true with each other or with the main leaf."

The committee believes that all spring ends should be finished and therefore recommends that spring ends be finished to a width of 1-16 inch less than the nominal width of the springs, with a plus or minus tolerance of .005 inch, to a point far enough back on the spring to allow free shackle movement or free sliding movement in case of flat end springs.

In addition dimensions of frame brackets, center bolt offset, spring clip nuts, center bolts and spring widths were also specified. There was no discussion.

How to Increase Activities of S. A. E. Sections

K. W. ZIMMERSCHIED spoke of making the constitutions of the various sections uniform.

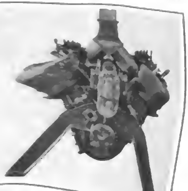
R. McA. Lloyd dwelt on the necessity for widening the scope of the educational work of the sections. He pointed out the favorable location of the New York section and the facilities for meeting provided by the Automobile Club of America. In the discussions held at the section meetings Mr. Lloyd stated as his belief that everyone should join in the talks regardless of whether they were specialists in the subject at hand or not. This, he believes, would tend to make the meetings more valuable because, even if more research work were not directly brought out by it it would certainly increase the knowledge and interest of those who participated in the debates either by asking and answering questions or by giving personal experiences on the points at issue. Another point which Mr. Lloyd brought up was that in his belief the winter meetings should be less technical in order to increase the attendance against the counter attractions of the show and the city. "The S. A. E. can do much more than standardization," said Mr. Lloyd, "and this field of education is a valuable one and should be one of the major aims."

Others Use S. A. E. Standards

Mr. Zimmerschied stated that the Society of Automobile Engineers has kept away from deep mathematical discussion on account of the small amount of time that the engineers in the industry could afford to put on the work. He said, "That the value of the work of the society and the automobile industry at large is appreciated, is shown by the manner in which other lines of engineering seize upon the ideas which have been engendered in the automobile industry. This is especially true in the art of designing machine tools." He also pointed out that the adoption of S. A. E. standards by other engineering bodies showed that the work was progressing along the correct lines.

Joseph Anglada, Chairman of the Metropolitan Section, gave the primary object of the sections as a means for permitting the various members of the industry to meet one another. He stated that the meetings had been of all classes. Technical discussion had served to bring out one group of men; non-technical discussion had brought out another and the object of the governing committee of the sections was to get this entire group together by the production of discussions and meetings that would be of value to all. He spoke of the work of the various research committees of the Metropolitan section and stated that the one devoted to gasoline-electric research was formulating a report which would cover the entire field in this work, both from a standpoint of its past history and its present development.

W. P. Kennedy, who also spoke on the necessity for greater activity in the work of the sections, dwelt on the opportunities for increasing the knowledge of the engineering profession in transportation engineering. He stated, "The majority of those using trucks are intensely ignorant of how to apply them." He stated that when a man is sold a truck it is a different proposition than selling a passenger car as that man is sold transportation and if the transportation is not up to its proper efficiency that man is not getting the proper value for his money.



Side and end views of the motor used as a basis for the inferences drawn by Henri G. Chatain in his paper on eight-cylinder motors

An Eight-Cylinder Engine

S. A. E. Paper by Henri C. Chatain Presenting Experiences with Three Eight-Cylinder Motors

THE object of this paper is to give a description and discuss the features of design of an eight-cylinder four-cycle gasoline engine which has been developed during a number of years for a specific purpose, namely railway traction. The problem was in some respects a peculiar and difficult one, but not very unlike that of its smaller sister, the automobile engine, and the writer hopes that this paper will prove of some interest to his associates in this Society who are engaged in designing multi-cylinder engines for diverse purposes and conditions.

The problem was to design a complete motor car for branch railway service, of sufficient size for seating fifty passengers and a small baggage compartment, etc., and capable of attaining a maximum speed of 50 miles per hour on level track. Our first design was an eight-cylinder V-type 90-degree engine, 7 1-2 by 8-inch, 550 r.p.m. This operated commercially in a little car on a western road until quite recently, when fire destroyed it.

The second attempt was a larger and heavier engine of essentially the same type, 8 by 8 inch, 550 r.p.m. Conditions demanded more power. The second car was run experimentally in service 50,000 miles in one year on various roads throughout the country, and served its purpose admirably in showing up some glaring defects.

First—The exhaust valves needed regrinding once a week, as they were unduly distorted and burnt.

Second—The position of the camshaft and valves was extremely inaccessible.

Third—It was uncommercial to make the cylinders sufficiently strong.

Fourth—Vibration. It was difficult to mount the engines in the car so as to take care of the horizontal component of *the reciprocating forces.*

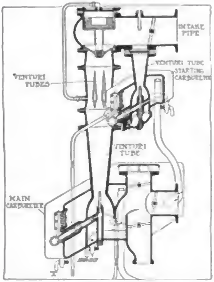
Fifth—Total width of engine.

With these facts at hand and an ever-increasing demand for more power, the third and present engine, which fulfilled expectations and met conditions, was designed. Fig. 3 will give a good idea of its construction. To overcome the first difficulty mentioned above, auxiliary exhaust valves with port entrance to the cylinders were embodied in the design. The cams actuating these valves are so designed that the valve is entirely free of its seat when the piston passes the port opening. The timing is shown in the diagrams of Fig. 4. This arrangement has worked well. The auxiliary valves need practically no attention except about once a year. The exhaust valves in the head need to be ground every 50,000 miles. In some cases they have run for upwards of 90,000 miles when the engine has been carefully handled. The appellation "auxiliary valves" is certainly a misnomer, as the major portion of the gases goes through the lower ports and valves.

The second change made was the relocation of the cam shaft due to its inaccessibility, and also because the stroke of the engine was to be lengthened. Two camshafts were decided upon, located externally, cams, shaft, etc., running in a bath of oil. One cam actuates the auxiliary exhaust valve, and one cam with suitable contour imparts the proper motion to the long pushrod extending to the top of the cylinder and suitably connected to the intake and exhaust valves. See page 89.

The L-head form of cylinder had little to recommend it in an engine of this size. The castings had to be made very heavy; otherwise they would crack; and heavy castings interfere somewhat with the cooling. Extremely strong construction at this point was proved to be essential. Reference to Fig. 5 will show the form of cylinder construction adopted, a barrel, a head and valves contained therein, all held down by long studs to the base. (Note that the water-circulating systems of the head and barrel are distinct.) The arrangement of two valves actuated from one cam is quite satisfactory at 500 to 600 r.p.m. With higher speeds the design would be unsatisfactory, as the mass of the moving parts would necessitate unduly high spring pressures. On page 89 A indicates the make-and-break spark plugs, E the air-starter valves, C and B the water inlets, D the exhaust ports.

A 45-degree angle between the rows of cylinders was



Sectional view through the carbureter used in connection with eight-cylinder motor

decided upon to decrease the horizontal component of the reciprocating forces, as well as to decrease the overall width. See chart, page 89, showing curves of reciprocating forces.

The crankshaft has four crank pins, of which the two outer pins are 180 degrees from the two inner pins. Two pistons are attached to each pin, the axes of their cylinders being at an angle of 45 degrees, or in other words each cylinder is set at an angle of 22 1-2 degrees from the vertical.

The reciprocating forces for one cylinder along its axis

$$= .0000284 \times W \times r \times N^2 \left(\cos\theta + \frac{\cos 2\theta}{n}\right) \text{ pounds}$$

Where

W = weight of reciprocating parts = 30 pounds.

r = crank throw in inches = 5.

N = R.P.M. = 550.

n = length of connecting-rod divided by throw of crank = 4.5.

θ = crank angle in the direction of rotation from top dead center of piston.

The vertical component of the reciprocating force is obtained by multiplying by cos 22 1-2 degrees = .92388, and the horizontal component by multiplying by plus sin 22 1-2 degrees = plus .38268 on one side of the vertical and by minus .38268 on the other side of the vertical.

For the whole engine the vertical component of the reciprocating forces

$$= 2081 \ (\cos 2\theta + \sin 2\theta) \text{ pounds}$$

and the horizontal component of the reciprocating forces

$$= 862 \ (\cos 2\theta \text{ minus } \sin 2\theta) \text{ pounds}$$

In an eight-cylinder engine with cylinders set at 90 degrees the vertical components of the reciprocating forces are all cancelled and the horizontal components are combined in the expression

$$\cos 45° \times .0000284 \times 8W \times r \times N^2 \left(\frac{\cos 2\theta}{n}\right) \text{ pounds.}$$

$$= 3200 \ (\cos 2\theta) \text{ pounds.}$$

the letters having the same values as previously defined.

The connecting rods are mounted side by side on each crank. It was thought advisable to adopt this construction for mechanical simplicity. The piston pins are held fast to the rods and find their bearings in the piston proper. No bushings are used.

The construction of the carbureter is shown diagrammatically herewith. Air enters the starting or slow-speed carbureter through the cap and passes through the venturi tube and screen into the intake pipe. One-quarter inch above the smallest part of the venturi tube the gasoline is introduced through the nozzle controlled by the needle valve. The main or high-speed carbureter is controlled by the automatic valve, which is heavily weighted so that it remains closed until the throttle is opened considerably. Thus, when starting or running at low speed with partly closed throttle, all or nearly all the mixture is supplied by the starting carbureter. When the throttle is opened more widely the suction on the intake pipe increases sufficiently to lift this valve and draw a mixture through the main carbureter. This has venturi tubes and a gasoline nozzle with the controlling needle valve similar to that of the starting carbureter. At full speed and load the valve is raised wide open by means of the piston acted on by the suction in the venturi tube through the vacuum pipe. The main carbureter is supplied with air from two sources, each being controlled with a butterfly valve, as shown. The connection draws heated air from around the muffler, and draws cold air from the cab. Owing to the presence of the lower exhaust ports, which allow the flame to escape freely at the bottom of the stroke, back-firing does not occur until the strength of the mixture has been reduced far below its proper value.

The lubrication system is of the forced-feed type.

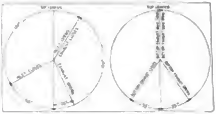
The total weight of the engine is 9,000 pounds; with generator 13,000 pounds.

The power of the engine is transmitted electrically to the driving wheels. A brief description of the operation and performance is given hereinafter.

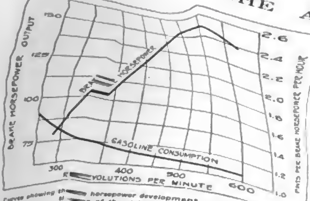
SPECIFICATIONS OF THREE EIGHT-CYLINDER ENGINES

Cycle	4	4	4
Number of cylinders	8	8	8
R.P.M.	535	550	535
Bore	7⅝"	8"	8"
Stroke	7"	8"	10"
Displacement	320 cu in	402 cu in	503 cu in
Valve area Inlet	3.05 sq in	3.06 sq in	7.87 sq in
Exhaust	3.94 sq in	3.0[illegible] sq in	4.91 sq in*
Valve-lift	31/64"	21/64"	½"
Mean velocity of air in intake pipe	6320 ft per min	6100 ft per min	2100 ft per min
Distance of valve from center of cylinder	6¼"	6⅝"	In head
Exposed radiating surface per cylinder, max.	460 sq in	515 sq in	384 sq in
min.	220 sq in	333 sq in	133 sq in
Projected bearing surface, end	15.75 sq in	20.2 sq in	24 sq in
center	13.1 sq in	13.1 sq in	15 sq in
Section of connecting rod max.	1.79 sq in	1.85 sq in	2.18 sq in
min.	1.39 sq in	1.43 sq in	1.57 sq in
Number bearings	5	5	5
Length of cylinder	13 31/32"	17⅝"	22⅝"
Length of piston	8⅜"	9⅝"	11⅝"
Piston-pin center below piston top	3⅝"	3⅞"	5⅝"
Number rings	3	3	4
Ring width	5/32"	5/32"	3/16"
Ring spacing	3/16"	3/16"	3/16"

*Supplemented by auxiliary exhaust



Valve timing diagram of the Chatain eight-cylinder motor



Curves showing the horsepower development and the gas consumption of the eight-cylinder motor

Length of connecting-rod C to C	14"	12"	
Diameter of piston pin	1"	2"	
Diameter of shaft	2¼"	2¼"	
Length of end bearings	5"	5½"	2¼"
	1½"		2"
Length of center bearings	1¾"	3⅞"	1"
Number of camshaft bearings	2	2	1¾"
Length of camshaft bearings	2 19/32"	3 29/32"	1"
	3 3/16"	3 13/16"	
	2 19/32"	6¾"	
	1½"	1⅞"	1½"
Diameter of camshaft	¾"	[illegible]	1½"
Cylinder wall thickness	[illegible]	[illegible]	¾"
Water space around cylinder	[illegible]	[illegible]	[illegible]
Height overall	[illegible]	[illegible]	6' 2½"
Length less generator	[illegible]	[illegible]	[illegible]
Length including generator	[illegible]	[illegible]	3' 2"
Width overall	[illegible]	[illegible]	4' 1½"

The electric drive differs from the mechanical drive usually used on automobiles in that the clutch and the transmission gear are replaced by an electric generator direct connected to the engine, and two or more electric motors geared to the wheels of the car in the same manner as in an ordinary electric trolley car. The current from the generator is conducted to the motors through a controller whose function is to connect the motors in series for starting and subsequently in parallel for running at speed, and also to control the voltage of the generator by varying its field strength.

The mode of operation is as follows: The controller is placed on the first notch, which connects the motors in series and places maximum resistance in the generator field. This resistance is such that when the engine is started and running at full speed the full power of the engine is absorbed in the windings of the motors, developing maximum draw bar pull at standstill of the car. As the car gets under way the counter-electromotive force in the motors rises, thus cutting down the current and reducing the load on the engine, causing its speed to rise. The controller is now placed on the second notch, which cuts out some of the field resistance and raises the generator voltage, which increases the flow of current, bringing the output and speed of the engine back to normal. As the speed of the car increases further, the controller is notched up point by point until all resistance is cut out of the generator field, when the generator is working at full voltage, each motor receiving one-half voltage.

The next step on the controller is to connect the motors in parallel and cut resistance into the generator field so that the voltage becomes slightly more than one-half maximum. This resistance is again cut out step by step until full voltage is again reached.

The final step on the controller, for very high speed, connects a shunt around the motor fields, which has the effect of still further increasing the speed of the car without additional increase of the generator voltage.

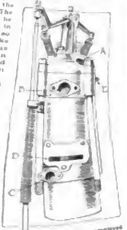
It should be noted that at no time is there any resistance connected in series with the motors in the manner in use in the ordinary trolley car, that is, there are no rheostat losses other than the negligible losses in the field rheostat.

When a grade of sufficient magnitude to slow down the car is encountered, the natural tendency is to slow down the engine. This is counteracted by moving the controller back one or more notches, which reduces the voltage of the generator, thus relieving it of sufficient load to allow the engine speed to return to normal and continue to develop full power.

Discussion on Practicabilities

[illegible] Hewitt, engineer of the International Motor Co., opened the discussion by asking if oiling difficulties did not develop owing to the fact that the force of gravity and the throw of the connecting rods tended to keep the oil on one side of the cylinder. Mr. Chatain replied by stating that the oiling troubles were very marked and that the only way that they can overcome them was by the proper timing of the oil pulses to reach the bearing surface of the cylinders at the proper time. Mr. Hewitt stated that he had considerable experience in this and that he had solved the problems in different ways. One was by making the splash troughs larger allowing a greater amount of oil to be splashed up and at the same time by having different rings on different pistons to suit the oiling requirements of the particular surface with which they were in contact. This plan he said worked very well but whenever a repairman took down the motor he was almost sure to put it back wrong and have the wrong combination of rings. The final solution that he held to be the most simple and best was in the use of rings which were so good that it did not make any difference how much oil was fed. After fitting these rings an oil supply so large that it could not help reaching the cylinders in sufficient quantities was used.

The motor with which Mr. Hewitt has had experience was a 4 by 4.75 size rated at 45 horsepower. Another point which he discovered in connection with this motor is that the inlet valve can have a greater lead, thereby materially increasing the height of the horsepower curve. As much as 65 per cent increase in lead can be used. The power at 400 and 450 r.p.m. is decreased about 5 per cent with this lead, but this is more than made up by the large increase in the height of the curve and also by the flatness at the point of maximum horsepower. Mr. Hewitt pointed out his preference for the 60 degree as compared with the 90 degree arrangement of the cylinders for the reason that the valve accessibility is greater. Another point on which he expressed himself as surprised was that the overhead exhaust was not used to clear up the sides of the motor. On his motor, he stated, this was done



Valve arrangement employed

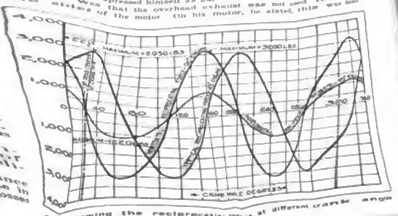


Chart showing the reciprocating forces at different crank angles

November Exports Total $2,879,177

Patent Owners Must Prove Damages in Infringement Suits—Goodyear Takes Over Motz Sales

WASHINGTON, D. C., Jan. 11—Figures issued today by the Federal bureau of statistics show that during November last 1,618 automobiles and trucks of all kinds, valued at $2,879,177, were exported, while in November, 1913, the number was 1,771 and the value $1,782,227. During the 11 months ended November the number of motor vehicles exported decreased from 24,500, valued at $24,877,307, in 1913, to 23,189, valued at $24,121,037, in 1914.

Interesting figures are presented in the latest export statistics as a result of the European war. For instance, in November, 1913, France imported eighty-seven cars, valued at $63,641, from the United States, while in November last the number had increased to 695, the value of which was $1,714,145. On the other hand Germany took sixty-nine cars valued at $35,827, in November, 1913, while in last November the records show that not a single car was sent to Germany. Italy also shows a big decline in imports of American cars, twenty-five, valued at $17,899 being sent there in November, 1913, while in November last the number had been decreased to 2, the value of which was $8,360. The United Kingdom was a big customer in November last, importing 404 cars, valued at $683,496, while in November, 1913, the number was 321 and the value $297,771. Other European countries, evidently as a result of the war, failed to import American motor cars to any extent, the figures showing that in November last, the exports to "other European countries" numbered twenty-two cars, valued at $24,256, as against 121 cars, valued at $80,216, exported there in November, 1913. Canada, another good customer of the United States, likewise failed to take the usual number of cars, the figure showing the exports to that country declined from 266, valued at $396,753, in November, 1913, to 105, valued at $133,103, in November last. South America, British Oceania and Asiatic countries also showed marked decreases in the imports of American cars.

Patent Owner Must Prove Actual Damages

WASHINGTON, D. C., Jan. 11—The Supreme Court today decided the owner of a patent, suing for infringements, must prove how much of the profits obtained by an infringer by the sale of a machine, including a part covered by a patent, was due to the patented part.

NEW YORK CITY, Jan. 9—The Isotta-Fraschini Motor Co., Fifth avenue and Fifty-seventh street, has taken on the distribution of the Scripps-Booth car.

NEW YORK CITY, Jan. 11—W. C. DuComb, Jr., has been appointed sales manager and engineer of Barthel & Daly, sole importers of Schafer ball bearings. He has had charge of the engineering department of that company.

BOSTON, MASS., Jan. 12—The Standard Oil Co. of New York has reduced the price of gasoline 1 cent per gallon in wholesale prices, quoting now at $0.13, and 1-2 cent a gallon on kerosene, which is now quoting at $0.08 a gallon.

Goodyear To Take Over Motz Sales Feb. 1

NEW YORK CITY, Jan. 12—The Goodyear Tire & Rubber Co., Akron, O., has taken over the sale of the products of the Motz Tire & Rubber Co. The transfer of sales will formally take place February 1. On and after that date Goodyear will make all sales and adjustments. In the meantime special representatives of the Motz company will call at all Goodyear branches to make sure that all details are handled without confusion and that the trade is taken care of.

By the new arrangement users of Motz tires will have the use of the service provided by Goodyear branches in all the principal cities of the country. Hitherto Motz tires have been handled in all the principal cities, but hereafter the sales methods and policies applying to them will be the same as apply to other products in the regular Goodyear line.

For the present the sale of Motz tires will be handled as a part of the work of the Goodyear motor truck tire department, under the direction of C. W. Martin, Jr., manager of that department.

Automobile Securities Quotations

NEW YORK CITY, Jan. 12—Automobile and tire securities, reflecting the increased public confidence in improving business conditions and the great effect produced on the business world by the great success of the New York automobile show, showed a much stronger tone during the past week, several of the stocks reaching new high levels. Some of the larger gains recorded are: Kelly-Springfield common, 6; first preferred, 4; second preferred, 2; General Motors preferred, 7; common, 3; New Departure common, 9; Maxwell common, 2; first preferred, 4 1-2; Goodrich common, 3; Goodyear common, 3; Reo Motor Car, 2 1-4; and Willys-Overland, common, 3, and preferred 2.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	195	..	250	..	..
Ajax-Grieb Rubber Co. pfd	98	102	100	..	..
Aluminum Castings pfd	97	100	95	100	..
J. I. Case pfd	..	..	..	85	..
Chalmers Motor Co. com	90	93	..	97	..
Chalmers Motor Co. pfd	92	97	..	93½	..
Electric Storage Battery Co	..	..	48	49	..
Firestone Tire & Rubber Co. com	248	252	348	352	—2
Firestone Tire & Rubber Co. pfd	102	104	109½	111	— ½
Garford Co. pfd	80	90	..	..	..
General Motors Co. com	44	45½	84	85	+3
General Motors Co. pfd	82½	84½	92	94	+7
B. F. Goodrich Co. com	22	23	26	27	+3
B. F. Goodrich Co. pfd	81	83	92	95	..
Goodyear Tire & Rubber Co. com	240	255	188	191	+3
Goodyear Tire & Rubber Co. pfd	95½	97	100¼	101¼	— ¼
Gray & Davis, Inc., pfd	90	98	..	..	..
International Motor Co. com	..	5	..	..	..
International Motor Co. pfd	..	15	..	..	..
Kelly-Springfield Tire Co. com	39½	41	75	77	+6
Kelly-Springfield Tire Co. 1st pfd	106½	107½	79	80	+4
Kelly-Springfield Tire Co. 2d pfd	..	..	95	100	+2
Maxwell Motor Co. com	5	5½	17½	18	+2
Maxwell Motor Co. 1st pfd	29	30	48	49	+4½
Maxwell Motor Co. 2d pfd	9	10	18	20	..
Miller Rubber Co	124	130	150	158	..
New Departure Mfg. Co. com	120	124	110	120	+9
New Departure Mfg. Co. pfd	100	104	102	..	..
Packard Motor Car Co. com	..	..	..	100	..
Packard Motor Car Co. pfd	95	..	93	..	+3
Peerless Motor Car Co. com	15	25	15	20	..
Peerless Motor Car Co. pfd	75	80	..	55	..
Portage Rubber Co. com	..	40	33	36	+8
Portage Rubber Co. pfd	..	90	80	85	..
*Reo Motor Truck Co	6¾	7½	11½	12¼	+1
*Reo Motor Car Co	14¾	15¾	24½	25½	+2¼
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	30	52	52½	53½	+ ½
Stewart-Warner Speed. Corp. pfd	94	96	100	102	+1
Studebaker Corporation com	21	22	36	37	+ ¼
Studebaker Corporation pfd	71½	72½	91½	92½	+1½
Swinehart Tire & Rubber Co	69	71	69	71	..
Texas Company	..	..	133	134	+3
U. S. Rubber Co. com	38½	59½	52½	58	+1
U. S. Rubber Co. pfd	103	104	102½	103½	+1¼
Vacuum Oil Co	216	218	198	201	+1
White Co. pfd	105	110	108	110	..
Willys-Overland Co. com	58	62	86	90	+3
Willys-Overland Co. pfd	83	86	90	95	+2

*Par value $10; all others $100 par value.

NEW YORK CITY, Jan. 8—The United States Rubber Co. held its board of directors' meeting yesterday, after which it was announced that the treasurer's statement as submitted to the meeting showed the net earnings of the company for 11 months from January 1 to November 30, 1914, sufficient to cover the dividends declared for the year 1914, including those declared yesterday, which were 2 per cent. on its preferred and 1 1-2 per cent. each on its second preferred and common stocks, payable January 30, to holders of record of January 15. There was no estimate of the December earnings submitted, but whatever they may be will be additional to the dividend requirements, according to a statement given out by President Samuel P. Colt after the meeting.

Prices Reduced on Aermore Exhaust Horns

MILWAUKEE, WIS., Jan. 11—The Fulton Co., manufacturer of the Aermore exhaust horn, has reduced the prices as follows: No. 1 size is reduced to $7.50; No. 2 to $6.50 and No. 3 to $5.50.

Market Reports for the Week

NEW YORK CITY, Jan. 13—The dropping of fine Up-River Para rubber from $0.72 to $0.67 was the most important change in this week's market reports. The announcement on Saturday of the lifting of the embargo on plantation rubber from Liverpool and London, brought the price of Para down to $0.67 with no change up to Tuesday. On Tuesday the offerings in all grades of crude rubber was light and the prices ruled steady, especially in fine Up-River Para. A few changes of small importance occurred in the metal markets. Tin went up $0.13 and electrolytic and Lake coppers rose $0.00 1-3 and $0.00 3-8 respectively. Antimony, which is in fair demand and firm, closed at $0.14 1-2 a pound at a gain of $0.01. Lead went down $0.10 per 100 pounds, closing at $3.70. There was an active market this week for linseed oil which rose $0.04, closing at $0.54. Cottonseed oil closed at $6.20 a barrel.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.13½	.14	.14	.14½	.14½	.14½	+ .01
Beams & Channels, 100 lbs..........	1.21	1.21	1.21	1.21	1.21	1.21	......
Bessemer Steel, ton.	18.50	18.50	18.50	18.50	18.50	18.50	......
Copper, Elec., lb..	.13⅜	.13¼	.13⅜	.13⅜	.13½	.13 9/16	+ .00⅓
Copper, Lake, lb...	.13¼	.13¼	.13⅜	.13⅜	.13½	.13⅝	+ .00⅜
Cottonseed Oil, bbl.	6.12	6.19	6.29	6.38	6.21	6.20	+ .08
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.38	.38	.38	.38	.38	.38	......
Gasoline, Auto, bbl.	.13	.13	.13	.13	.13	.13	......
Lard Oil, prime...	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.....	3.80	3.78	3.70	3.70	3.75	3.70	— .10
Linseed Oil.......	.50	.52	.52	.52	.54	.54	+ .04
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude.....	.55	.55	.55	.55	.55	.55	......
Petroleum, bbl., Pa., crude.......	1.50	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.71	.71	.71	.71	.71	.71	......
Rubber, Fine Up-River, Para.....	.72	.72	.69	.67	.67	.67	—. 05
Silk, raw, Ital.....	..	3.90	..	..	3.90	3.90	......
Silk, raw, Japan...	..	3.48	..	..	3.50	3.50	+ .02
Sulphuric Acid, 60 Baume.......	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb........	33.25	32.75	33.38	33.25	33.75	33.38	+ .13
Tire Scrap.........	.05	.05	.05	.05	.05	.05	......

Hudson Sales for 5 Months $7,500,000

NEW YORK CITY, Jan. 9—The Hudson Motor Car Co., Detroit, Mich., according to statements given out at the automobile show in this city, made a sales record of $7,500,000 in the 5 months between July 1 and December 1, 1914. This aggregate of sales compares with $3,000,000 in the same period of a year ago, and is an increase of 150 per cent. There are now 10,000 Hudsons of the light six model in use in forty-three different countries.

Offer of $61,000 for Pope West Works

HARTFORD, CONN., Jan. 13—*Special Telegram*—The Organ Power Co. has made an offer to Colonel Geo. Pope, receiver of the Pope Mfg. Co., of $61,000 for the West works of the Pope company. The receiver made application to judge Milton A. Shumway in the superior court for an order of sale. Judge Shumway will give a hearing on the application on Friday, January 22, at 10.30 a. m. If the proposition is approved by the court the purchaser will move to the new location. John R. Hillard and F. C. Billings appraised the land on which the West works are located at $47,200 and the buildings at $62,800.

Judge Shumway yesterday made an order authorizing Colonel Pope as receiver to pay a dividend of 25 cents on $1 to those creditors who already have been paid a dividend of 10 per cent. and that creditors may share equally he will pay a dividend of 35 per cent. to the creditors who did not share in the prior dividend of 10 per cent.

Adams Reorganization Scheme Completed

FINDLAY, O., Jan. 11—W. D. McCaughey has been discharged as receiver of the Adams Bros. Co., builders of the Adams truck. A reorganization scheme has been completed. Old stockholders have surrendered all their stock and in return received 25 per cent. back in the reissue, the balance of $140,000 being sold to other parties. The capital stock of the company is now $300,000, at $100 per share. Murray Irwin, of Jackson, Mich., is the new general manager, and C. M. Carter, also of Jackson, is secretary. The selling force of the company will be completely reorganized.

To Permit Rubber Exports to U. S.

England Will Allow Shipping of Plantation Product to this Country Under Guarantees

NEW YORK CITY, Jan. 11—The British Government has provisionally come to an agreement with the American rubber exporters in Great Britain which will permit of licenses being given under proper guarantees for the export of plantation rubber to the United States from London and Liverpool.

A statement issued by the British Embassy at Washington said: "Manufacturers wishing to obtain large shipments will be required to give a bond through their agent in London. In other cases shipments will be allowed to approved manufacturers and dealers who signify their willingness to sign appropriate guarantees. Shipments will be addressed to a bank in New York City, which will not deliver rubber until the purchaser has signed and deposited guarantee with His Majesty's Consul General at New York City and he sanctions delivery."

The statement goes on to state that manufacturers in the United States must guarantee not to export any raw waste or reclaimed rubber except to United Kingdom or British possessions; not to sell rubber now delivered, but to use it in own factory; to execute orders for manufactured goods from neutral European countries from stocks in United Kingdom. Shipment to manufacturers who have given a bond will be allowed direct.

The above announcement has imparted a weaker tone to the local rubber market and prices declined. Fine Up-River Para dropped 2 cents, quoting at $.67. Pale crepe from Ceylon, which was formerly quoted at $.76 and $.77, dropped on Saturday to $.66. Small sales were reported with the decline. Plantation rubber in London advanced 4 cents, quoting at $.52.

A committee of rubber manufacturers has been formed to see that the conditions of the British embargo are lived up to as far as is possible, so as to prevent the restoration of the export prohibiting order. This committee has informed the Treasury Dept. at Washington that it will organize a service to prevent the falsification of manifests which might involve re-exports of the British rubber products, and it will establish a secret service or institute a clearing house to guard against trading in rubber under false pretenses or without authority.

Favorable news has been received from B. G. Work of the Goodrich company, who went to London, to co-operate with the British dealers, who found themselves overloaded with an enormous stock of crude rubber which they were not allowed to sell.

It is stated that it will be 2 weeks before the machinery for operating this plant will be completed. It is the opinion of well informed members of the rubber trade that it will take at least a month before rubber can be landed in New York City from London. American manufacturers, it is said, own about 2,000 tons of rubber now held in various warehouses in London awaiting shipment.

Engineers Visit New Departure Plants

NEW YORK CITY, Jan. 9—A party of consulting engineers and engineers representing the Packard, Peerless, General Motors, Overland, Chevrolet, Auburn and a number of other automobile companies yesterday inspected the ball-bearing plants of the New Departure Mfg. Co., in Hartford and Bristol, Conn. The trip from New York was made in special pullmans, via Hartford, where 2 hours were spent at the plant. The journey from Hartford to Bristol was made by automobile and the afternoon was spent in an inspection of the works under the guidance of General Manager DeWitt Page and Chief Engineer Frederick G. Hughes.

FINDLAY, O., Jan. 11—The Lauth-Juergens Motor Car Co., of Fremont, has decided to increase its capital stock from $150,000 to $250,000, to provide capital to furnish motor trucks for European countries. The company has a large number of orders.

NEW YORK CITY, Jan. 11—Ferdinand Jehle's address was given as the Commercial Testing Laboratories, Detroit, in THE AUTOMOBILE for January 7. It should have been Automobile Club of America, where Mr. Jehle holds the position of laboratory engineer.

Austin Wins Two-Speed Axle Suit

Apple Charges Infringement of Patent on Starting and Lighting System

GRAND RAPIDS, MICH., Jan. 9—A decision in favor of Walter S. Austin, of the Austin Automobile Co. was rendered yesterday in his suit against the Cadillac Motor Car Co., Detroit, charging the latter with infringing his two-speed axle patent in the axles used by the Cadillac company during 1914. District Judge C. W. Sessions has declared the Austin patent claims valid and also infringed and the decree will be entered granting an injunction and ordering an accounting. The plaintiff will recover costs. The Cadillac company will appeal to a higher court.

This suit for infringement was started in July, 1914, by Mr. Austin, who claimed that the Cadillac company had been infringing patent No. 1,091,618, issued to him March 31, 1914.

The court's decision analyzed the case at length and affirms that "The invention belonged to the plaintiff and not to the defendant" in referring to the two-speed axle construction. Further: "Defendant's (Cadillac) two-speed mechanism is almost an exact copy of plaintiff's patented structure except as to two changes or modifications; probably made for the purpose of avoiding infringement . . . these changes or modifications, however, are not material upon the question of infringement of the claims hereunder considered. In plaintiff's (Austin) machine one of the gears upon the rear axle is secured to the differential housing and the other gear is loose and revoluble independently of the first, and one of the pinions is loose upon the propeller shaft and revoluble independently of the other. In defendant's machine the two gears upon the rear axle are secured to each other and to the differential housing, while both pinions upon the propeller shaft are loose. This change made necessary a further change in the clutch which operates to engage and disengage the gears. Plaintiff's (Austin) clutch is necessarily doubled with a lever connection, one operating the loose gear upon the axle and the other the loose pinion upon the propeller shaft. Defendant's (Cadillac) clutch is a single one of the sleeve pattern operating the two loose pinions upon the propeller shaft. It may be conceded that defendant's device is an improvement upon that of the plaintiff, but mere improvement does not avoid infringement. . . . That the plaintiff made a distinct step in advance of the prior art cannot be denied. . . . His two-speed direct drive mechanism can be and has been successfully used and operated. . . . In its efforts to show an anticipation of plaintiff's claimed invention, defendant has cited and referred to seventeen patents, foreign and domestic. Each is for a combination. . . . Some of these patented structures have existed only upon paper, others have been found inoperative, and none of them contains all of the essential elements of the plaintiff's combination Probably the most prominent feature of plaintiff's combination is "the outer gear and pinion being of higher ratio than the inner gear and pinion."

Files Wire Wheel Patent Suit

CLEVELAND, O., Jan. 9—Action charging infringement of his patent on wire-spoked wheels was brought in United States district court, Cleveland, January 5, by John Vernon Pugh, of Allesley, England, against the Winton Motor Car Co. Mr. Pugh is represented by Augustus B. Stoughton, attorney, 1506 Land Title Building, Philadelphia. He asserts title to patent No. 1,047,702, issued December 17, 1912, an improvement in wire spoked wheels for automobiles. He charges that wheels made by the Houk Mfg. Co., of Buffalo, which he calls an infringement on his patent, are used in the equipment of Winton cars and asks an injunction against the Winton company and damages, to an extent that he alleges can be proved in court.

Apple Sues for Patent Infringement

NEW YORK CITY, Jan. 12—Vincent G. Apple, president of the Apple Electric Co., Newark, N. J., has started suit against a New Jersey dealer in automobiles which automobiles are being sold with the Delco starting and lighting system, the suit being for infringement of patent No. 1,079,090 issued to Mr. Apple, November 18, 1913. It is claimed that the Delco system infringes this patent which refers to a machine for generating electricity as well as cranking a gasoline motor, the two functions being combined in the one unit. The patent alleged infringed refers to the methods of driving the main shaft of the machine which is driven at one end from the gasoline engine as a generator but must be provided with means at the opposite end for cranking the motor. The patent is claimed to embrace automatic means between the generator-starter shaft and the gasoline engine shaft which provide for disconnecting at this end when the cranking motor is starting the engine; and to incorporate means at the flywheel end for manually engaging a pinion with the toothed flywheel rim. The connection at the forward end of the shaft also is claimed to incorporate means whereby after the generator-starter is disconnected in starting and the gasoline motor speeds up the automatic means will engage and drive the generator-starter for battery charging purposes.

Regal Eight at $1,250, Four, $650

DETROIT, MICH., Jan. 13—*Special Telegram*—The Regal Motor Car Co. expects to have at the Chicago show the two new cars which will feature the line for the coming year. These are an eight-cylinder design to sell at $1,250 and a small four-cylinder car at $650. Both are to be in either roadster or touring form. The eight is a 40-horsepower car with a 2 7-8 by 4 1-2 V motor, the two blocks of four cylinders being at 90 degrees on the crankcase. The usual eight-cylinder practice will be adhered to, the crankshaft having four throws and two rods connecting to each. Silent chain drive for the camshaft is used, and the only thing between the blocks is the Stewart carbureter, which is fed by the Stewart vacuum fuel feed. The starting and lighting is by two-unit system with the generator driven by silent chain from the crankshaft with 1 to 1 ratio. The ignition distributer is a part of it. The starting motor gears to the flywheel with 30 to 1 reduction. The oiling is force feed through the crankshaft and the connecting-rods.

This motor is interchangeable with the regular Regal four-cylinder engine on the standard Regal chassis. The wheelbase is 112 inches, with gearset in unit with the rear axle, which is three-quarter floating, and the propeller shaft is inclosed in a torque tube. Tires are 33 by 4 and rear springs three-quarter elliptic.

The small four-cylinder type has a 3 3-8 by 3 3-4 block unit power plant, the three-speed gearset in unit being a new feature to Regal construction.

Electric cranking and lighting is by a single unit system, the drive being through a silent chain to the crankshaft. Other specifications include 106-inch wheelbase, 30 by 3 1-2 tires, cantilever rear springs and floating rear axle.

Fred W. Haines, president of the Regal company, today reported that great interest is being shown in the new models, production of which is to begin at once.

Ross Eight-Cylinder Car Enters Market

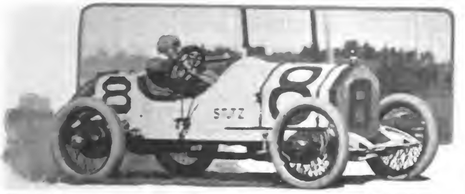
DETROIT, MICH., Jan. 13—*Special Telegram*—The Ross & Young Machine Co., prominent in the parts and machining business of the city and heretofore concerned in the making of automobiles for another concern, has entered the car-making business itself with the Ross eight, which is to sell for $1,350 in five-passenger touring form. The eight-cylinder engine is made by the concern in its own factory and has the usual two blocks of four cylinders arranged on the common crankcase at an angle of 90 degrees to each other. The cylinders have a bore of 3 inches and a stroke of 4 1-2 inches, and there is nothing in the V between the two blocks except the carbureter. The camshaft is above the crankshaft and drives through silent chain. The three-bearing crankshaft is the same in form as that used in eights already brought out. Connecting-rods attach to it in hinge fashion.

The Stewart vacuum system of fuel feed is employed, and oiling is by force feed to the cylinder walls, the crankshaft and the camshaft. The starting and lighting equipment is of the single unit type, the combined motor generator being placed on the gearbox and driving through silent chain to the flywheel with a 3 to 1 reduction.

The motor is three-point suspended and by having the three-speed gearset integral with it, forms the usual unit power plant design. Other specifications of the car are 115-inch wheelbase, 34 by 4 tires on wood wheels, open driveshaft fitted with two Spicer universals and Timken front and rear axles, the latter being a floating construction. The rear springs are long three-quarter ellipties. Finish of the Ross car is very attractive, the upholstery being Spanish leather.

John L. Ross stated today that his concern is taking steps to perfect a dealers' and sales organization and that from 500 to 1,000 cars are to be marketed this year.

Cooper, in Stutz, Wins Point Loma Race



Earl Cooper in the Stutz with which he won the 305.082-mile Point Loma road race at 65.05 miles per hour

Carlson's Maxwell Sets Non-Stop Mark of 305.082 Miles

Finish in Point Loma Road Race

Car	Driver	M.P.H.
Stutz	Cooper	65.05
Maxwell	Carlson	63.98
Duesenberg	Alley	62.77
Mercer	Ruckstell	57.56
Alco	Taylor	54.10

Duesenberg - O'Donnell - Callaghan running at finish.

SAN DIEGO, CAL., Jan. 9—*Special Telegram*—Driving with rare judgment of pace and reducing repair time to the minimum, Earl Cooper, in the Stutz, won the 305.082-mile Point Loma road race in 4:40:10 1-5, or an average of 65.05 miles per hour.

A Non-Stop Record

It was a hard-fought victory, the winner crossing the tape only 90 seconds ahead of Carlson, the Maxwell driver and another native son, who took second place and incidentally hung up a new world's non-stop record of 305.082 miles. Cooper covered the fifty-one laps of the dangerous 5.982-mile course in 4 hours 40 minutes 10 4-5 seconds, an average of 65.05 miles per hour. Cooper's time today is the slowest in his speedy career and the slowest ever made in any race on the coast since the inaugural of the Santa Monica event in 1910, when Harris Hanshue, at the wheel of an Apperson, averaged 64.45 miles per hour in leading the field home. Today's time, however, is considered remarkable for the San Diego course which has a number of grades and, moreover, is new, consequently not being as fast as the Santa Monica and Corona roads on which world's speed records have been attained.

Time Was Slow

Because of the slow time, Carlson's non-stop achievement at a rate of 63.98 miles per hour loses much of the punch that a feat of this sort generally carries. True, he bettered the mark of Barney Oldfield, who drove 301.81 miles without a single halt in the recent Corona speed massacre, but Carlson's average today was more than 20 miles an hour less.

Third place in today's contest went to Tom Alley, the speed meteor among the unknowns who forged to the front last season. De Palma's former mechanician, who was at the wheel of a Duesenberg, got the checkered flag 10 minutes after Carlson shot over the line, but he was a more serious contender than the comparative times at the finish show. Alley went to the front at the start of the race and although forced to surrender this coveted position at the completion of 108 miles, he was always up with the leaders and running dangerously close to the pacemaker.

First prize was $5,000; second $2,500; third, $1,250; fourth, $750; and fifth, $500.

Only two other cars, out of a field of eighteen starters, finished. Guy Ruckstell, the young California protegé of George Bentel and the driver of the No. 5 Mercer, took fourth money after playing in hard luck throughout the contest. After completing six circuits of the course, he lost an entire lap when forced to stop three times to repair a sticking air gauge. With the race half over, he lost more ground in making a tire change and taking on fuel. Engine trouble cost him another lap at the end of 215 miles. But Ruckstell was game and won $750.

The last contestant to get the checkered flag was William Taylor, driving the same Alco which defeated Ralph de Palma's crippled Mercedes in the grand prize at Santa Monica last February. Taylor's car was the slowest on the course. It was lapped several times by the leaders before the race was half over but kept religiously and gamely to its touring car pace and gradually climbed up into seventh position. Jack Callaghan, in a Duesenberg, pushed the Alco hard, however, until the fortieth lap when a burnt out coil made a stop imperative. The stop was costly and although Callaghan resumed the chase, there was not enough speed in his mount to overtake the rattling Alco and capture last prize money.

When Taylor finished with an average of 54.1 miles per hour, Callaghan's was the only car running and was flagged in. Cooper, the winner, used Firestone tires.

A Gruelling Test

That it was a gruelling test for the cars is evidenced by the fact that only six machines out of eighteen starters were running when the race was called and that when the contest was half over, only ten were thundering over the roads. The first lap was a circuit of trouble for the drivers. Klein did not even get across the wire. At the start, he twisted off a pinion shaft, locking the whole rear end of the King. The car could be pushed back but all the officials on the course could not shove it forward an inch.

The Gordon Special failed to complete a lap. It struck a railroad crossing on the backstretch and blew three tires simultaneously and tore off radiator in collision against a curb. The spectators escaped injury by a miracle and Huntley Gordon, the driver, was fortunate to get out unhurt.

Callaghan, driving the No. 10 Duesenberg, wrecked his car on the first lap. He missed the curve at the Talbot street turn and crashed head on into a telegraph pole. He suffered the only injury of the day, breaking two teeth when his face was shoved against the steering wheel, but later relieved Eddie O'Donnell, his teammate.

Bob Burman, with the Boillot Indianapolis Peugeot, started with Oldfield and Cooper as one of the favorites but went out on the seventh lap with a broken connection. On the same lap, the No. 11 Marmon encountered spark plug trouble and its driver, Cadwell, sprained his wrist when he humped over the car tracks. He was relieved by Tony Janette, who completed another circuit of the course before he was forced to dock the car permanently because of a cracked cylinder.

The Tahis, with skyrocket-shaped oil tank on the hood, failed its driver, Gable, on the eleventh lap when it was running fourth. A broken wrist-pin forced him to leave it beside the road in the Canyon. A flying stone broke a gas line on the No. 12 Mercer and put Louis Nikrent out of the running on the fourteenth lap.

When showing the way to the field on the twenty-third lap, Eddie Rickenbacher broke a connecting-rod on the Peugeot. The Carling special burned out a connecting rod bearing on the twenty-fifth lap when running in ninth place.

Barney Oldfield was a dangerous contender until the thirty-seventh lap, when he retired the Maxwell with engine trouble, the exact nature of which will not be known until the car is torn down. Spark plug trouble bothered him; he changed a complete set twice, once on the seventeenth and again on the twenty-seventh lap, losing much time.

McCarthy, upon the No. 9 Peugeot, was in fifth place on the forty-first lap when his mount suffered a broken connecting-rod bearing near the Rossville turn. On the same lap in the Canyon, O'Donnell burnt out a coil and was relieved by Callaghan, whose loss of two teeth did not prevent him from running to the pits, repairing the damage to the car and pluckily but vainly resuming the race

The cars were started in pairs at 30-second intervals. Of the nineteen entered, Harry Grant's Sunbeam was the only machine that was not at the tape. Grant made his nomination at the proverbial eleventh hour, after conferring with the promoters, but this morning received a wire from William Zeigler, the owner of the English speed creation, ordering a withdrawal.

Tom Alley went to the front at the start and held the position of pacemaker for eighteen laps when he was passed by Rickenbacher's Peugeot. The French car showed the way for four more laps and then was eliminated, Cooper's Stutz moving up automatically to first place and holding the lead until the end.

Carlson started well down the list but worked up gradually. He was running third on the twenty-seventh lap and moved up to second on the thirty-third. At one time, he was only 52 seconds astern Cooper but never caught the Stutz.

Fifty thousand spectators witnessed the race which was promoted by the Al Bahr temple of the Mystic Shrine to advertise the Panama-California exposition, which opened here New Year's day. One hundred nobles guaranteed $100 each, making a purse of $10,000, which was split five ways—$5,000 for the first, $2,500 for second, $1,250 for third, $750 for fourth and $500 for fifth place. An additional $2,500 was hung up to be awarded the winner if the world's racing record was broken. The money is still in the bank.

Stutz Wins 50-Mile Tucson Race

TUCSON, ARIZ., Jan. 9—Averaging 54 miles an hour over a track that was soft and badly cut up on the turns, Dick Clarke, driving a local Stutz racer owned by Harold Steinfeld, won the first race held in Tucson under the auspices of the A. A. A. The race was for 50 miles and was held on a recently completed mile track and was for a purse of $1,000. Clarke started last in a field of eight and drove a consistent race to the finish, passing one competitor after another. At the finish he was 3 1-2 miles ahead of "Red" Brewer, who took second place in a Marmon. Clarke's time was 1:53:13 and Brewer's 1:59:02. Maxwell, at the wheel of a Fiat, finished third in 2:05:59. Billy Delano was fourth in a Moon; time, 2:09:54. Various troubles caused the other cars which started to drop out before the finish.

California Grand Prix Is Venice Race

VENICE, CAL., Jan. 6—The Venice road race which is scheduled for March 17 is to carry the name of the California Grand Prix. This announcement was made today by Leon T. Shettler, chairman of the racing committee of the Western Automobile Assn.

The Venice course has been changed and the motor parkway offers greater speed possibilities than ever. One turn has been eliminated entirely and the remaining turns are to be widened into sweeps and banked, making what is expected to be the fastest motor race course on the Pacific Coast.

Weed Hangs Up Prize for Vanderbilt

SAN FRANCISCO, CAL., Jan. 4.—Drivers in the Vanderbilt and Grand Prix races, to be held here February 22 and 27, will compete for other valuable prizes besides the $16,000 in cash prizes mentioned in the entry blanks and the Vanderbilt and Grand Prize cups. The Weed Chain Tire Grip Co., Bridgeport, Conn., has offered to put up as a trophy a Weed Chain bag filled with silver dollars, amounting to approximately $250. This will go to the driver who sets the fastest pace for the first 100 miles of the Vanderbilt cup race.

Stevens-Duryea Stops Manufacturing

CHICOPEE FALLS, MASS., Jan. 11—The Stevens-Duryea Automobile Co., this city, has notified all of its selling representatives that, owing to the financial depression and general uncertainty of business the further manufacture of Stevens-Duryea cars and the bringing out of new models has been definitely postponed. The company has on hand spare parts to the value of $1,500,000 for the 14,000 Stevens-Duryea cars now in use and will continue the manufacture of spare parts to meet all requirements.

The Stevens-Duryea Co. is entirely free from debt and owns two factories, both of which are free of incumbrances. One is a new plant completed 3 years ago and located in East Springfield, and the other is the old plant of the company in this city.

Van Alstyne Advertising Manager

NEW YORK CITY, Jan. 13—T. B. Van Alstyne has been appointed advertising manager of the Class Journal Co., publisher of THE AUTOMOBILE, with headquarters at 239 West Thirty-ninth street, this city.

Six Packard Worm Drive Trucks

Models Range from 1 to 6 Tons Capacity—All Are Separate Engineering Designs

DETROIT, MICH., Jan. 11—The Packard Motor Car Co. has a new line of motor trucks which range in capacities from 1 to 6 tons. These have been in the process of development for 3 years and have overhead worm drive with the control centralized below the steering wheel and on the steering column, which feature also characterizes the passenger vehicles of Packard make.

The 1-ton model marks the entrance of the big company into the field of light duty vehicles. A point is made of the fact that each of the six models is a separate engineering design and that for this reason they do not all adhere to exactly the same construction, although in the main they are all built along the same lines.

The details of the 1-ton and the two heavier models, the 5- and 6-ton, are not completely divulged at this time, but specifications of the 2, 3 and 4 tonners are available. They all incorporate four-cylinder block-cast engines which are three-point suspended. They have left drive and left control, shaft drive direct to the worm and three-speed gearsets. They are automatically governed and provision is made for electric lighting and cranking. Another feature is the power take-off, which makes it a simple matter to drive independent mechanism by the truck power.

The 3- and 4-ton models have a 4 1-2 by 5 1-2 motor of 32.4 S. A. E. horsepower. It has four-bearing crankshaft and camshaft and incorporates a multiple dry-disk clutch. The drive is through the progressive three-speed gearset to the worm gearing. The worm is of the straight type, and of steel, while the wheel is of bronze. Timken bearings are used in the axle construction, which is floating. The frame is a channel section and suspension by semi-elliptic springs all round. The wheelbase of either model is 13 feet standard, or 15 feet optional. The 3-ton has 36 by 5 tires and the 4-ton the same size front tires and 40 by 5 rear. The rear set are duals in either case.

The 2-ton has a 4 by 5 1-2 engine of 25.6 horsepower, S. A. E. rating, and adheres to the same general design throughout as the 3- and 4-ton types. Its wheelbase is 12 feet standard or 14 feet in the long size, and tires are 34 by 4 with the rear dual.

The price of the 2-ton truck is $2,800; of the 3-ton $3,400 and of the 4-ton $3,800. If the Packard-Bijur system of lighting and cranking is fitted at the factory, it adds $225 to these figures.

The outward appearance of the new Packard series is much the same as the older models. The motor is placed forward of the driver's cab and the radiator has the distinctive Packard shape. The hood is provided with louvers.

It is expected that the engineering department will have given its O. K. to the 5- and 6-ton models by the end of February, and that in three or four weeks the details of the 1-ton will be forthcoming.

Goodrich Making Millimeter Solid Tires

NEW YORK CITY, Jan. 9—The B. F. Goodrich Co., Akron, O., is helping out its plant in Colombes, France, in the manufacture of the millimeter band tires. The American plant has imported a millimeter mold and will manufacture these solid tires to relieve the Colombes plant, which is being operated by the French government. It is stated that 350 of the employees, who were under 45 years of age, have gone to war, leaving the work of the plant on the hands of the older workmen. Both the French and English demand will be supplied and buyers of American commercial vehicles can have an equipment which is interchangeable with European standards.

NEW YORK CITY, Jan. 12—The Mason-Seaman Transportation Co. has asked an injunction to restrain the enforcement of the public hack ordinance.

The company asserts the average cost of running a taxicab now is $0.32 a mile, and it charges only $0.25 a mile, operating at a loss. Under the amended ordinance the charge would be less.

To Nationalize Used Car Report

Arrangements Made for Dealers All Over Country to Co-operate with Chicago Assn.

NEW YORK CITY, Jan. 7—The Chicago Automobile Trade Assn., the local organization of automobile and accessory dealers, took its first active step today in its endeavor to nationalize its Used Car Central Market Report, which it has been issuing for several months and which is a complete report of prices at which used cars have been sold in the Windy City, by a luncheon given at the Engineers' Club in this city and attended by approximately forty car dealers from this city, Boston, Buffalo, Syracuse, Rochester, Brooklyn, Newark and other eastern cities. The object of the meeting was to lay the plan before the eastern dealers in order that they might take it under consideration in their local organizations.

As a result of today's luncheon, this Used Car Market Report will be considered by the different dealers' organizations represented with the possible thought of co-operating with the Chicago organization in furnishing prices of used cars sold in the different eastern cities, these to be incorporated in the quarterly market report, thereby giving national scope to the work.

The Chicago association was represented by President H. M. Allison, Treasurer Henry Paulman, and C. W. Stiger. President Allison outlined the plan of nationalizing these quarterly market reports by having the different dealers' associations furnish the prices at which their used cars are sold, and incorporating these prices in their reports. In order to make this possible the country was divided into zones corresponding with those of the Federal reserve. This was found unfavorable in New York as the metropolitan area was divided among three different zones, and if the books were to be nationalized different zones would have to be marked out.

Alfred Reeves, general manager of the National Automobile Chamber of Commerce, Inc., was heartily in favor of having the Chicago movement taken up in the east. In speaking of the necessity of aiding a dealer, he said: "The average citizen who comes into the dealer's show room to sell a used car in part payment for a new one, is shrewder than the salesman trying to dispose of a new car, and because of this the salesman should be backed up by such an accurate market report as this. Dealers are generally allowing too much money on used cars. The used car market is always a falling one, which makes it worse with those who allow too much for old cars. The average dealer is too careless an individual to be a successful business man. He does not keep sufficiently close record of costs, and when it costs the average dealer 15 to 16 per cent. to do business in a big city he cannot afford to give half of this away on a used car trade. The average dealer keeps his used cars in stock too long, and their value is constantly falling, a condition due to the fact that the allowance on the used car was too high, and the dealer holds on, hoping to realize, but the longer he holds the lower the value. There are approximately 21,500 dealers in the United States, and surely this huge number should have some national organization, and this question of market price is one of the first things that should be considered."

E. P. Chalfant, secretary of the association of electric passenger vehicles, has been working with the dealers in nineteen cities endeavoring to show them why more sane allowance must be made for used electrics, and was of the opinion that practically all of the dealers were holding their own cars too long with the hope of getting a high price, but were finally compelled to sell at a sacrifice. He was heartily in favor of the used car market report and was using his efforts to have all dealers selling the electrics he represented use such reports. One of the greatest difficulties, Mr. Chalfant considered, of the used car problem was that the dealer failed to keep record of the cost of selling these cars. Because of holding the price, sales were delayed, whereas if lower prices were in rule frequently the cars could be sold ten times quicker and consequently at a smaller loss.

R. H. Johnson, president of the New York dealers' association, favored the used car market reports, and stated that his association was going to consider the advisability of co-operating in the work. He thought that too frequently the dealer made the error of not passing up the sale rather than getting the sale, but allowing too much for the used car. Dealers would find themselves better off at the end of the year if they had the courage to lose sales rather than make them on unprofitable trades. This sentiment was corroborated by several other New York dealers

Representatives from Boston, Buffalo, and other cities all favored the scheme of nationalizing the Used Car Market Report and are going to lay the proposition before their respective organization.

Columbus Dealers Indorse Movement

COLUMBUS, O., Jan. 8—The Columbus Automobile Trades Assn. at the annual meeting held yesterday voted to affiliate with the Chicago Automobile Trades Assn. in its plan of looking after the used car proposition. It is the first club to affiliate with the Chicago organization in that matter. Columbus will be the headquarters for the central zone, into which the country will be divided. It is the plan to have reports made of all used cars which are bought and the price paid for the same and these will be tabulated every month. This information is expected to be useful in handling the used car question. The work of tabulating in the central zone will start February 1. Permanent headquarters for the Columbus association have been established in the Virginia Hotel.

Dealers Active at Milwaukee Show

MILWAUKEE, WIS., Jan. 9—Again taking rank as the first motor show of consequence to be held in the West this year, the seventh annual exposition of the automobile and allied industries opened in the Auditorium last night, Friday, January 8, under the auspices of the Milwaukee Automobile Dealers' Assn.

But for the presence of America's first eight-cylinder car and several new models recently announced by manufacturers as of New Year's day, 1915, the Milwaukee show is practically the same as in former years. The most striking special chassis exhibits are those of Pierce-Arrow, Cadillac and Chalmers. Cadillac's new eight is resplendent in nickel and cream enamel. Pierce-Arrow has a C38 stripped chassis and Chalmers is showing the new six at $1,400 simultaneously with its debut at New York. Cars, trucks and accessories are exhibited. At least 70 per cent. of the exhibitors here are state agents for the several lines they handle, and show week brings to Milwaukee a large percentage of the subdealers and agents throughout the state of Wisconsin, to bring prospects to see the show and get into personal touch with the state agent and make reports on progress, and seek the assistance of state agents in closing obstinate prospects.

During 1914 Wisconsin took 18,515 new cars, as compared with 10,068 new cars purchased in the state during 1913. Talks with state agents who know conditions indicate that the 1915 absorption will be no less than 25,000 cars, and nearly all requisitions are on that basis. This is more than the total number of cars owned in Wisconsin during the year 1912. The aggregate attendance at the Milwaukee show is approximately 50,000 for the week.

Over 64 Car Makes for Detroit Show

DETROIT, MICH., Jan. 11—At least sixty-four different makes of automobiles will be shown at the fourteenth annual automobile show promoted by the Detroit Automobile Dealers' Assn., which opens Saturday, January 16, in the two large buildings of the Detroit Lumber Co., West Jefferson avenue.

The promoters say that never before have the dealers responded so eagerly for space and shown as much interest. There is practically no space left vacant, but as usual there will be some late comers, who will be glad at that to be "among the others."

Of the sixty-four different makes of cars now on the exhibitors' list fifty-seven are gasoline cars and seven are electrics. Of the fifty-seven gasoline cars thirty-eight are passenger cars and nineteen are delivery cars or trucks. Of the seven electrics, six are passenger models and the seventh a taxicab. The number of car manufacturers who will be represented will be at least forty-four, of which thirty-seven make gasoline cars and seven electric vehicles.

Electrics Sell Well at Denver's Show

DENVER, COL., Jan. 6—Denver's first show exclusively for electric vehicles and their accessories is being held this week in the showroom of the Denver Gas & Electric Light Co. The event is being well attended and the interest shown thus far is regarded by the exhibitors as evidence that the fair will prove a substantial stimulant for trade. In fact, seven sales have been definitely closed during the first 3 days of the show. Five of these contracts are for pleasure vehicles and two for trucks.

Annual Banquet of the Motor and Accessory Manufacturers at the Waldorf-Astoria, January 6

NEW YORK CITY, Jan. 9.—The annual banquet of the Motor and Accessory Manufacturers held January 6 at the Waldorf-Astoria at which there were about 275 in attendance. At the meeting of the board of directors, held in the association's offices, 33 West 42d Street, January 7, the following officers were elected to serve for a term of 1 year (the officers are board members): President, F. Hallett Lovell, Jr., Lovell-McConnell Mfg. Co., Newark, N. J.; Vice-president, C. W. Stiger, Stromberg Motor Devices Co., Chicago, Ill.; Second vice-president, C. E. Thompson, The Electric Welding Products Co., Cleveland, O.; Third vice-president, T. J. Wetzel, The Dyneto Electric Co., this city; Treasurer, L. M. Wainwright, The Diamond Chain & Mfg. Co., Indianapolis, Ind., and secretary and assistant treasurer, A. P. Sloan, Jr., Hyatt Roller Bearing Co., Newark, N. J.

Show Results

Public Confidence Stronger —Policy of Announcing at Shows Gains

NEW YORK CITY, Jan. 12—Acting as a stimulus to Wall street and business activity throughout the country, with a 12 per cent. gain in paid attendance and showing a tendency among the manufacturers to announce their new models at show time, the New York automobile show closed its doors last Saturday evening on the most successful week in its history. Retail sales made were well in advance of the best records of previous years, the low-priced cars proving themselves good retail sellers. Over 4,000 dealers visited the show and many agencies were closed for the newly announced cars. Great interest was shown in the eight-cylinder cars, while the low-priced automobiles are evidently steadily gaining in popularity, as they were constantly surrounded by appreciative groups.

Three features of the show are especially noteworthy, its effect on the bankers of Wall street and general business conditions throughout the country, the tendency of car manufacturers to hold their announcements until show time and the consistent gain in attendance.

Wall street men were greatly surprised at the interest shown by the public and at the extensive car sales. These men cannot seem to get over the idea that the automobile is a luxury and apparently cannot be brought to understand that it has come to be a necessity. As a direct result of the public confidence in the automobile industry brought out at the show, automobile and tire stocks rose in value and the general market itself was strengthened. The automobile industry is setting the example in progressive prosperity to all the large industries of the country which have been complaining of the general depression but have done nothing to relieve it.

That car makers should make their announcements of new models, changes in price, etc., at the show was the original idea. For years the manufacturers have been drifting away from this policy but now they show a laudable tendency to return to it. Following this plan, the winter and spring months permit the factories to carry out their manufacturing while sales may be made through the spring, summer and fall months, besides getting rid of the distrust of the buying public that new models or lower prices will be announced at any time during the year.

With a 22 per cent. increase in paid attendance for opening night over 1914, the best previous year, the total attendance for the week was 12 per cent. better than for last year's show. Thursday the attendance was 20 per cent. in advance of the best previous figures.

Factory Miscellany

KISSEL Factory Busy—The first twenty-five cabs of an order for 200 Kissel taxicabs for the Los Angeles, Cal., Taxi Co. left the shops of the Kissel Motor Car Co., Hartford, Wis., recently on a special train. At the same time a special train loaded with four war trucks for European shipment went eastward. So busy are the Kissel shops that the usual holiday vacation was cut short and overtime is again the rule in the commercial car department.

Cleveland Welding Co. Adding—An additional factory, 100 by 160 feet, is being erected for the Metals Welding Co., Cleveland, O., next to its present plant.

G. & J. to Enlarge Plant—The G. & J. Tire Co., Georgia street, Indianapolis, Ind., is preparing to construct an addition to its plant to cost $4000.

American Roller Bearing Complete Plant—The American Roller Bearing Co., Pittsburgh, Pa., recently completed the erection of a new plant, which was placed in operation on January 1.

Van Blerck to Add—The Van Blerck Motor Co., Monroe, Mich., is contemplating the construction of a $100,000 addition to its plant. It will be two stories, of concrete or brick.

Edmunds & Jones Receiving Bids—Edmunds & Jones, lamp manufacturers, Detroit, Mich., are receiving bids for the construction of a one-story, 60 by 100 foot addition to their plant to cost $10,000.

Toledo Ford Tire Work Started—The work of constructing a plant for the Toledo Ford Tire Co., Findlay, O., has been started. It is announced that the foundations will be especially heavy.

Safety Fender Co. in Ohio—Plans have been prepared for the organization of the Automatic Safety Fender Co. of Ohio, with headquarters at Columbus. The company will have an authorized capital of $30,000 and will be licensed to manufacture the fender made by the Automatic Safety Fender Co. of Chicago. The Columbus company will manufacture for Ohio only.

Baily Body Builds—The expansion of the business of the Baily Mfg. Co., York, Pa., engaged in the manufacture of commercial automobile bodies, has necessitated the erection of a second plant, and contracts have been let for the erection of a factory building at North Wales, near Philadelphia. The North Wales factory will be used for the manufacture of bodies for Vim commercial cars. S. E. Baily, president of the York company, has closed a contract whereby his company is required to furnish $33,600 worth of bodies as soon as possible. The North Wales factory will be two-and-one-half stories in height, the main building 168 feet by 50 feet, with a wing 60 feet by 40 feet. It will be of concrete construction. The Baily Mfg. Co. has been in operation less than a year. Mr. Baily, prior to the organization of the Baily company, was president of the York Carriage Co., York, and the Kline Motor Car Corp., Richmond, Va.

Truck Plant for Ia. Penitentiary—The Iowa State Board of Control has authorized Warden J. C. Sanders, of the state penitentiary at Fort Madison, to hire an expert automobile engineer to draw tentative plans for an automobile plant at that institution. The warden is empowered to construct two motor trucks. Parts are to be bought from manufacturers and the trucks assembled at the prison. If the assembly proposition is a success the board may authorize the installation of the necessary plant for the assembling of trucks on a large scale. It is also possible that the various parts may eventually be manufactured at the prison. Several experts of automobile engineering are among the present prisoners of the institution.

The Automobile Calendar

Jan 9-16	Philadelphia Show, Metropolitan Bldg., Philadelphia Auto. Trade Assn.
Jan 16	Detroit, Mich., Show.
Jan 16-23	Cleveland, O., Show., Cleveland Automobile Show Co., F. H. Caley, Mgr.
Jan 18-23	Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 20	Denver, Colo., Lincoln Highway Assn. of Colo., Fourth Annual Convention.
Jan 20-28	Lancaster, Pa., Hiemenz Auditorium.
Jan. 21-23	Santa Ana, Cal., Show.
Jan 23-30	Montreal, Que., Show, Allen Line Liverpool Bldgs., Montreal Automobile Trade Assn., T. C. Kirby, Mgr.
Jan. 23-30	Portland, Ore., Show.
Jan 23-30	Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 25-30	Fall River, Mass., Show.
Jan. 25-30	Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan 28	New York City, S. A. E. Met. Section Meeting: Report Research Com. on Greases. Supplementary subject: Asphalt vs. Paraffin base lubricants.
Jan 30-Feb. 6	Columbus, O., Show, Memorial Hall, Columbus Auto Club and Columbus Auto Trades Assn.
Jan 30-Feb 6	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Automobile Trade Assn.
Feb	Portland, Ore., Show: Portland Auto Trade Assn.
Feb.	Toledo, O., Show, Toledo Auto Show Co.
Feb 1-6	Louisville, Ky., Show, Louisville Auto Dealers' Assn., First Regiment Armory.
Feb. 4-6	Marinette, Mich., Show, Dealers Assns. of Marinette and Menominee.
Feb. 2-7	Kalamazoo, Mich., Show. Armory.
Feb. 8-13	Toledo, O., Show, Terminal Bldg., Toledo Auto Shows Co., H. W. Blevins.
Feb. 8-14	Kansas City, Mo., Show
Feb. 8-14	Troy, N. Y., Show, Troy Auto. Dealers' Assn.
Feb. 9-12	Eau Claire, Wis., Eau Claire Auto Dealers' Assn.
Feb. 9-12	Peoria, Ill., Show, Peoria Auto & Motor Cycle Dealers.
Feb 15-20	Grand Rapids, Mich., Show. Klingman Furniture Exposition Bldg., Grand Rapids *Herald*; C. L. Merriman.
Feb. 15-20	Omaha, Neb., Show, Auditorium, C. G. Powell.
Feb 15-20	Bridgeport, Conn., Show, State Armory: B. B. Sterber.
Feb. 22	Newark, N. J., Light Car Club of N. J., Hillclimb at Teaneck.
Feb. 22	San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Feb. 23-27	Syracuse, N. Y., Show, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27	Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 25	New York City, S. A. E., Metropolitan Sec. Meeting Report of Research Committee on Kerosene Carbureters. Research Com. Report on Non-Electric Continuous-Torque Transmission.
Feb 27	San Francisco, Cal., Panama-Pacific Exposition Grand Prize Race, Panama-Pacific Exposition Grounds. Promoter, Panama-Pacific Exposition Co.
Mar. 3	Albany, N. Y., Associated Garages of America, General Convention.
Mar 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar 6-13	New York City, Made in the U. S. A. Exhibition, Grand Central Palace
Mar 8-13	Canton, O., Show, Auditorium, Stark Co. Auto Show and Electrical Exposition
Mar. 8-13	Des Moines, Ia., Show. C. G. Van Vliet
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds. Promoter, Panama-Pacific Exposition Co.
Mar 17	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race
April	Calumet, Mich., Show, Coliseum
May 17-18	Boston, Mass., A. A. A. Annual Meeting
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway
June 9	Galesburg, Ill., Two-mile Track Meet
June 16	Chicago, Ill., Speedway 500-Mile Race, Speedway Park Assn.
June 25	Sioux City, Ia., Track Meet
July 4	Tacoma, Wash., Road Race
Aug 20-21	Elgin, Ill., Road Race
Sept 20-25	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

MILWAUKEE Mayor Heads Tire Co.—The Wisconsin Tire Co., Milwaukee, Wis., incorporated last week, with prominent officials of the city of Milwaukee as members, has elected the following officers: President, Dr. G. A. Bading, mayor of Milwaukee; vice-president, J. A. Werwinski, South Bend, Ind.; secretary, Louis M. Kotecki, city comptroller; treasurer, Joseph P. Carney, city treasurer; general manager, Fred G. Simmons, commissioner of public works. The company is organized to distribute motor car tires and tubes direct to owners. The tires will be trademarked "Badger" and will be sold at wholesale prices. The office and distributing station is located at 188-192 Eighth street, in the Wisconsin garage.

Burgess Resigns from Enger—W. L. Burgess has resigned as sales manager of the Enger Motor Car Co., Cincinnati, O.

Wood Duplex Engineer—L. E. Wood is an engineer for the Duplex Engine-Governor Co., Inc., New York City. He was formerly a road engineer for the Milwaukee Locomotive Mfg. Co.

Toaz Maxwell Draftsman—The Maxwell Motor Co., Detroit, Mich., has appointed G. A. Toaz chief draftsman. He was formerly designer for the Northway Motor & Mfg. Co., Detroit.

Pritchard Heads Philadelphia Hupmobile—T. W. Pritchard, former sales manager of the local Krit branch, Philadelphia, Pa., has been placed in charge of the downtown branch of the Tioga Automobile Co., home of the Hupmobile.

Cermak Premier Engineer—J. Cermak is with the Premier Motor Mfg. Co., Indianapolis, Ind., as an engineer. He was formerly efficiency engineer with the Fairbanks-Morse Electrical Co., Indianapolis.

Gas Tank Co. Elects—At the annual meeting of the Gas Tank Recharging Co., Milwaukee, J. J. McJeskey was elected president; J. G. Butzer, secretary, and T. J. Pagels, treasurer. Arrangements are being made for a larger output of acetylene gas.

Hathaway Makes Change—D. C. Hathaway, until recently with the Cleveland, O., branch of the Firestone Tire & Rubber Co., has been appointed manager of the solid tire department of the Kelly-Springfield Tire Company, Cleveland, O., branch.

Maines Locates in Denver—G. H. Maines, recently sales manager for the Chalmers-Syracuse Co., Syracuse, N. Y., distributor of the Chalmers and Chevrolet cars, has just located in Denver and gone into partnership with his brother, H. E. Maines, Colorado and New Mexico distributor of the Chevrolet and Monroe.

Kidder Heads Reo Dept.—M. D. Kidder, for 3 years at the factory of the Reo Motor Car Co., Lansing, Mich., is now in charge of the wholesale department of the Linscott Motor Co., Boston, Mass., Reo distributor for New Hampshire, Vermont and Massachusetts.

Mowe Joins Kelly-Springfield Tire—J. V. Mowe, 7 years Detroit manager for the Firestone Tire & Rubber Co. and lately representative at large for the Goodyear Tire & Rubber Co., has been appointed assistant general sales manager of the Kelly-Springfield Tire Co., New York City. Mr. Mowe will make his headquarters in Detroit.

Kaufman Resigns—President J. A. Ables has been appointed general manager of the Motor Car Equipment Co., New York City, to take the place of Carl Kaufman, who has resigned as treasurer and general manager. He continues as a director. He will take an active interest in the Nonpareil Horn Mfg. Co., New York City, of which he becomes president.

Rice Heads N. Y. Knight—L. I. Rice has been appointed manager of the new branch of the Knight Tire & Rubber Co., Canton, O., at 215 West Fifty-first street, New York City. He was formerly connected with the Republic Rubber Co. as traveling representative, and previous to that with the Century Tire Co., Buffalo, N. Y.

Young Pneumatic Tool Mgr.—H. B. Young has been appointed manager of the Cleveland, O., branch of the Chicago Pneumatic Tool Co., and will have charge of both the commercial car and tool departments. Young has been identified of late with the local distributors of the Velie cars, but was connected several years ago with the sales department of the concern he now again is connected with.

Brink Heads New Top Co.—The Auto Top and Seat Cover Co., Kalamazoo, Mich., is the name of a new concern located there for the manufacturing of automobile tops and seat covers. S. G. Brink, who has had many years of experience in this line, is at the head of the concern. Mr. Brink has been associated with the Velie Motor Co., Moline, Ill.; Auburn Auto Co., Auburn, Ind.; Eckert Carriage Co., Auburn, Ind.; Page Bros. Buggy Co., Marshall, Mich., and for the last 2 years he has had entire charge of the trimming department of the Michigan Automobile Co. The new concern is located at 214 East Water street.

Garage and Dealers' Field

Marathon Agency in Cuba—G. Miguez y Cia., Havana, Cuba, has been appointed distributor there for the Marathon Tire & Rubber Co., Cuyahoga Falls, O.

Jacksonville Overland Moves—The Overland-Florida Co. has moved into its new quarters at 314 West Monroe street, Jacksonville, Fla.

R. M. Owen Opens New Salesroom—R. M. Owen & Co. has opened its showrooms for the Metropolitan district for the Owen Magnetic cars at 737 Seventh avenue, New York City.

Oxy-Hydrogen Welding in Waupun—The J. S. Morris Carriage Co., Waupun, Wis., has made an installation of oxy-hydrogen welding and cutting apparatus and will specialize in motor-car work. Heretofore it was necessary to send work to Milwaukee.

To Form Grand Rapids Assn.—The automobile and accessory dealers of Grand Rapids, Mich., will form an association to be known as the Grand Rapids Automobile and Accessory Dealers' Assn. A meeting is to be held this month when the formal organization will take place.

New Buffalo Branch—The Tire Sales Co., Buffalo, N. Y., will open a branch store at 827 Main street, that city, to be called the Motor Tire Supply Co. The new company will handle both wholesale and retail factory second tires and low-priced guaranteed tires. A. Greenbaum is proprietor.

Large Garage for Argyle—Philippson Bros., owners of the present largest garage in Argyle, Wis., are having plans prepared for a $25,000 building, in which will be incorporated a large garage and repair shop and an auditorium seating 300 to 400. It will be of brick and hollow tile construction, fireproof, 64 by 90 feet in size and 2-story with basement. It will be ready May 15.

Establishes Large Repair Shop.—The Racine Carriage Co., organized recently at Racine, Wis., with $25,000 capital to consolidate the vehicle interests of the Richardson-Kennedy Co. and the Racine plant of the Racine-Sattley Co., is organizing one of the largest trimming, repainting and repair shops for motor cars in the state in connection with its business of manufacturing carriages. Later it is intended to establish a department for the production of special motor car bodies.

Recent Wichita Changes — Several changes have taken place along automobile row, Wichita, Kan., recently. The agents for the Regal car have moved into their new building at 210 South Lawrence avenue. The Mid-West Motor Co., which handles the Haynes cars has moved to 208 South Lawrence avenue. I. E. Martin, who handles the Paige cars, has moved to the second story of the building where he has been located at Lawrence avenue and English street pending the completion of his new building at 131 North Lawrence avenue. The Calendar-Cadillac Co., has moved to Lawrence avenue and English street.

New Fisher Rim-Grip Agents — The Western Auto Sub-Casing Co., Los Angeles, Cal., manufacturer of the Fisher rim-grip sub-casings, has appointed the following new agencies: Distributors—Guarantee Tire & Rubber Co., Salt Lake City, Utah; Auto Tire & Rubber Co., Seattle, Wash. Agents — R. C. Brewer, Riverside, Cal.; Central Garage, Fullerton, Cal.; Crowe & Sons, Santa Cruz, Cal.; Drew Carriage Co., Ontario, Cal.; C. D. McNeil, Corona, Cal.; Ford Sales & Service Co., Santa Ana, Cal.; Escondido Garage Co., Escondido, Cal.; Graham & Willsey, Elsinore, Cal.; Greenleaf Garage, Whittier, Cal.; Independent Vulcanizing Works, Orange, Cal.; Mosher & Freeze, Santa Barbara, Cal.; H. J. Painter, Long Beach, Cal.; Rabau & Baumgartner, San José, Cal.; F. J. Rawson & Son, Venice, Cal.; Remick & Co., Sacramento, Cal.; Ulrey & Co., King City, Cal.; Frank P Verbeck, Pasadena, Cal.

Two Great Successes

Yesterday and Tomorrow

The New York Automobile Show of 1915 is an event of the past. A great success it was, both in the completeness of its exhibits, and because of the enormous crowd of motor enthusiasts in attendance, reported at 400,000.

The great New York Show Number of THE AUTOMOBILE, which appeared December 31st, was also a distinct success, not alone because its advertising section exceeded by several pages that of last year, but because its reading pages contained the most accurate and complete summary of the growth and development of the industry during the past year. Its specification tables of 1915 passenger automobiles are the most complete published this year and contain over 115 American makes.

Next

The Chicago Show comes January 23-30.

THE AUTOMOBILE will publish its Big Chicago Show Number January 21st. This issue is distributed at the show.

If you did not take advantage of the New York Show by telling your story in the big New York Show Number you still have one opportunity to start 1915 right and tell your story to the thousands whose interest is keenly aroused by the great shows.

Those who attend the shows and those who do not, read these great show numbers to learn what is new and up-to-date in motordom, and what is offered thru its advertising pages. These issues are kept for reference use thruout the year.

This is the time to present your product to the largest number of interested buyers.

Send your copy today or write us to prepare it for you.

THE AUTOMOBILE

239 West 39th Street New York

Uncommon Conveniences

In the Overland Coupé you get many conveniences that are out of the ordinary.

The windows are raised and lowered by a small nickel plated handle.

It turns as easily as a door knob.

The foot pedals can be adjusted to any length or angle.

The electric starting buttons are on the steering column. Without bending or stooping you can start, stop and light the car.

On the steering column is a lock. Turn the key in this and no one can meddle with the controls or drive the car.

You should have one of these beautiful Coupes *now*.

We can make immediate deliveries.

Catalogue on request. Please address Dept. 38.

The Willys-Overland Company
Toledo, Ohio

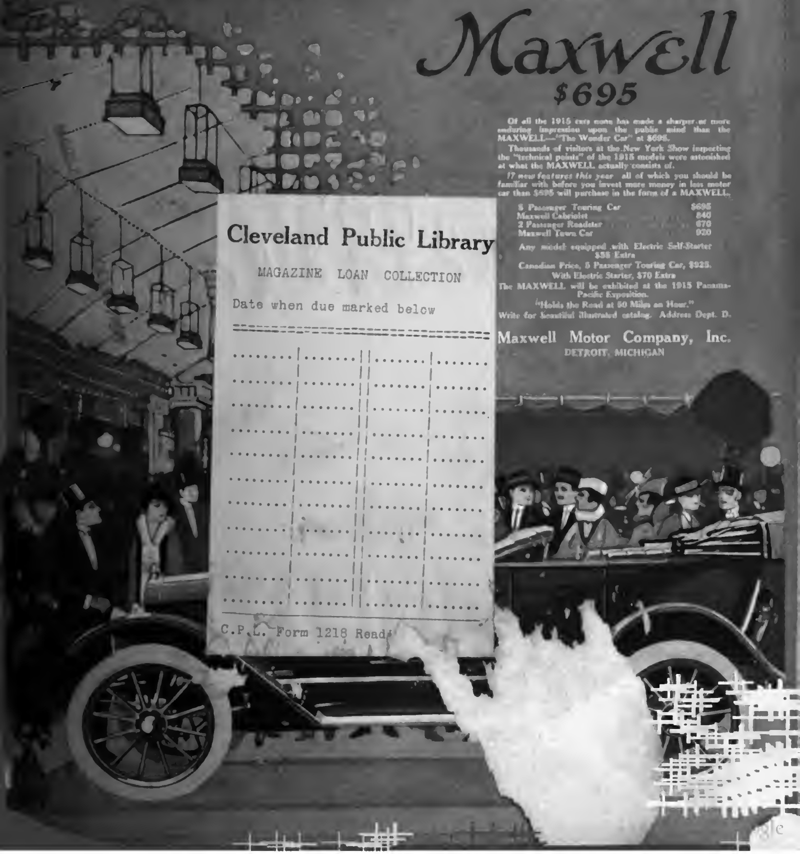
ANUARY 21,1915

25¢ A COPY

The AUTOMOBILE

MAGAZINE LOAN COLLECTION

CHICAGO SHOW ISSUE



Maxwell

$695

Of all the 1915 cars none has made a sharper or more enduring impression upon the public mind than the MAXWELL—"The Wonder Car" at $695.

Thousands of visitors at the New York Show inspecting the "technical points" of the 1915 models were astonished at what the MAXWELL actually consists of.

17 new features this year all of which you should be familiar with before you invest more money in less motor car than $695 will purchase in the form of a MAXWELL.

5 Passenger Touring Car	$695
Maxwell Cabriolet	840
2 Passenger Roadster	670
Maxwell Town Car	920

Any model equipped with Electric Self-Starter
$55 Extra

Canadian Price, 5 Passenger Touring Car, $925.
With Electric Starter, $70 Extra

The MAXWELL will be exhibited at the 1915 Panama-Pacific Exposition.

"Holds the Road at 50 Miles an Hour."

Write for beautiful illustrated catalog. Address Dept. D.

Maxwell Motor Company, Inc.
DETROIT, MICHIGAN

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Read

BRISCOE

Individuality stands out all over the BRISCOE car. It is not a copy but a creation, possessing an air of exclusiveness that makes an instant appeal to every buyer—built to stand up indefinitely.

In representing the BRISCOE, you are selling a car that gives the purchaser greater value than anything else at anywhere near the price.

You are offering a foreign car, with all that term implies—an automobile of French design mechanically, as well as in graceful foreign body lines—*at an American price.*

The prospect feels instinctively that here is a car singularly worth while, and the more he studies it, the more positive he becomes—an enthusiastic worker on your behalf—a more valuable sales agent than money could buy.

This is one of many reasons that make the BRISCOE the easiest and most thoroughly satisfactory car for dealers to handle.

CONSIDER THE BRISCOE, FROM ITS UNUSUALLY SMART EXTERIOR TO THE INNERMOST PARTS OF ITS MECHANISM, AND YOU WILL FIND BY FAR THE BIGGEST VALUE, DOLLAR FOR DOLLAR, TO BE FOUND IN ANY CAR.

A liberal contract is offered to all responsible live-wire dealers who wish to increase their profits by the sale of BRISCOE cars. But territory is being allotted fast right now. Better get in touch with us without delay.

BRISCOE MOTOR COMPANY INC. JACKSON MICHIGAN

Vol. XXXII New York—Thursday, January 21, 1915—Chicago No. 3

The Automobile

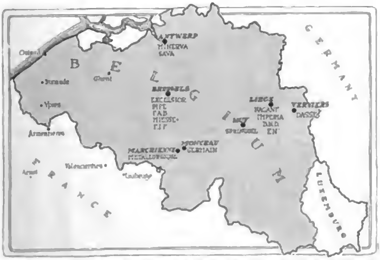
Belgian Car Factories Intact

Automobile and Accessory Plants Escape Practically Unharmed in War Zone—Even Foundries and Forges Undamaged—Germans Urge Production but Belgians are Reluctant

By W. F. Bradley

Special Representative of The Automobile *with the Allied Armies in France*

PARIS, Dec. 31—Belgian automobile and kindred factories are undamaged; their condition is such that if the war had to stop tomorrow work could be resumed with a minimum delay. I have been able to obtain this review of the situation in the invaded territory from a person holding an important position in the Belgian automobile industry and who has enjoyed unusual facilities for examining the industrial condition of the country. For military reasons my informant must remain anonymous. Since mid-September Belgium has been a land of mystery. With the exception of a strip near the shore the country is held tight in the grip of the Germans. Nobody can get in and it requires some ingenuity for anybody to get out. The few who have escaped bring with them local information. They have been numbed by bombardment or dazed by rapid movement; their range of vision is usually equal to that of a man down a shaft.



Map of Belgium, showing war zone and cities containing the leading automobile and accessory factories. These all escaped serious damage

According to my informant the following automobile factories are intact: Minerva and Sava at Antwerp; Excelsior, Pipe, F.A.B., Miesse, F.I.F., at Brussels; Nagant, Imperia, and the B.N.D. steel works at Liège; Springuel at Huy; Metallurgique at Marchienne-au-Pont; Dasse at Verviers. The railroad wagon department of the German company, at Monceau-sur-Sambre, was partly destroyed by a shell, but the automobile shops have not suffered in any way.

One of the most important automobile centers in Belgium is Liège. Here there were some marvellous escapes. The Derihon Brothers' steel works, at which the famous B.N.D. steel is produced, are situated less than 500 yards from the fort of Loncin. Owing to their location it was imagined that the works had been utterly destroyed when this fort fell into the hands of the Germans. Doubtless this lot would have befallen it if the city had been taken in the normal manner. But the enemy broke down one of the strongholds in the ring of forts and got into the city through the gap, leaving the other forts standing. These, including the Loncin fort, were shelled from the inside instead of from the outside, and as the Belgians did not know the exact position of the German batteries, they were unable to reply effectively for fear of destroying their city.

The staff of the Derihon factory witnessed one of the most spectacular bombardments the world has ever known. Some automobile engineers took up a position in the tower by the side of the fort. They could see the approach of the 12-inch shells and notice where they fell. So near were they to the line of fire that the tower trembled under the displacement

Albert Guyot, standing in the ruins of a mechanic's shop in bombarded Clermont-en-Argonne

of air as each shell went by. When the fort had crumbled under the terrible bombardment, when the land around had been ploughed by shells, some of which made holes 12 feet in diameter by 6 feet in depth, the factory remained without a scar. Within a few hours of the declaration of war, and before the German troops had penetrated far into Belgium, the enemy's aeroplanes passed over Liège, dropping bombs. Two of these fell into a garden surrounding the house occupied by one of the engineers at the B.N.D. works, but as the family had just left no injury to persons resulted.

F. N. Works Unharmed

The F.N. factory near Liège came in for particular attention. In addition to producing the F.N. car and motorcycles, these works turn out vast quantities of arms, the full title of the concern being the Fabrique Nationale d'Armes de Guerre. The Germans obtained military possession of the whole of this district, including the ring of forts around Liège, without doing any damage to the ordnance and automobile factory. They were desirous of making use of this factory for their own purposes and negotiations were entered into with the management with this object in view. All proposals that the Belgian factory should work for the German government were refused with indignation. When persuasion would not suffice, threats were resorted to, the director of the factory, M. Galopin, being put against a wall and threatened with instant execution if he did not place his services at the disposal of the German army. But M. Galopin remained firm and the threat was not put into execution. German officers then took charge of the factory and appealed to the workpeople to return, offering them more advantageous conditions than they enjoyed before invasion. Not a man replied. Unable to make use of the factory, the German authorities began to ship the special machinery in the gunmaking departments to Germany. When these departments had been stripped, many of the lathes in the automobile factory were sent across the frontier. According to the latest and most reliable information, however, the automobile shops are not in a very bad condition.

Destruction has been carried out on methodical lines, and it is one of the hazards of war that the automobile factories of Belgium have not stood in the path of the method. Louvain was sacrificed, but the whole of the commercial and industrial interests in and around Brussels are intact.

Not only have the Belgian automobile factories escaped destruction, but the foundries and forges specializing in automobile work are practically all undamaged. I have definite information that Charleroi, which supplies immense quantities of castings and forgings to the automobile factories of France and England, has suffered but slightly. That these classes of works should have escaped is more important than that the automobile factories should have been spared. It means that, as soon as the war comes to a close,—providing of course no damage is done in the meantime,—work can be resumed without delay. Staffs have been scattered, many of the workpeople are in England, more are in France and a certain number have disappeared. Despite this, the heads of industrial organizations have been able to keep in touch with their men and can call them together at very short notice as soon as conditions are ripe for a resumption of manufacturing operations.

Urge Business as Usual

A strong effort has been made on the part of the Germans to keep manufactories going. The owners of factories have not only been advised, but, in many cases, ordered, to open up and run as if nothing had happened. Every encouragement is made to do business with neutral countries. As an instance, I am informed by a foundry master that this month he shipped a big consignment of castings to an important automobile factory in Italy. The goods were carried on a German military train and everything possible done to expedite their delivery. The evident intention of the German authorities is to restore the country they are now holding to as prosperous a condition as possible and to reconcile the Belgians to German rule. To be able to point behind their line of troops to a prosperous country working under German protection would be a valuable lesson to neutral countries and would be calculated to offset the charges of brutality levied by the Allies. The Belgians, however, refuse to respond to this move. The working classes will not look upon the German troops otherwise than as murderous invaders and prefer exile and poverty to the usurper's promises of steady employment.

Production Is Kept Small

The directors of manufacturing establishments have an interest in responding to the German invitation, but at the same time anything like an approach to normally prosperous conditions would mean advantage to the enemy. Thus they are complying with the letter of the law by opening their works, but production is kept so low as to be a really negligible quantity. At such a time as the present irrefutable arguments can be produced showing why production cannot be carried on, and how even German labor would not solve the many difficulties. In this way the nucleus of an organization is maintained and manufacturers are willing to await the deliverance which they believe the Allied troops will bring at no distant date. It is reported that the Minerva factory has been seized and manned by Germans who are producing material for the German army. So far as can be learned, this is the only automobile factory so treated. The others have remained in Belgian hands and are of no material value to the invaders.

Ten Belgian Cars Seized

The number of Belgian automobiles seized by the Germans does not appear to be large. In the first place the Belgian army requisitioned immense numbers of private cars and manufacturers' stocks. When it was evident that the country was about to be overrun by German troops there was sufficient time to get the cars away, thousands crossing the frontier and finding refuge at Havre, where the Belgian government was offered temporary quarters. Railroad material was treated in the same way, all the locomotives and many of the freight cars being brought into France when it was probable that they would otherwise fall into German hands.

Trees Destroyed

In addition to the wrecked towns and the destroyed church towers, many of them being brought down to prevent them being used as observation posts by the enemy, the appearance of many parts of the Belgian countryside has been entirely changed by the systematic destruction of roadside trees. This was ordered by the military authorities, evidently without due consideration, on the ground that the trees would be of advantage to the invading forces, while felled and laid across the road they would hinder their progress. The felling of the trees did not seriously interfere with the enemy's advance, and it has caused a loss to the countryside which cannot be replaced for generations.

In fact, the terrible effect of the fighting and the accompanying devastation wrought by the troops and supplies in passing over the country, to say nothing of the disastrous effects of shell fire, will be evident for years.

A corner of the British Army repair depot, showing wrecked army trucks

French motor workshops at an important aeroplane depot in the field

French Automobile Industry Is Also in Good Condition

THE French automobile industry, which is one of the most important allies of the war department, has not up to the present been seriously handicapped by lack of either material or men. Where army contracts are in hand, the war department facilitates the task of the manufacturer by liberating from military service all the men necessary for this work. It is with the greatest difficulty, however, that the release of men can be obtained for the ordinary work of the factories. In consequence the factories have to be run by men who are free from military obligations with in some cases the help of workmen from allied and neutral nations.

As the north and north-east portions of France now held by the enemy supply three-quarters of the raw material necessary for automobile construction, it is evident that factories have been and are somewhat inconvenienced. Aluminum castings can be obtained in any quantities; there is no shortage of brass work; forgings are obtained with a certain amount of difficulty. It is almost impossible to obtain big steel castings. Manufacturers, however, are not worried for the moment. There is a plentiful stock of raw material in the factories and in the stores around Paris, and other parts of France not affected or likely to be affected by the war can be called upon for'the material. Factory managers declare they are more concerned in getting men than in securing material. Their viewpoint is that if they had all the men they could use they would soon find the material for them to work on. It is evident, however, that with a sudden rush of work, consequent on the cessation of war, there would be a shortage of material, for the foundries and forges cannot get into operation at a moment's notice. This situation would have to be met by foreign supplies. Manufacturers consider that they would first turn to England, but if this country could not meet all the demands the United States would be a certain provider. Up to the present time the only supplies coming from America appear to be magnetos. There appears to be no doubt, however, that French manufacturers will be prepared to send orders across the Atlantic at a later date unless something unforeseen occurs.

Opportunity for American Makers

The ousting of German automobiles and accessories from the French market will leave an opening for American products. Patriotic feeling runs so high that it is certain few

How Maurice Sizaire solves the drink problem. He carries a 5-gallon keg of wine on the running board of his Sizaire-Berwick, and this is often of service in assuaging the thirst of tired soldiers

German goods can be offered for sale in France for years after the war. An important phase of this situation is that successful dealers who have hitherto handled German cars will be open to take other lines. Every American firm having tried to do business in France has been brought face to face with the difficulty of getting live dealers of good standing to take up their lines. The best men were tied up with French, Italian or German houses and would not undertake to do the missionary work necessary to put an American firm in good standing on the Continent of Europe. Scores of American manufacturers have come to Paris to offer their agencies to successful French dealers and have had them refused, or have received a counter offer which no sane man could consider. After the war some of these successful dealers will be on the wait for new lines, and there is no reason why those lines should not be American.

Few Paris Plants Closed

Few, if any, of the automobile factories around Paris now remain closed. The failure of the Germans to make any impression on the Allied lines, and the knowledge that the Allied forces are steadily increasing, while the enemy is lowering his strength, has brought about a feeling of security and a revival of business as great as is possible with the manhood of the nation under arms. The Sizaire-Berwick factory opened this week for purely touring car work; Darracq is increasing its staff by about 40 men a week; Saurer is working day and night shifts; the Hotchkiss gun making factory is to be returned to its original headquarters and the automobile department will reopen. When the Germans threatened Paris the Hotchkiss factory was removed to Lyons. Such a removal would have been impossible, even at normal times, without the help of the government, and altogether impossible with a nation at war. Seven special trains were placed at the disposal of the factory, and the whole of the valuable machinery necessary for making guns was removed 300 miles and installed in an automobile factory at Lyons with such rapidity that a week later guns were being produced in bigger quantities than before. The demands on the gun section and the removal of half the factory to Lyons made it impossible to produce cars, but with the return of the works to Paris, car construction will be resumed.

Darracq Building Aeroplanes

In addition to other war material, the Darracq Automobile Co. has undertaken the construction of aeroplanes for the British and French governments. The machines are the Vickers type, and will be equipped with a rotary motor fitted with a compressed air selfstarter. The only other French automobile factory making aeroplanes is the Bayard-Clement, which has for several years specialized in various types of flying machines. The war has revealed the manufacturing importance of aeroplane motors and has brought a considerable amount of business to those firms making light-weight motors suitable for aeroplane work.

Influence of Aeroplanes

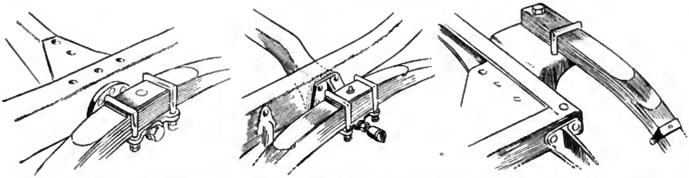
At the beginning of the flying era practically every automobile firm experimented with aeroplane motors in prevision of the rapid development of flying. Commercial development of the aeroplane did not materialize and the motor business dropped into the hands of a few specialists. Now that the war has shown the value of the aeroplane, there is a certain regret that this experimental work was not continued. The aeroplane motor specialists, such as Gnome, Renault, Clerget, Canton-Unné, are reaping a wonderful harvest. The outcome doubtless will be that car manufacturers again will take up the aeroplane motor in view of the permanent increase of flying machines.

V-Eight Motor a Factor

It is practically certain that the rotary type, which has been practically supreme in France since almost the beginning of the flying movement, will have a very keen competitor in the eight-cylinder V motor. The former type has not all the simplicity which is desirable for war conditions.

Under the test of war the airship has been completely knocked out by the aeroplane. The French fleet of airships has ceased to exist, and the total damage done by Zeppelins is insignificant. At the outbreak of war the French fleet of airships was small compared with that of Germany, and it was rendered still smaller by shots from both friend and enemy. Three big airships, considered to be equal to the latest Zeppelins, were under construction in the Bayard-Clement airship sheds at Lamotte-Breuil when war broke out. The mechanical part of these airships had been constructed at the Bayard-Clement automobile factory near Paris, and comprised for each ship four 200 horsepower six-cylinder motors. The mechancial work was undoubtedly the finest France has ever produced. In their march on Paris the Germans entered Lamotte-Breuil and destroyed the almost finished airships. As the German airships, although much more highly developed, have shown no better practical results than those of the French, it can be assumed that the completion of the Bayard-Clement ships would have had little influence on the military operations. The Bayard-Clement company is the only one in France having devoted itself to airships. The lessons of the war are such that the example of this company is not likely to be followed.

French officers inspecting the passports of travelers on the highways. Note the baggage carried on the running board of the car



Left—Flared cross-bar of frame to support cantilever spring bracket. Center—Way of riveting bracket and cross-bar at one operation. Right—Mounting for rear spring on narrow frame

Engineering Analyses—Part III

Foreign Engineer Applies First Principles to Designs at New York Show—Discusses Propeller Shafts, Torque Arrangements, Brake Design and Practice in Springs

By A. Ludlow Clayden
Member Institute of Automobile Engineers of Great Britain

As concerns propeller shaft arrangements, these are just as many and as various here as abroad, but the American engineers are to be complimented upon the pains they have taken to insure ample protection for the universals. Lubrication depends upon the driver in all but one type, but a good cover is half the battle since it will retain such oil as is put in from time to time. For many reasons the best form of construction for the rear end of the gearbox consists of an inclosed shaft with a ball and socket inclosing the joint. It allows the joint to be lubricated from the gearbox without separate attention; it does away with the awkwardly placed rear-end joint; it eliminates the need for a telescopic joint and it removes the need for a torque stay; while leaving the springs free to do their work of carrying the load comfortably.

On the other hand it is said to be more expensive than the open shaft with two joints because the ball and socket are not cheap parts, and the tube enclosing the propeller shaft is fairly heavy and needs a fair amount of machining. Taking it from another viewpoint a good deal of fitting is saved in the assembling operation so there cannot be very much difference in cost either way.

There seems little purpose in the fork-ended type of torque tube because, while mechanically the same as the ball and socket, it does not enclose the universal joint and it calls for a swivel bearing on the torque tube. Also it has two swivel pins to carry its extremities and these need solid foundations as they have to take the drive. The self-aligning ball seems all around simpler and neater and less trouble, once the machining rig has been installed. One point is in favor of the fork and that is it can be used in combination with a gearbox brake, while to combine a ball joint and such a brake is not easy.

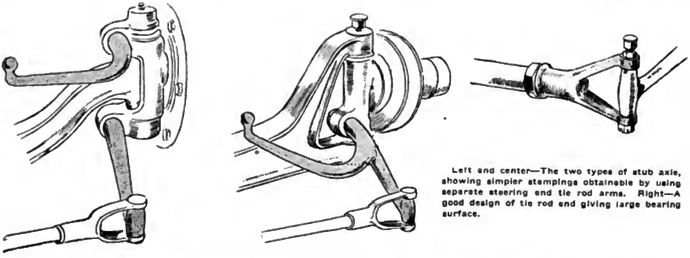
Taking Torque

The vexed question as to whether it is right or wrong to utilize the springs to take torque or drive or both, is as far from being settled as ever it was and likely to remain so. It is a fact, though, that all the very best cars in the world have the springs free. Fundamentally a spring, especially when flat, is better suited to take drive than torque; it is really actually an observable fact that a car with the torque taken by the springs is always liable to shudder when accelerating rapidly, and even more so when braking. The same is true to a great extent of cars where there is a torque stay ending in a ball mounted between coil springs and hung on a swinging bracket. Stays of this sort seem scarcely to be worth the extra cost involved in making and attaching them. Similarly with radius rods, by the time these are made and put on in addition to a torque stay the total cost must be at least as great as the inclosed shaft.

Bad Brake Design

While the general advance in automobile design here has been phenomenal there is one feature that has been neglected most woefully, one part of the average chassis which dates from the dark ages of automobile history, and this is the brakework. Last year the European shows made clear that makers were not satisfied with the powerful and smooth brakes which they had been making previously, for increase in size and width was noticed everywhere, but it is not increase in size which average American brakework needs so much as a wholesale scrapping and complete redesign. The immense demand for cars has made matters very difficult for the axle manufacturers and signs are present that next year will see a great many more cars with adequate brakes, but it is very surprising that engineers and users have so long endured some of the brakes seen in the show.

Firstly, a brake can only work well when the surface is so great that the shoe and drum cannot be pressed together with a sufficient number of pounds per square inch to cause binding or a jerky seizing of one of the surfaces the other. Secondly, if a brake is to work smoothly both parts of it must be perfectly rigid with respect to each other; if the shoes are on insufficiently firm supports the brake is bound to chatter. Again, for powerful action the operating links must be free from spring and the attachment of any intermediary fulcrums to the frame of a firm nature. In



Left and center—The two types of stub axle, showing simpler stampings obtainable by using separate steering and tie rod arms. Right—A good design of tie rod end giving large bearing surface.

how many of the brake systems in the show were all these facts taken care of? A few, certainly, and all honor to their constructors, but what a few!

It is also amazing that the external band brake could ever exist in this country of heavy roads and thick mud. In Europe it was complained of years ago on account of its tendency to clog up and the conditions here are ten times more likely to produce trouble. Also it is very difficult to make so that it clears the drum when in the off position, and a very heavy massive construction is essential if it is to have any perceptible power. Nor, considering all the bits can it possibly be cheap. It is a manufacturing axiom to keep down the number of different parts as much as may be, and surely it is cheaper to make two identical pairs of expanding shoes than to make one pair and such another pair of bands, with their guides, brackets, release springs and what not.

Also it looks as though the axle men had seldom paused to think what a tremendous load is put on the fulcrum pins and the spreading cams of expanding brakes, nor to realize that the working surface of the brake shoe needs a solid enough backing to give it firm support and so to equalize the pressure over all the surface. Axles unchanged in design, which were used on the little fours of several years ago, ought not to be powerful enough for the much more speedy cars of today carrying bigger loads.

There seems little to choose between a gearset brake and a really good expanding brake in the commoner position, though it is worth noting that all cars built near mountains are provided with transmission brakes. In England there is a pronounced trend in favor of the all-axle construction, two sets of shoes being located side by side in the same drums, but the continental firms seldom get away from the gearbox brake.

The growing popularity of woven linings is causing makers to increase the size of the spreading cams so as to allow the use of thick linings and enable adjustment to be made for wear, and ribbed drums of cast steel or malleable iron are replacing pressings, being cheaper and apparently just as good.

Need of Accessibility

Most foot brakes, whether American or European, are geared too high when located on the axle; that is, they do not give the foot sufficient leverage. It is not easy to allow very long travel for the foot, so the remedy is to provide a very accessible adjustment whereby the brake can be kept fairly closely set and ample mechanical advantage given to the foot. Many accidents happening to lady drivers have been caused by their natural lack of the strength sufficient to operate a heavy pedal.

In the study of brakework one finds another advantage for the inclosed propeller shaft because it serves as a convenient mounting for the brake rods. It is to be noticed that American designers usually locate a fulcrum somewhere near the center of oscillation of the axle so that the up-and-down movement of the latter does not cause movement of the brakes, and compensation is generally carried out thoroughly though not always as neatly as sometimes.

Good Differential Adjustments

Concerning axles there is little to be said because they are nearly all alike. The pressed steel housing is not very popular in England because it is heavier for its strength than other forms, but, of course, the roads here call for greater strength. One excellent point in axle construction is the customary accessible adjustments for setting the depth of engagement of the bevels.

Mention of the latter naturally leads to consideration of the final drive and the spiral bevel. This is so far peculiar to America; because the Citroen double helical bevel is not the same thing at all. It seems to be as quiet as the worm which the Citroen gear is *sometimes*, but not always, while it also seems easier to make than the worm. Unquestionably it is attractive where axle clearance is of importance, but a good deal more experience of it in service is needed before its durability as compared with worm gearing can be decided. Worm gearing to be of any use at all must be very well made, and must be fitted with care, which means that it can hardly hope to compete with bevel gearing on price. When well made its durability is wonderful, however, and new methods of grinding worm gearing will tend to make this durability greater still.

Spring Education Needed

Springs are a whole big subject in themselves and the violence of the discussion on a recent S. A. E. paper showed that the general state of ignorance as to spring design is very great indeed. No agreement is to be found anywhere on spring problems and all that can be deduced by a study of all the different well known chassis in the world is that good springs or bad springs may be made to any design.

All types seem capable of giving much the same riding effect. The cantilever spring has no intrinsic mysterious property which makes it easier to design right than any other kind—so far as one can ascertain, but it is a little easier to apply to a chassis and should ultimately prove cheaper.

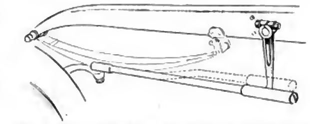
A broad rule in spring design deduced from current European practice is that cars with flat springs are steadier than those in which the springs normally have camber, but there are noteworthy exceptions.

A remarkable difference in front axle construction is the popularity here of the type which has the jaws on the axle and the tongue on the stub axles, remarkable because it is usually judged in Europe that the other kind, with the jaws on the stubs, is easier to make cheaply. Rather less bearing is given on the swivel pins here, and there are fewer ball thrusts, which is a pity since easy steering is more dependent upon adequate ball or roller thrusts in the swivels than upon any other one thing.

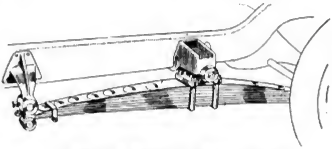
Just as abroad, there seems to be a disinclination to make the steering gear itself big enough to allow a useful contact between the worm and sector, and it is surprising that rough roads have not caused the abandonment of the drag link with a bend in it, for this can scarcely fail to put some whip in the steering. One would expect that altogether heavier steering would be called for here for this is a part in which weight *is* intimately connected with strength and rigidity.

Frame Design Possibilities

In frame design there are two extremes, one is the narrow straight-sided type in which the back axle projects a long way from the frame and the springs are carried by brackets, likewise projecting sideways from the side rails. The other case is where the frame is widened so that the rear springs are located beneath it, and the ordinary type is half way between the two extremes. A convenient style which can be applied to some chassis proportions is to have the side rails straight, but not parallel, tapering towards the front, of course, but for ease in turning out a well proportioned car the usual bent frame side is far the most convenient. It seems, judging by a few examples, that more might be done in the way of combining purposes as by making the spring hanger also serve as a support for some part of the brakework. Altogether though, the frame design is good and clean and an example of how to obtain strength from simple pressings.



Dotted line shows undesirable bend in drag link caused by putting ball joint behind lever in order to facilitate the fitting of fenders



The flat type of cantilever spring construction

In a general review of this kind discussion of control systems and such petty detail would be out of place so the writer will here conclude. In doing so, however, he would like again to emphasize that in offering criticism he has endeavored to do so from the viewpoint of the first principles of engineering mechanics rather than from his knowledge of current European practice. Circumstances have assisted the British automobile engineer to go rather more deeply into some matters than his American colleague has had time to do, but the latter has now such an opportunity to catch up as has never before been offered him and we can all with one accord devoutly hope that in this instance history may never repeat itself, to the end of time.

New Willard Battery Branch in Chicago

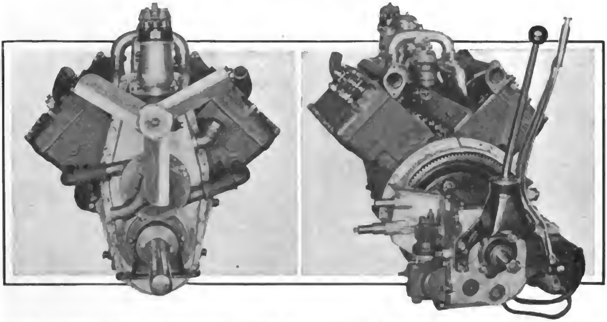
¶*The new Chicago branch of the Willard Storage Battery Co., Cleveland, O., is one of the recent examples of extended service to car owners, and is, it is claimed, the biggest and most complete service plant of its kind in the country, with a capacity for charging 1,000 batteries at one time, and with space in the service end of the plant for twenty-five cars under cover at once and ability to care for fifty at one time if necessary. This new service plant, located at 2524-30 South Wabash avenue, is a brick and steel, one-story construction, fitted with concrete floors throughout, the floor area measuring 14,000 square feet. It is manned by a working office force of twelve, together with twenty-five operatives, the working men having factory experience and being educated in battery repairs, such as complete assembling and reassembling. All types of batteries for different makes of cars are kept in stock, together with repair parts.*

The battery room is divided into three parts, charging, repair, and service sections. The charging department is handled by five men. In the repair department are seven repair benches, and the work is handled by four men. In this department batteries are inspected, repaired and reassembled. Upwards of 1,200 repair batteries can be handled at one time. An idea of the capabilities of the plant may be gained from the accompanying illustrations which are two views of the service department.

The stock room contains all parts of all Willard batteries as well as assembled batteries placed in racks fitted with charging plugs so that stock batteries can be kept on charge. The employees' room is fitted with lockers, shower bath, etc. This new service station takes care of nine states, Illinois, Wisconsin, Northern Michigan, Minnesota, Iowa, Nebraska, Missouri and North and South Dakota.

Two New Eight-Cylinder Motors

A Buda with Staggered Cylinders and a Northway Made for the New Cole Eight

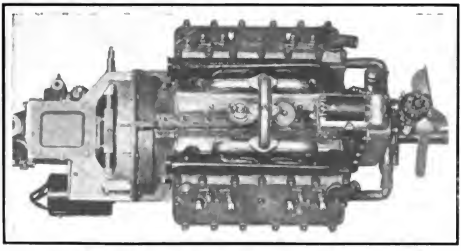


Left—Front of Northway motor, showing water pump. Right—Showing vertical division of crankcase and mounting of tire pump

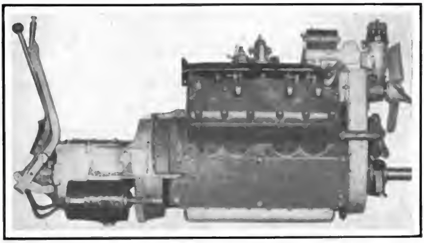
THE new Northway eight will be found at the Chicago show on a new Cole chassis and judging from photographs it seems to be of particularly neat appearance. The cylinders are, of course, arranged at 90 degrees and are cast in two blocks, each block being one piece with half the crankcase, which means that the latter is split vertically, as is made clear in the illustrations. Detachable cylinder heads are employed and these are so set that their removal would be easy without disturbing many other parts. Instead of using rockers so as to operate the valves from only eight cams, sixteen cams are used and the tappets are of a plain straight type. A curious feature is that the angle between the valves is 101 degrees, so the valves are inclined towards the cylinder centers, which makes for a reduction in the valve pocket space helpful towards obtaining high efficiency.

There are three crankshaft bearings and the connecting-rods on one side are yoked in the manner which is becoming customary in eight construction. The bearing is secured in the yoke and the small end rod which fits inside moves on the outer surface of the main babbitt bushing. The bore is 3 1-2 inches and the stroke 4 1-2, giving a capacity of 346 cubic inches, and the valves are large in proportion to the cylinder diameter being 1 1-2 inches clear and having a lift of 11-32 inch. Tungsten steel is used and the springs and tappet gear are inclosed by pressed steel plates.

One of the neat features of the motor is the location of the water pump, which is driven directly from the intermediate pinion of the timing gear, the latter being helical spur gearing. Accessiblity is assisted a good deal by mounting the cranking motor on the side of the gearbox instead of placing it between the cylinders, and the same applies to the tire pump which balances the starting motor. Quite a high position has been chosen for the carbureter which should be correspondingly easy to inspect and the ignition timer is also mounted high; as shown in the photographs. A somewhat unusual valve timing is used, the intake opening 15 degrees past dead center and closing 28 degrees past lower dead center, while the exhaust opens 45 degrees before lower center and closes 10 degrees after top center; this introducing an exceptionally long gap between the closing of the exhaust and opening of the inlet. The firing order is 1-8, 3-6, 4-5, 2-7, considering



Plan of Northway motor, showing valve covers and double intake manifolds



Northway motor, showing the detachable cylinder head and location of starting motor

the first cylinder on the left as No. 1 the second on the left as No. 2, the first on the right as No. 5 and so on.

Lubrication seems to have been cared for particularly well, since not only is oil forced from the pump to the main crankshaft and connecting-rod bearings, but it is also led to a pressure indicator and regulator and thence to a duct which floods the cams; the pressure of oil at normal speed of running is said to be 30 pounds per square inch. The electrical starting and ignition gear is of Delco manufacture, the timer having dry cells as a source of current supplementary to that provided by the Exide battery, while the timer, generator and motor are all separate units. Weight is claimed to have been saved in the construction by the very free use of pressed steel which is employed for the oil base and also for inclosing the distribution gearing.

As regards details of the cars to which this motor will be fitted, the arrangement of clutch and gears is well shown in the photograph. Final drive is through an open shaft, three-quarter springs taking torque and drive effort, and the floating rear axle gives a top speed ratio of 3.5 to 1, the brakes and other details following ordinary practice. There will be two body styles, one a seven-passenger with disappearing auxiliary seats, and the other a three-passenger roadster with width enough for all three on a single seat.

The Buda Motor

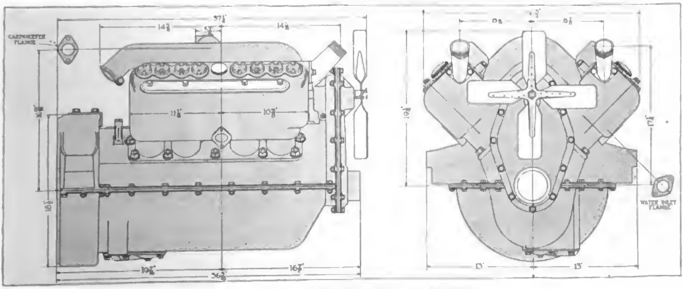
The Buda motor is of quite different design, since the connecting-rods are not yoked, their lower end bearings being located side by side as in the Herschell-Spillman, this necessitating a slight stagger between the cylinder blocks. Thermosyphon cooling is used, this also being an unusual feature on eights, and the waterjackets are baffled so as to insure ample circulation around the valve packets. There is only one camshaft with eight cams, operating through rockers and, as in the Northway, large valves are provided, the clear diameter being 1 1-2 inches, while the bore and stroke of the motor are 3 by 5 1-8 which corresponds to a capacity of 290 cubic inches. No cast iron has been used except for the cylinders, since the crankcase is aluminum alloy, thus enabling a slight reduction in weight to be made. Actually the weight is said to be 550 pounds.

Three main bearings are used for the crankshaft and the proportions of the crankcase are such that it is possible to withdraw the pistons without removing any other portion of the motor except the oil base. Lubrication is by gear pump, forcing oil to the main crankshaft bearings, thence through ducts to the crank pins and also by separate leads to the camshaft bearings. The firing order is 1-5, 3-7, 2-6, 4-8, using the same nomenclature as the Northway. Provision is made for mounting either a standard magneto or a battery system distributer. Special attention is given to insuring accurate running-balance to the crankshaft and flywheel, while the pistons and connecting-rods are balanced against each other so as to reduce vibration to the absolute minimum.

To Show Abbott Eight at Chicago

DETROIT, MICH., Jan. 18—The Abbott eight-cylinder car which the Consolidated Car Co., successor to the Abbott Motor Car Co., is building will be shown at the Chicago automobile show. Fully equipped, the price of the five-passenger touring car as well as of the roadster, is $1,685.

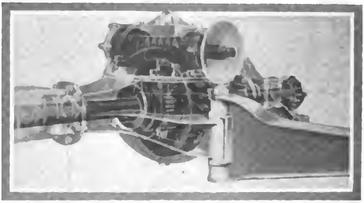
The new eight uses a Perkins motor, the cylinders being cast in two blocks of fours and mounted at an angle of 90 degrees to each other. The bore is 3 1-8 and the stroke 4 1-2, giving an S. A. E. horsepower rating of 31.3. Other features are Zenith carbureter, Atwater Kent ignition system, Remy or Gray & Davis starting and lighting system.



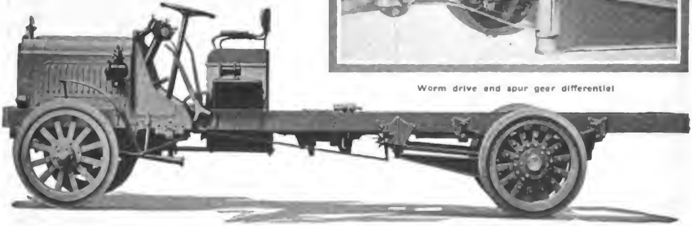
General outline of Buda motor, with main dimensions

The New Packard Worm-Drive Trucks

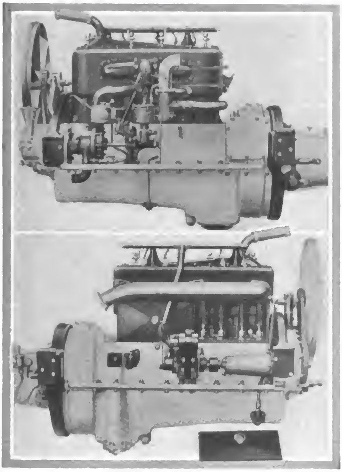
Picture Story of the New Line—L-Head Motors with Automatic Governor—Accessibility a Feature



Worm drive and spur gear differential



Side view of 3-ton Packard truck chassis, showing control centralized under steering wheel



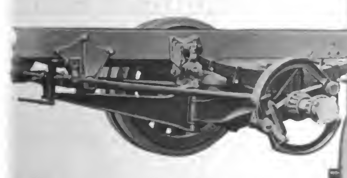
Upper—Shows carbureter governor arranged on left side of motor. Lower—Gives good idea of value and magneto accessibility, a feature of design adhered to closely throughout

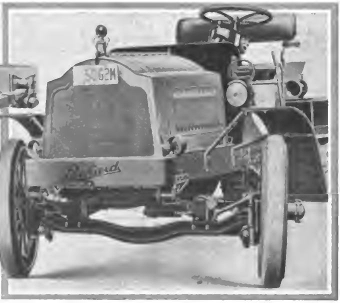
In The Automobile for January 14 some details of the specifications of the new Packard trucks were given and the illustrations appearing on these pages serve to amplify the bare specification. The photograph of the motor shows the L-head type which is new in Packard truck practice and is of particularly neat appearance; the clean lines suggest that accessibility has been cared for more than usual. The governor is completely inclosed and can be sealed so that it is impossible for anyone to adjust it without authorization; for though the driver controls an ordinary throttle, either by hand or by pedal, the governor throttle is entirely independent, opening and closing solely in accordance with motor speed. All the controls for the motor and the electrical system are centralized on a board mounted directly in front of the steering column following the standard Packard practice for pleasure cars. This arrangement not only facilitates driving but is likely to improve durability by making all control connections an integral part of the chassis quite independent of any body work. Left side levers are used for gearshifting and emergency brake, this also being like the Packard pleasure car.

Every essential of the motor is readily accessible, as is shown in the illustration, but attention may be drawn to the high mounting of the carbureter which facilitates its cleaning very greatly, while also assisting to maintain it at a good working temperature. On the other side of the motor the valve springs and tappets can be inspected, adjusted or removed without interference with any other parts, the exhaust manifold being carried sufficiently high up to keep it well out of the way.

A good point of detail is the location of the oil filler on the left side of the motor, because if the hood has to be lifted it is nine times out of ten the carbureter side of the motor that is wanted, and to have the oil intake on that side too often saves the necessity of a double job enabling a gain of a minute, perhaps, on each occasion.

Torque stays and brakes of substantial size. Right shows spring radiator mounting

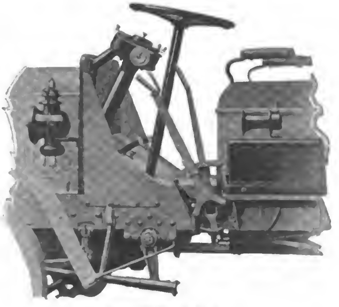




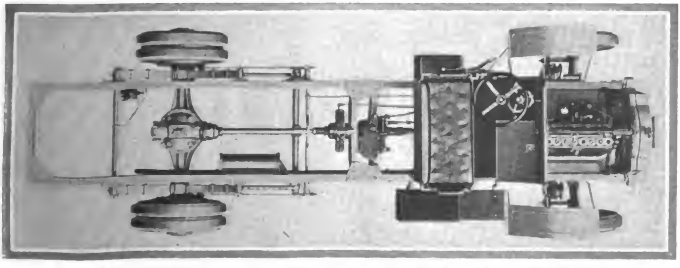
Special care has been taken with the radiator mounting, this important fitting being supported on springs which insulate it from road shock or from motor vibration. Further, the mounting is independent of the hood so that any weave in the frame cannot apply force to the top of the radiator through movement of the dashboard.

Of course, the worm drive is one of the greatest novelties and this seems to have been carried out in accordance with the very best accepted practice. That is to say, judging from the photograph, the worm and worm-wheel are mounted on bearings of adequate dimensions to give the durability demanded in truck service. All this gearing is easy to remove since the cover of the center housing is detachable with the worm and its bearings and, when the driveshafts are withdrawn, every part of the running gear in the axle can be taken out. These driveshafts fitting in key ways in the differential gears and the outer end flanges, in which the driving dogs for the road wheels are cut, are forged solid with the shafts. The steel plates slotted to correspond with the dogs on the driveshafts are bolted to the wheel hubs and there is a certain amount of clearance allowed, so that a little relative motion can take place between the end of the driveshaft and the hub. This prevents any play, which may develop in the wheel bearings, causing the transfer of undesirable road stresses to the driveshafts themselves.

Of course, anything which tends to reduce the labor in caring for a truck is of value to its owner and that this point has been thought of may perhaps be indicated by the careful attention to small details. One may mention, as an example, the fact that spring lubrication has received special attention, dustproof caps being arranged in such a manner that the shackle pins can be greased with the minimum of labor.



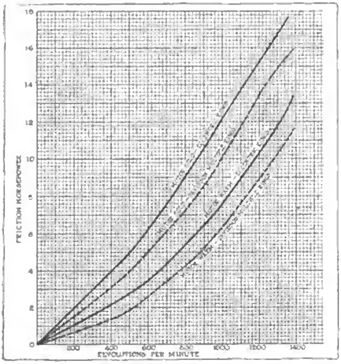
Centralized control platform



Plan view of 3-ton chassis. Observe large transmission brake and method of mounting gearbox

A. C. A. Tests Tireseal and Multiple Rings

Service Conditions Observed—Tireseal Tried on Nail Punctures—Motor with Davidson Multiple Piston Rings Run on Block



Curves of frictional horsepower with Davidson multiple piston rings and the ordinary eccentric rings as compiled from data obtained by The Automobile Club of America

TWO certified tests have recently been made by the Automobile Club of America, one on Tireseal, a fluid inserted in the tire to heal punctures, and another on the Davidson multiple piston ring. The purpose of the two tests was to determine the efficiency of each of these products in its particular field by carrying out an investigation under service conditions.

The Davidson multiple product is a lap-joint ring made up of two thin concentric rings pinned together. The joints of the ring do not coincide peripherally and hence there is no possiblity of gases blowing through aligned joints.

The tests were of a comparative nature, being run on a Pierce motor alternately with the Davidson rings and with the ordinary eccentric rings ordinarily furnished with the Pierce motor. Each piston has four rings each .25 inch wide and four tests were made to include measurement of frictional losses and compression with the motor cold at different speeds, power and fuel consumption and friction and compression with the motor hot.

The results showed that there is no considerable difference in power with the two rings. The compression pressures as measured with a gauge showed that there is a slight difference in favor of the Davidson ring and the friction losses are less with the Davidson ring than with the ordinary eccentric type. The actual figures as given in the tests showed that this difference varied between 7 and more than 30 per cent.

Differences caused by atmospheric changes from day to day were compensated for by inclosing the carbureter in a box and controlling the air supplied to this box by means of a throttle valve. The air pressure in the box was kept constant at 28.5 inches of mercury. The temperature of the ingoing air was kept within close limits and that of the cooling water was also substantially constant. The carbureter adjustment was not changed during the four runs. It will be noted in the accompanying curves of results that the fuel consumption per unit of horsepower showed no great difference. With both rings also the carbon deposit was negligible and both showed efficient lubrication.

Tests on Tireseal

In the tests on Tireseal, the left front and the right rear tires were treated with the compound by pumping in 3 pints through the valve opening with an instrument similar to a grease gun. The valves were removed in order to permit of the ready admittance of the Tireseal and after it was put into the tubes the valves were replaced and the tires inflated in the usual manner. The size of the tires was 34 by 4.

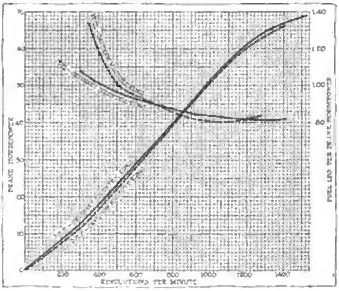
After inflating the tires a short run of 2 or 3 miles was taken to distribute the Tireseal throughout the tube. The pressure in the front left tire was 80 pounds to the square inch, which is in accordance with the amount specified by the tire manufacturer, and that in the rear tire was 65 pounds, which is the inflation pressure recommended by the Puncturemend Co., of Cleveland, O.

Sixteen nails were driven into the two tires, eight in the front and eight in the rear. In the front shoe six of the nails were 1.25-inch long and .125 inch diameter and two 1.25 by 5-64 inch. Each of these nails in the front shoe was immediately withdrawn and the punctured part of the tire turned toward the bottom to allow the Tireseal to enter the puncture. The nails were driven into various parts of the tire, some being directly in the center of the trend and others offset considerably from the center. After the punctures were made and the fluid had time to seal the leaks the tire was again reinflated to 80 pounds.

In the rear tire there were driven five 1.25 by .125 nails, two 1.25 by 5-64 and one 1 by 1-16. These nails were not removed and after each puncture was made the wheel was revolved to give a similar effect to that on the road when a nail is picked up and the car continues to go ahead. The pressure in this tire after the eight nails were forced in had dropped 2 pounds, from 65 to 63.

After standing in the clubhouse for 15 hours the inflations were again measured and it was found that the rear tire retained the same pressure, 63 pounds and the front tire had dropped from 80 to 55, a loss of 25 pounds. The front tire

(*Continued on page 156*)



Brake horsepower and fuel consumption curves of the two types of rings compiled from data obtained in the A. C. A. test

THE AUTOMOBILE has made a custom of presenting annually an illustrated review in which representative cars with each of the various body types were grouped. The greater number of closed bodies offered for the 1915 season, as compared with previous seasons, made it necessary that the annual motor car art gallery this year be opened in two sections. Open cars, therefore, were shown in a comprehensive review in the issue of December 31 and the inclosed cars, being supposedly cast in a finer mold, are accorded separate representation in the following pages.

In classifying the body types in these pages, it has been found necessary to adopt certain definitions arbitrarily, which in some cases are not in accordance with the nomenclature employed by certain of the manufacturers. This is because inclosed body names are far from standardized, the same name being applied to several different body types by different designers, and conversely, the same body being designated by different names. Consequently, a nomenclature for this review was adopted which coincided with that used by the greater number of car makers. This will explain, for instance, why one or two bodies which by their makers are called limousines, appear in the group headed Sedans.

Closed Body Styles as Dictated

IN dividing the cars according to body types, THE AUTOMOBILE has classed as limousines those cars having bodies carrying four or more passengers and in which the driver is separated from the passengers by a partition, but the driver's compartment is not completely inclosed by full-length doors.

Berlins are those cars carrying four or more passengers, and in which the driver is separated from the passengers by a partition, but the driver's compartment is completely inclosed by full-length doors.

Landaulets are limousines, the portion of whose top above the rear-seat passengers may be folded back.

Sedans are those cars carrying four or more, all of whom are completely inclosed, but with no partition between front and rear seats.

Coupes are two- or three-passenger completely inclosed cars.

Convertible coupes are two- or three-passenger inclosed cars which may be transformed into open roadsters or runabouts by either folding back the top or removing the upper portion of the body.

Convertible sedans are cars which may be made either open touring cars or sedans by the removal of the upper portion of the sedan body.

Convertible bodies are one of the distinguishing features of the season in body styles. They have come in answer to the demand of the owner-driver for a design which will give him and his family comfort in winter driving combined with the freedom of the open car for summer work without the necessity of maintaining two cars or purchasing two bodies.

About a year ago the convertible roadster-coupes made their appearance. These were an adaptation of the landaulet idea to the two- and three-passenger vehicles. There were nine of them at that time, nearly every different make having a different name, such as landaulet-coupe, cabriolet, convertible, convertible coupe-roadster and landau-roadster.

The number has been increased the present season to sixteen or more but there is nearly as much divergence in names as last year. Cabriolet and coupelet are the most in favor with the manufacturers. In addition to the folding coupe top there is another type, of which the Hupmobile is an example, in which the roadster is converted into a coupe by substituting for the roadster top a wood top of conventional coupe lines.

The most recent addition to this field of convertible bodies is comprised in the convertible sedans or convertible limousines, as they sometimes are called. The term sedan is the more proper one as in no case is the driver separated from the rest of the occupants of the car. The convertible sedan performs the same

Ford, T, Coupelet, Four, 3¾ x 4, two-passenger, $750, 100 W.B., 30 x 3½-inch tires.
Pierce-Arrow, 38-C-3, Coupe-runabout, Six, 4 x 5½, two-passenger, $4,575, 134 W.B., 36 x 4½-inch tires.
Kisselkar, 42-Six, Coupelet, Six, 3⅜ x 5½, two-passenger, $1,850, 126 W.B., 34 x 4-inch tires.
Stearns, Cabriolet, Four, 3¾ x 5¼, two-passenger, $2,250, 119 W.B., 34 x 4-inch tires.
Velie, model 15, Biltwell coupe, Six, 3½ x 5, three-passenger, $1,850, 124 W.B., 34 x 4-inch tires.

In addition to these, the following cars are made as convertible coupes, but are not illustrated as such: Cadillac, Peerless, Pullman, Scripps-Booth.

by Dame Fashion for this Year

service for the touring car that the convertible coupe does for the roadster.

It makes a completely inclosed car for winter work out of the open touring car. It is distinctly an owner-driver's proposition, and as such has a distinct appeal to the man of family who cannot afford two cars or two bodies, but desires the open car for touring and the closed one for winter city driving. The convertible sedan is simply a touring car provided with two interchangeable tops, one the usual folding top and the other a paneled glass and wood construction. With the latter connections are made with the touring door latches so that the upper halves of the doors in the detachable top unite with the lower portions or touring doors and operate as one solid door.

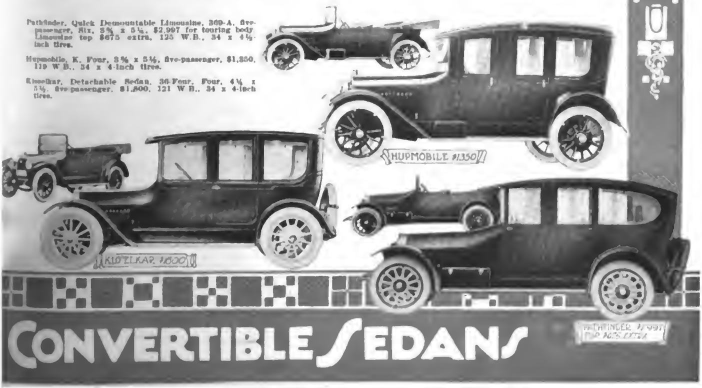
Among the first cars to appear with such bodies as stock bodies were Keeton and Kisselkar. The latter utilizes the two-door design of its touring cars and the bifurcated front seats in producing a convertible sedan having only one door on a side. The same idea recently has been adopted in the latest Pathfinder design. The obstacle which formerly held back the development of these convertible bodies was the difficulty of making permanent connections for the removable top without making the whole affair look like an afterthought. The new designs, however, seemingly have overcome this difficulty and some of them are indistinguishable at first glance from the true sedans. The interiors as well as the exteriors do not give away the double purpose of the car, for in many instances the fittings are as complete as in the conventional inclosed types and even the electric dome and corner lights are not omitted.

It is significant that most of the convertible bodies are in the medium price cars. There are only a few under $1,000 and none over $3,000 in price. The combination coupe-roadsters appear under some one of their various names in all the price classifications.

Among the cars listing at less than $1,250, which we may call the $1,000 class, there are two of the cabriolets. It is in the class of cars selling in the neighborhood of $1,500 that the most of the convertible coupes are found. There are ten or twelve of them which sell at prices between $1,250 and $2,000.

Nearly as many of the two-passenger convertibles are to be found in the class of cars whose price range is between $2,000 and $3,000. There are seven or eight of them in this $2,500 class, as it may be called and more may be expected before the month is out. Altogether, there are no less than twenty different models of this type on the 1915 market.

Naturally, the convertibles of four or more passenger carrying capacity are not nearly so numerous in any of the price classes, because this type of body is less than a year old as a stock proposition. Practically all the sedans sell under $2,000 and over $1,250.

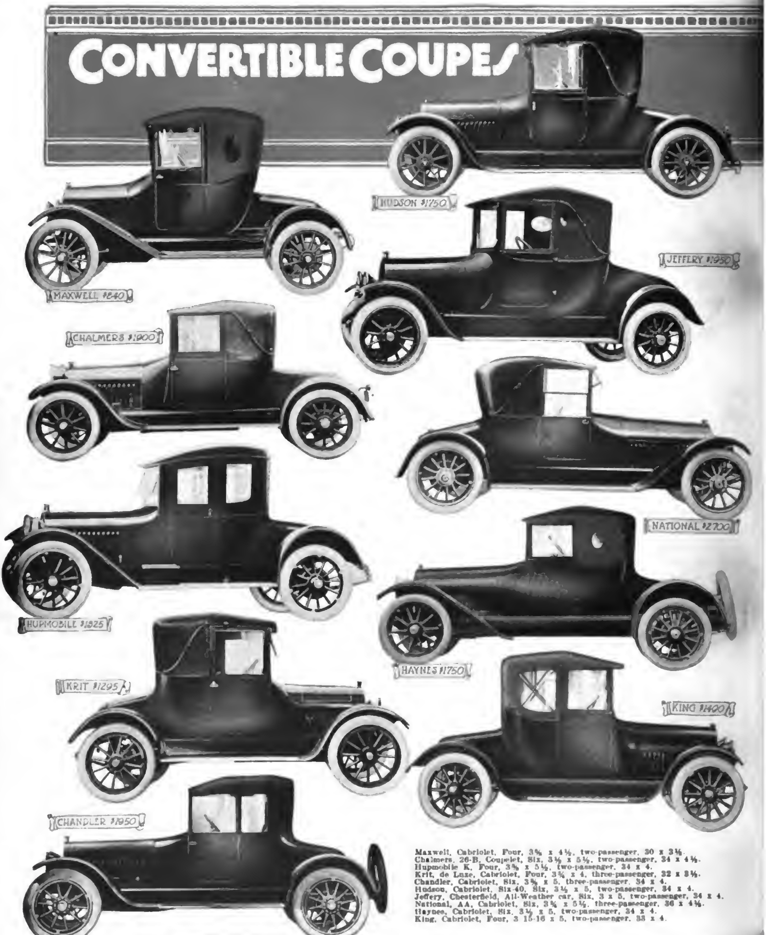


Pathfinder, Quick Demountable Limousine, 309-A, five-passenger, Six, 3⅜ x 5¼, $2,997 for touring body Limousine top $675 extra, 128 W.B., 34 x 4½-inch tires.

Hupmobile, K, Four, 3¼ x 5½, five-passenger, $1,350, 119 W.B., 34 x 4-inch tires.

Kisselkar, Detachable Sedan, 36-Four, Four, 4¼ x 5½, five-passenger, $1,800, 121 W.B., 34 x 4-inch tires.

CONVERTIBLE COUPES



HUDSON $1750

MAXWELL $840

JEFFERY $1950

CHALMERS $1900

NATIONAL $2700

HUPMOBILE $1325

HAYNES $1750

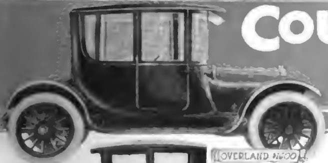
KRIT $1295

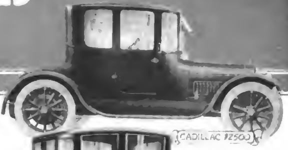
KING $1400

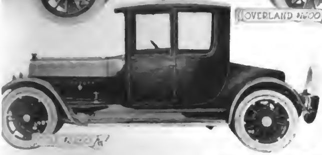
CHANDLER $1950

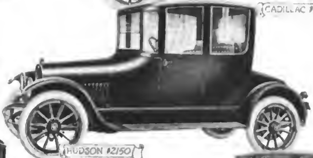
Maxwell, Cabriolet, Four, 3⅝ x 4½, two-passenger, 30 x 3½.
Chalmers, 26-B, Coupelet, Six, 3½ x 5½, two-passenger, 34 x 4½.
Hupmobile K, Four, 3⅜ x 5½, two-passenger, 34 x 4.
Krit, de Luxe, Cabriolet, Four, 3¾ x 4, three-passenger, 32 x 3½.
Chandler, Cabriolet, Six, 3⅜ x 5, three-passenger, 34 x 4.
Hudson, Cabriolet, Six-40, Six, 3½ x 5, two-passenger, 34 x 4.
Jeffery, Chesterfield, All-Weather car, Six, 3 x 5, two-passenger, 34 x 4.
National, AA, Cabriolet, Six, 3¾ x 5½, three-passenger, 36 x 4½.
Haynes, Cabriolet, Six, 3½ x 5, two-passenger, 34 x 4.
King, Cabriolet, Four, 3 15-16 x 5, two-passenger, 33 x 4.

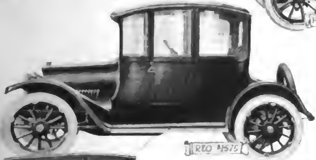
COUPES

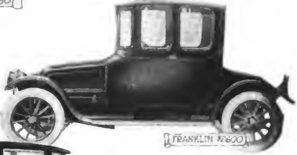


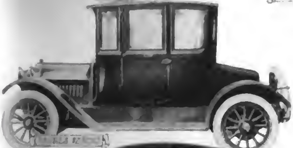


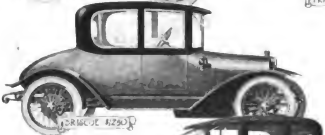


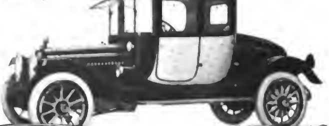


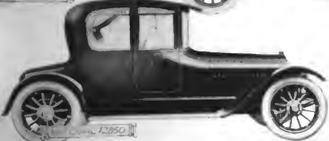


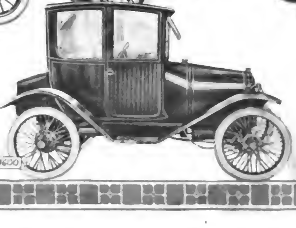






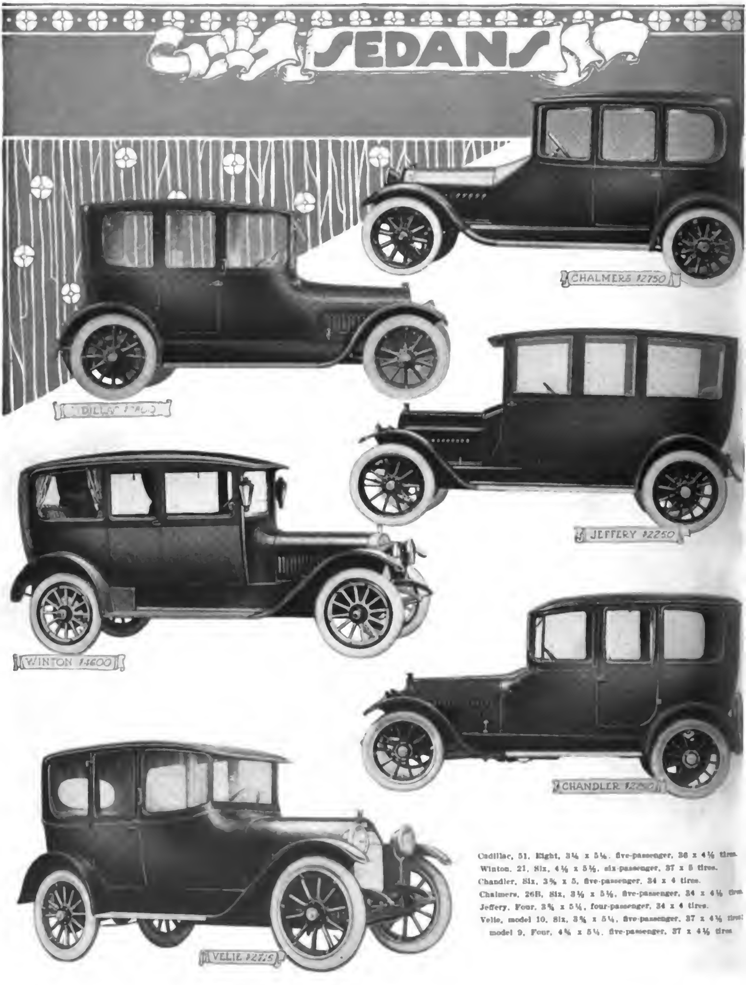






Overland, 80, Four, 4⅛ x 4½, four-passenger, 35 x 4½
Packard, Six, 4 x 5½, three-passenger, 37 x 5.
Reo, 5T, Four, 4⅛ x 4½, four-passenger, 34 x 4.
Haynes, 32, Four, 4½ x 5½, four-passenger, 34 x 4.
National, AA, coupe, Six, 3¾ x 5½, four-passenger, 36 x 4½.
Cole, 6-50, Six, 3½ x 5, two or three-passenger, 35 x 4½.
Cadillac, Type 51, Eight, 3⅛ x 5⅛, three-passenger, 36 x 4½.
Hudson, Six-40, Six, 3½ x 5, four-passenger, 34 x 4½.
Franklin, Coupe, Six, 3¼ x 4, three-passenger, 34 x 4½.
Briscoe, Four, 3⅛ x 5⅛, two-passenger, 30 x 3½.
Trumbull, Four, 2⅜ x 4, two-passenger, 28 x 3.

SEDANS



CHALMERS $2750

[illegible]DILLAC [illegible]

JEFFERY $2250

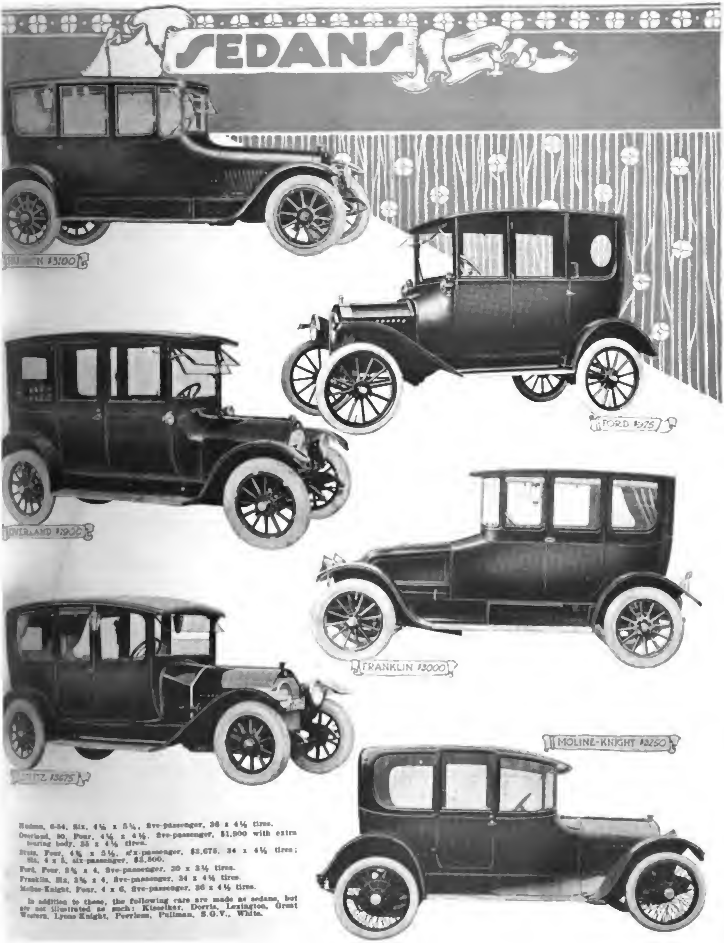
WINTON $4600

CHANDLER $12[illegible]

VELIE $2775

Cadillac, 51, Eight, 3⅛ x 5⅛, five-passenger, 36 x 4½ tires.
Winton, 21, Six, 4½ x 5½, six-passenger, 37 x 5 tires.
Chandler, Six, 3⅜ x 5, five-passenger, 34 x 4 tires.
Chalmers, 26B, Six, 3½ x 5½, five-passenger, 34 x 4½ tires.
Jeffery, Four, 3¾ x 5¼, four-passenger, 34 x 4 tires.
Velie, model 10, Six, 3⅜ x 5¼, five-passenger, 37 x 4½ tires;
model 9, Four, 4⅛ x 5¼, five-passenger, 37 x 4½ tires

SEDANS



Hudson, 6-54, Six, 4⅛ x 5¼, five-passenger, 36 x 4½ tires.

Overland, 80, Four, 4⅛ x 4½, five-passenger, $1,900 with extra touring body, 35 x 4½ tires.

Stutz, Four, 4¾ x 5½, six-passenger, $3,675, 34 x 4½ tires; Six, 4 x 5, six-passenger, $3,800.

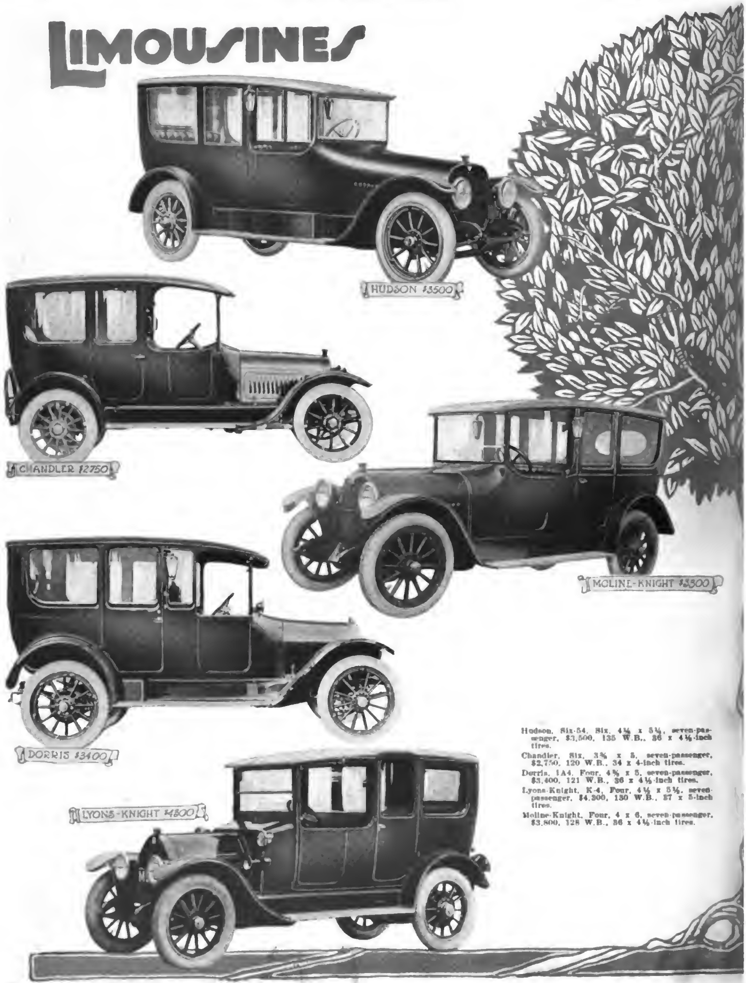
Ford, Four, 3¾ x 4, five-passenger, 30 x 3½ tires.

Franklin, Six, 3¼ x 4, five-passenger, 34 x 4½ tires.

Moline-Knight, Four, 4 x 6, five-passenger, 36 x 4½ tires.

In addition to these, the following cars are made as sedans, but are not illustrated as such: Kisselkar, Dorris, Lexington, Great Western, Lyons Knight, Peerless, Pullman, S.G.V., White.

LIMOUSINES



Hudson, Six-54, Six, 4⅛ x 5¼, seven-passenger, $3,500, 135 W.B., 36 x 4½-inch tires.

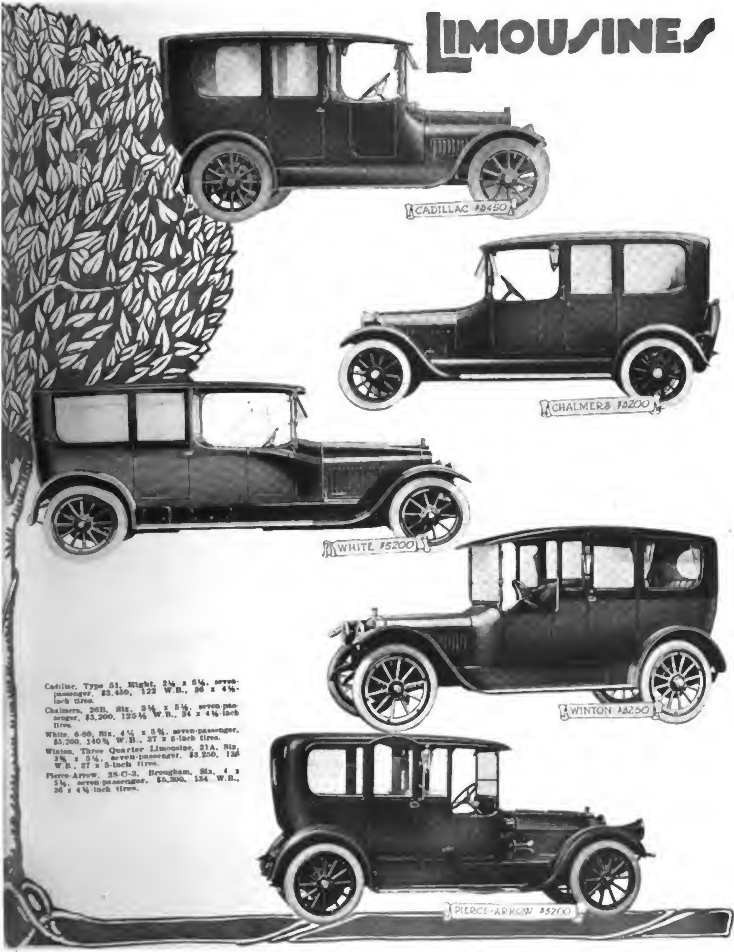
Chandler, Six, 3⅜ x 5, seven-passenger, $2,750, 120 W.B., 34 x 4-inch tires.

Dorris, 1A4, Four, 4⅜ x 5, seven-passenger, $3,400, 121 W.B., 36 x 4½-inch tires.

Lyons-Knight, K-4, Four, 4½ x 5½, seven-passenger, $4,300, 130 W.B., 37 x 5-inch tires.

Moline-Knight, Four, 4 x 6, seven-passenger, $3,800, 128 W.B., 36 x 4½-inch tires.

LIMOUSINES



Cadillac, Type 51, Eight, 3⅛ x 5⅛, seven-passenger, $3,450, 122 W.B., 36 x 4½-inch tires.

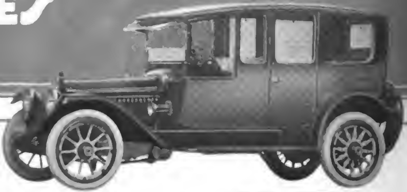
Chalmers, 26B, Six, 3¼ x 5½, seven-passenger, $3,200, 125½ W.B., 34 x 4½-inch tires.

White, 6-60, Six, 4¼ x 5¾, seven-passenger, $5,200, 140⅝ W.B., 37 x 5-inch tires.

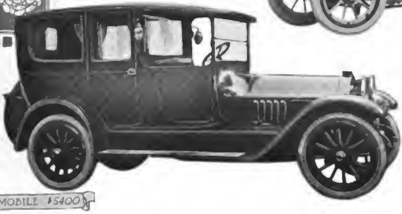
Winton, Three Quarter Limousine, 21A, Six, 3¾ x 5½, seven-passenger, $3,250, 128 W.B., 37 x 5-inch tires.

Pierce-Arrow, 38-C-3, Brougham, Six, 4 x 5½, seven-passenger, $5,200, 134 W.B., 36 x 4½-inch tires.

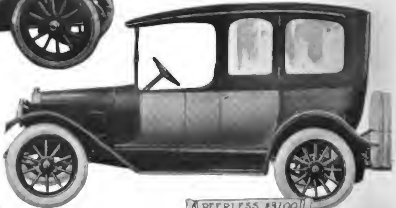
LIMOUSINES



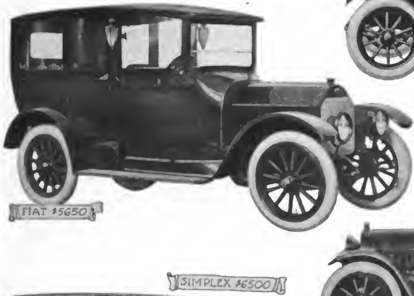
PACKARD $4900



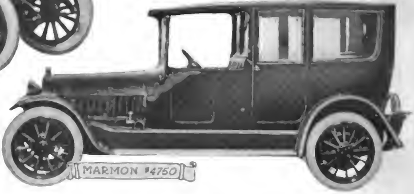
LOCOMOBILE $5400



PEERLESS $3100

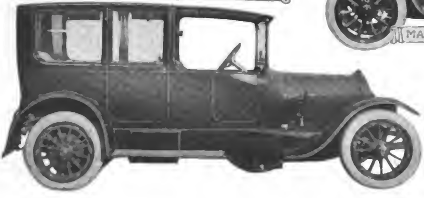


FIAT $5650



MARMON $4750

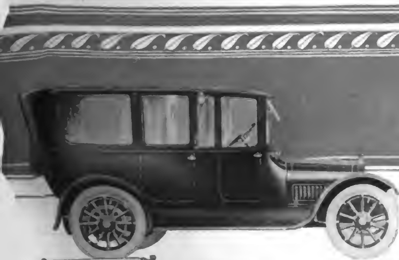
SIMPLEX $6500



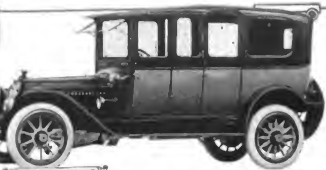
Locomobile, 38, Six, 4¼ x 5, seven-passenger, 37 x 5 tires.
Fiat, Limousine 55, Four, 5⅛ x 6¼, seven-passenger.
Simplex, Four, 5⅜ x 6½, seven-passenger, 37 x 5 tires.
Packard, 3-38, Six, 4 x 5½, six-passenger, 37 x 5 tires.
Peerless, All Purpose Four, Four, 3⅝ x 5, seven-passenger.
Marmon, 41, Six, 4¼ x 5½, seven-passenger, 36 x 4½ tires.

In addition to these, the following cars are made as limousines, but are not illustrated as such: Jeffery, Kline, Stearns, Austin, Chadwick, Cunningham, Great Western, Kisselkar, Lexington, Pullman, S. G. V., Stevens-Duryea, Touraine.

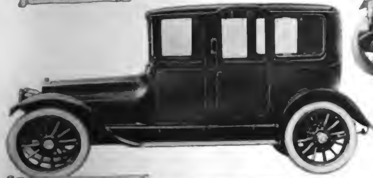
BERLINES



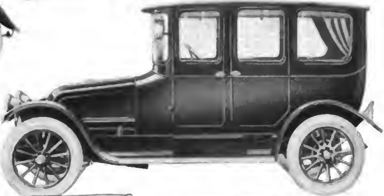
CADILLAC $3600



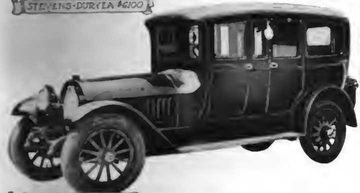
PACKARD $6100



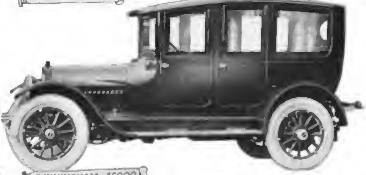
STEVENS-DURYEA $6100



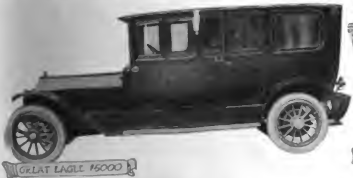
FRANKLIN $3200



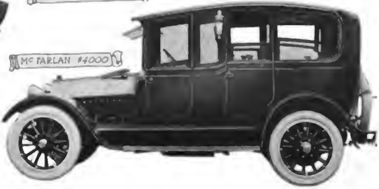
LOCOMOBILE $[illegible]



CUNNINGHAM $5000



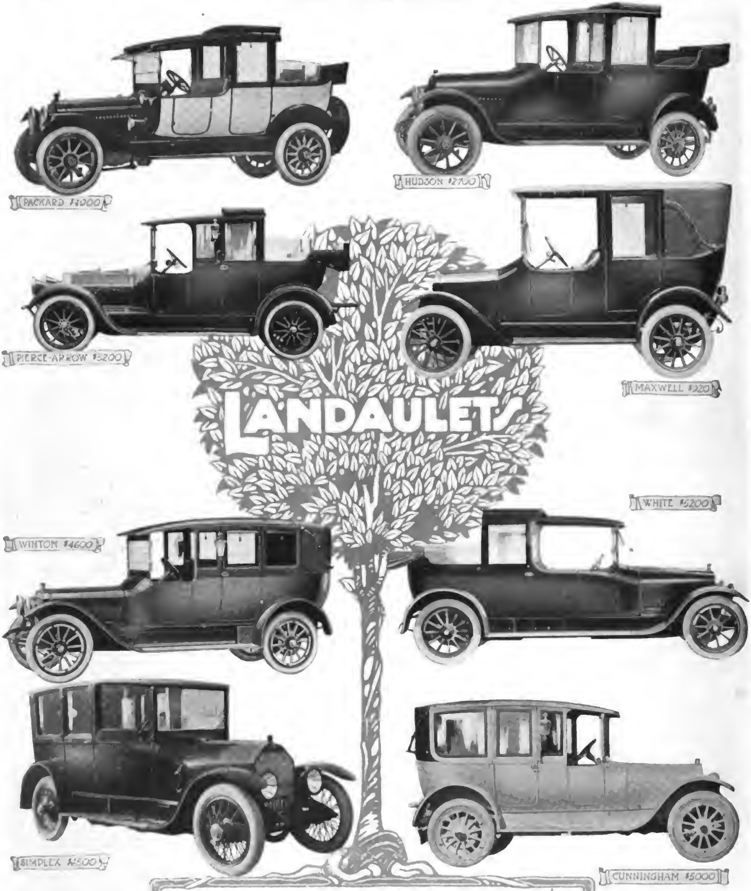
GREAT EAGLE $5000



McFARLAN $4000

Cadillac, type 51, Berlin Limousine, Eight, 3⅛ x 5⅛, seven-passenger.
Stevens-Duryea, Limousine, Six, 4 7/16 x 5½, seven-passenger.
Locomobile, 38 Berline, Six, 4½ x 5, seven-passenger.
Great Eagle, 1272 Limousine, Four, $5,000; Six, $5,500.
Packard, Limousine, 5-48, Six, 4½ x 5½, seven-passenger.
Franklin, Berlin, Six, 3¼ x 4, six-passenger.
Cunningham, Limousine, Four, 4⅝ x 5⅝, seven-passenger.
McFarlan, Model 79-T, Six, 4 x 6, seven-passenger.

In addition to these, the following cars are made as berlines, but are not illustrated as such: Fiat, Peerless.



Packard, Six, 4 x 5½, six-passenger.
Pierce-Arrow, 38-C-3, Six, 4 x 5½, seven-passenger.
Winton 21, Six, 4½ x 5½, seven-passenger.
Simplex, Four, 4⅜ x 6½, seven-passenger.
Hudson, 6-40 Six, 3½ x 5, six-passenger.
Maxwell, Town car, Four, 3¾ x 4½, six-passenger.
White, 45 Landaulet-Limousine, Four, 4¼ x 6⅝.
Cunningham, Model R, Four, 4¾ x 5¾, seven or eight-passenger.

Development in Art of Body Design for Inclosed Cars

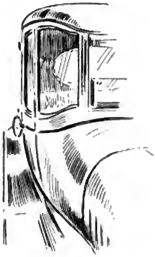
Improvements Evidenced in Both Esthetic and Practical Sides

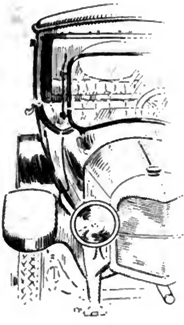
INCLOSED cars for 1915 provide a most interesting study of the body designer's art, and there is perhaps more advance to be seen from both the esthetic side and that of utility during the past 12 months than has been evident at the end of any previous similar period. In general, the two seemingly opposed ideas of greatest comfort and greatest beauty of line have been approached simultaneously. Just how this has been accomplished requires a special study of each of the different body designs as each artist-engineer has had his own ideal in mind and has approached it in his own individual way justifying it by results.

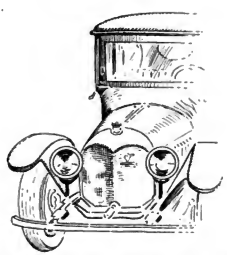
However, on the whole, it may be stated that as comfort cars the new models are very much ahead of their predecessors of previous seasons. The majority of them are larger throughout. There is more seating room without lessened upholstery. There is more leg room. A three-passenger coupe, for instance, can carry its full quota without uncomfortable crowding. The same thing is true of the larger inclosed cars such as the sedans, limousines, etc. To gain this very desirable effect, it has been necessary only to shorten somewhat the deck at the rear in the case of the coupes, so that an increase in wheelbase has not been found necessary.

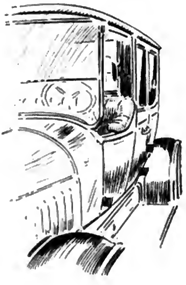
The somewhat lessened overall length of the motors this year has made possible a shorter hood and consequently has given more room within the interior of the closed cars and permitted the wheelbase to remain the same. There has not been a great deal of change in upholstery methods, although some of the extravagantly deep cushions which appeared last year have been reduced to a somewhat saner depth. The conservative maker has held his cushions to something very close to 10 inches as giving the greatest comfort combined with good wearing qualities. Improvement in spring suspension and other things which make for easier riding in the cars, a tendency which has been growing for many years, has rendered it a waste of luxury to provide a cushion depth much greater than that.

The divided front seat, the chair-type of seat, either independently movable or capable of revolving on the pedestal, have become even more



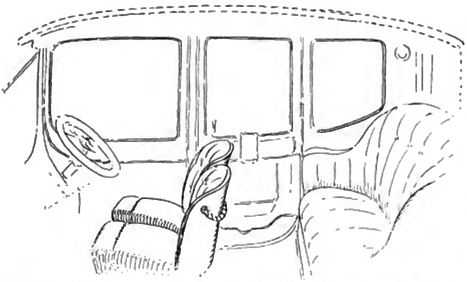






A Study in Body Lines as Evidenced in New Inclosed Cars

The sketch at the left illustrates an Oakland limousine and shows how the boat effect is obtained. The upper of the two at the center is a Velie sedan and the lower one a Pathfinder. At the right is a Locomobile limousine



Interior of a New Cadillac Sedan Showing the Chair Front Seats and the Lounge-Type Rear Seat

popular in the inclosed car field than they are in the touring cars. This is only logical inasmuch as the introduction of this seating arrangement came originally through the inclosed car, being developed first in the electric. It was with the advent of seating arrangements which provided a passage way between the two front seats that made the sedan body possible, for the value of the compartment type of body is lessened if free intercommunication between front and rear-seat passengers is in any wise restricted by a partition, such as that formed by the back of the complete transverse front seat.

Likewise it was the extension of the vestibule seating arrangement into the touring car class that made the convertible body applicable to cars of more than two or three-passenger capacity—that is, applicable as a manufacturers' equipment. It is true that one or two of the detachable sedans marketed as stock equipment by the lower-priced car makers do not have the bifurcated front seats, but the advantage of the convertible feature makes it more than worth while.

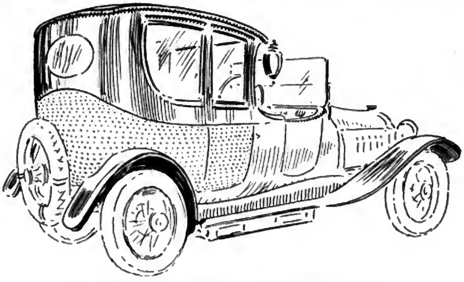
The two-door idea has been extended to the inclosed cars and has found particular favor in this field. This type of entrance arrangements is one in which there is but a single door on either side of the car and permits entrance and egress from either front or rear seats. Of course, with types on the vestibule idea, the divided front seats are an absolute necessity.

To the observer of the 1915 inclosed cars, if he were to see them grouped together, would come a rather distinct impression of long flowing lines, smooth curves and an unusual amount of glass. It is quite possible that the first impression will be that the new cars are trimmer than their predecessors. There are several reasons why this should be so.

In a great many instances, frames are considerably lower. This is a tendency that probably will be found a permanent one if the action of makers of such cars as White, Pierce-Arrow and others is any criterion. Most of the concerns have succeeded in one way or another in getting their chassis nearer the ground without materially lessening the road clearance. In the inclosed-car field this feature is particularly worthy of approval for one of the body designer's chief difficulties is to produce a superstructure for inclosed bodies that will give ample headroom without giving the appearance of being top-heavy.

There is another feature in which this lowering of the car will be appreciated, by the car's passengers—if not by the man on the street. This is the fact that a lower step is permitted and thus it is possible for a feminine passenger to enter the vehicle without the display of hosiery that often is unavoidable where the step is too far from the ground.

Trimness in appearance also comes from the general attempt of manufacturers to develop further the streamline principle in their vehicles as a whole. This is not limited to the closed cars but it is in these bodies that the idea can be carried out most fully and with best results. The ostensible object of streamlining, that of reducing wind resistance, may not be the moving one with the makers of the luxurious closed cars, but the fact that the large wind resisting area of closed



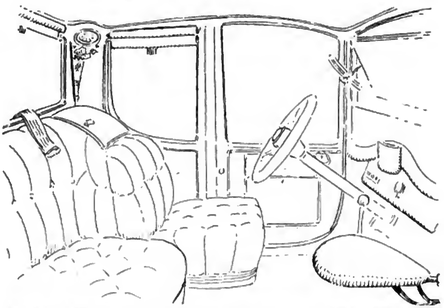
Basket Body Limousine on Willys-Knight Chassis cars does effect speed and economy gives an engineering basis for that artistic instinct to which the smooth flowing lines appeal. At the same time it presents a pretty problem to the body designer to combine the trinity of good engineering, artistic excellence and a comfortable, roomy interior.

Application of the cleverly curved cowls between the engine hood and what formerly was the dashboard has had a distinct effect in altering the appearance and at the same time of increasing efficiency, for it undeniably is easier to drive a pointed body through the air than it is a flat one. At the rear of the car the proper design for streamlining is as important as it is at the front, as witness marine practice. Most of the body builders have given thought to the rear lines with a consequent improvement in efficiency and looks.

Toward the rear, the bodies are rounded or tapered slightly, both by making them slightly narrower at the rear than they are at the middle and by curving the roof downward at the rear. This year's chief improvement in this regard is in providing softer corners and edges by smooth curves instead of sharp angles.

In rounding off the vertical edges both at front and rear, the designer has faced the problem of giving smooth curves and at the same time meeting the popular demand for maximum window space. Consequently, the use of curved glass for the corners has increased materially.

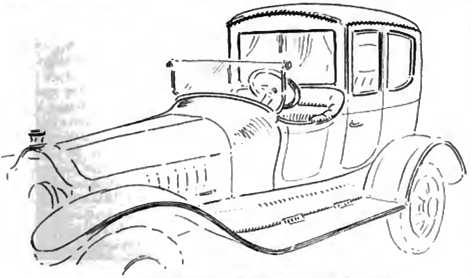
Likewise, designers have endeavored to provide arrangements for opening up the inclosed cars to the greatest possible extent, particularly for warm-weather driving. Not only are the windows in the doors capable of being opened but also it is possible in most instances now to drop the window in the back and sometimes those in the side panels. The use of sashless windows, which came into practice to a slight extent last year, is almost the rule throughout the inclosed cars this season.



Seating Arrangement of New Scripps-Booth Coupe. Main Seats Are Stepped and Extra Seat Swings Back Under Cowl

To get down to the body types themselves, we find that the limousines are by far more popular than any other body type, if we are to judge by the number of different models offered. There are thirty-seven different models of limousines on the 1915 market and this is more than twice as many models as are offered in any other one type of body. Next to the limousine the sedan shows the greatest popularity. There are twenty-three of these and their number is growing more rapidly than that of any of the others. It is to be expected that before many years the sedans will outnumber the limousine. The landaulets come next, being found on eighteen different cars, and the coupes and the combination coupe-roadster also are found on an equal number of models. Berline bodies, which are closely related to the sedans, being the same except for the partition between the front and rear seat passengers in the berline body, have a following of eight models and the brougham is found on two; a town car which is usually a small limousine is on three different chassis.

The class of buyer to which the different sorts of inclosed cars appeal can best be illustrated by a consideration of the numbers of different models offered by the manufacturers as divided on a price basis. Of the cars which list with complete equipment at less than $1,250, there are only five

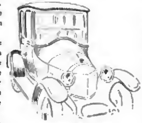


Cunningham Limousine with Top over Driver Removed

Lewis VI Coupe with Exceptional Window Space

inclosed cars. There is one coupe, a coupelet, two town cars and one sedan.

Among the cars selling between $1,250 and $2,000 we find the convertible coupe-roadster, variously known as coupelet, cabriolet, landau-roadster, etc., to be very much in the lead. There are ten of these offered in this $1,500 class, as it may be called. There are three coupes, a convertible sedan and one conventional sedan.



Scripps-Booth Coupe

In the $2,500 class, that is, those cars whose list price runs from $2,000 to $3,000, we find that the sedan has the call, with the coupelet a close second; the former appears in nine different models and the coupelet in seven. The coupe proper appears in five styles, the limousine in three and the laudaulet in one.

Among the cars of higher price, that is, those which sell at over $3,000, the limousines are by far the most populer. There are thirty-four limousine models in this price classification and only three in all of the other classes together, and these three are confined to the $2,500 class of cars. The landaulet comes next in popularity among the makers of cars which list in this highest-price class. There are seventeen of these as against twelve sedans, nine coupes, eight berline bodies, two broughams and a town car.

If we consider some of the individual cars which show some of the present tendencies in closed-car body design we are confronted with a wealth of examples of up-to-the-minute practice. An evidence of one of the forcible trends at the moment is the new Lewis VI sedan. This body was designed with the idea of providing all the openness of the touring car combined with the elegance and protection of a completely inclosed vehicle and one which can be made as exclusive as desired.

This is accomplished by providing an unusually great amount of window space, the greater portion of which can be lowered in the body panel for opening up the rear and side, but, in addition, there is a skylight in the roof which makes about a third of the roof transparent, but which can be closed by a silken curtain.

Another feature which has received considerable attention from designers is the difficulty in seeing through a windshield which is coated with snow or rain. This has been overcome in many instances by using an additional upper half of the windshield. In some cases this is a fixed glass shelf inclined at an angle which catches the rain or snow and prevents it from sticking on the windshield glass proper. In other instances, the second or outer glass is permanently attached to the upper half of the windshield and turns with it. This method is used in a Franklin and the stationary glass arrangement is employed on the Overland coupe, the Lewis VI sedan; the Scripps-Booth coupe and a number of others.

One of the Cunningham inclosed models is an open-front limousine or a brougham which is provided with a detachable roof over the driver's compartment, thus converting the car into a true limousine.

In the matter of body refinement, in fact, the past year has marked the greatest degree of progress since the inception of the industry. Increased attention to the beauties of European designs, more advanced conceptions of engineering in respect to wind resistance and economy, etc., and a more critical demand on the part of the motor-buying public have directed the attention of the makers to the need for the minor refinements usually referred to as luxuries. Dome lights, step lights, baggage compartments and general comfort were given but slight consideration a few years ago though they are now accepted as a matter of course and the people are requiring more and more complete equipment every year. The body designs of today may not be taken as the ultimate in coach work but they indicate that designers and builders are giving every thought to the perfection of detail required to render their work at the same time beautiful, comfortable and durable. Particularly are the closed cars replete with thoughtful little touches calculated to catch the eye of the prospective owner: luxurious upholstery harmoniously blending with the color scheme, side pockets with toilet articles, dome and side lights, in fact, everything to assure the comfort of the passenger. Such is the closed car of today.

Electric Car Registrations Increasing

According to statistics compiled by the Electric Vehicle Assn. of America, there are over 35,000 electric passenger cars in use in the United States and over 12,000 electric commercial vehicles. Although registration figures are available for only eighteen states and in four of these trucks and passenger cars are not segregated, these states alone have 21,082 electric passenger cars and 5,199 trucks. In four of the states there are no electric commercial cars.

New York Leads

An idea of the distribution of electrics throughout the United States, so far as may be gained from the table of registrations appearing herewith, shows that New York, as in the case of gasoline machines, is in the lead with 7,455 passenger electrics and 2,461 commercials. Pennsylvania is second with 5,000 passenger vehicles and 1,000 trucks. Ohio has 3,877 electric cars of both passenger and commercial types registered, no separate lists being kept. Massachusetts has 923 passenger machines registered and 78 commercial vehicles, a somewhat surprising proportion when compared with the figures for the other states. The District of Columbia is credited with a registration of 784 passenger cars and 105 trucks. These statistics, however, are very probably higher than the actual number of cars in use, as the district does not have yearly registration, the vehicle being registered only when first bought and upon changing owners. Sales of cars have thus necessitated their re-registration, in some cases several times, which means duplication in the records.

According to the secretary of state of Alabama, that commonwealth has [illegible] electric machines registered, no record being kept of their type. In many cases figures were available only up to October 1, 1914. This was the case with Connecticut, which, at that time, had registered 420 passenger cars and 220 trucks; Georgia had registered 500 passenger cars and no trucks; Maryland had registered 175 passenger cars and 100 trucks; Oklahoma 150 registered cars of both types; and other registrations were: Utah 119; Oregon eighty passenger cars and thirty-eight trucks; New Hampshire sixty passenger and twenty commercial vehicles; Arizona sixteen passenger, no commercial cars; North Dakota fifteen passenger and no commercial vehicles; Maine five passenger and two commercial machines. Up to January 1, 1915, Vermont had four passenger cars and [illegible] electric trucks. Nevada did not keep a separate record of its electric passenger cars, and has no electric commercial [illegible]

Some City Statistics

Some of the figures for individual cities which the Electric Vehicle Assn. has been able to compile show that there are over 2,860 electric passenger cars and trucks in use in Greater New York; Chicago has over 2,000; Cleveland 1,800; while Denver is unofficially credited with nearly 1,000.

Of the registered electrics in use in New York City approximately 2,480 are commercial cars and about 400 are passenger machines.

An idea of the wide variety to which electric commercial cars are put may be gained from an inspection of the accompanying table showing number of users and number of vehicles in use in different business in the Metropolitan territory.

ELECTRIC VEHICLE REGISTRATIONS BY STATES

State or Territory	Electric Passengers	Electric Commercials
Alabama*	500	**
Arizona†	16	None
Arkansas	**	**
California	**	**
Colorado	**	**
Connecticut†	420	220
Delaware	**	**
District of Columbia*	784	105
Florida	**	**
Georgia†	500	None
Idaho	**	**
Illinois	**	**
Indiana†	1,000	500
Iowa	**	**
Kansas	**	**
Kentucky	**	**
Louisiana	**	**
Maine†	5	2
Maryland†	175	100
Massachusetts†	923	78
Michigan	**	**
Minnesota	**	**
Mississippi	**	**
Missouri	**	**
Montana	**	**
Nebraska	**	**
Nevada	**	None
New Hampshire†	60	20
New Jersey	**	**
New Mexico	**	**
New York†	7,455	2,461
North Carolina	**	**
North Dakota†	15	None
Ohio*	3,877	**
Oklahoma†	150	**
Oregon†	80	38
Pennsylvania*	5,000	1,000
Rhode Island	**	**
South Carolina	**	**
South Dakota	**	**
Tennessee	**	**
Texas	**	**
Utah†	119	**
Vermont*	4	5
Virginia	**	**
Washington	**	**
West Virginia	**	**
Wisconsin	**	**
Wyoming	**	**
Total	21,082	5,199

Note—*Statistics from secretary of state to January 1, 1915. †Figures given up to October 1, 1914. **Electric and gasoline cars are not separately listed. Statistics furnished by Electric Vehicle Association of America.

Classified List of Commercial Electric Vehicles in Manhattan and the Bronx

A table compiled by the New York Electric Vehicle Association.

Used in	Users	Vehicles
[illegible]	9	21
Bakeries	10	166
[illegible]	2	2
[illegible]	2	3
Bill Posting, etc.	1	2
Bolt & Iron, etc.	1	16
Breweries	11	231
Building Materials, etc.	4	12
Bus Operators	2	4
Butchers—Retail	1	3
Butchers—Wholesale	3	47
Butter and Eggs	6	16
Buttons	1	1
Carpet Cleaners, etc.	2	3
Carpets and Rugs	1	4
China	1	1
Coach and Wagon Builders	1	2
Coal	9	2
Confectioners	2	11
Cotton Bags, Rope, etc.	4	1
Cornices	1	1
Costumes, Ladies'	1	17
Dairy Products	2	6
Delivery, General	3	31
Department Stores	16	312
Dresses (Ladies)	1	1
Drugs	1	1
Dry Goods, Wholesale	1	21
Dyeing and Cleaning	2	2
Electric Car Garages	4	5
Electric Car Mfrs.	2	9
Electric Lt. and Pr. Cos.	2	157
Electrical Specialties	6	2
Engraving, Printing, etc.	5	4
Express Companies	6	213
Florists	2	2
Food Specialties	3	5
Furniture—Office	1	1
Furriers	2	2
Gas Companies	8	20
Grocers—Retail	1	1
Grocers—Wholesale	3	18
Hardware, etc.	1	9
Hatters, Retail	1	3
Hides, Leather, etc.	6	1
Importers	1	12
Inks	5	3
Jewelers	1	42
Laces, Embroideries, etc.	2	1
Laundries	2	2
Libraries, Museum, etc.	2	2
Linens	3	6
Lumber, etc.	3	3
Machinery	4	7
Mail Delivery	2	42
Markets	4	5
Men's Clothing	1	2
Metal Specialties	1	1
Millinery	4	6
Miscellaneous	8	4
Newspapers	1	1
Oriental Goods	1	6
Paints	1	2
Paper	2	1
Paper Boxes	1	1
Pianos	1	5
Picture Frames	1	1
Plate Glass	1	1
Police Department	1	1
Powder, Explosives, etc.	1	2
Produce Merchants	1	1
Provisions	4	26
Railroads	1	1
Railroad and Steamship Timetables	1	1
Restaurants	1	1
Rubber Specialties	2	2
Rubber Tires	1	1
Shirts	1	1
Shoes—Retail	1	3
Sight Seeing Cars	1	9
Silks	1	1
Silk Ribbons	1	1
Stationers	1	4
Storage Warehouses	10	16
Street Railway Companies	2	42
Tailors	1	1
Tobacconists	1	7
Transfer, Theatrical	1	2
Trucking	4	1
Trunks, Umbrellas, etc.	1	1
Undertakers' Supplies	1	3
Window Shades	1	2
Wines and Liquors	2	17
Wood Yard	1	1
Yeast	1	25

12 New Commercial Electrics

Five New Names Added to List of Makers—Eight Firms Make Indoor Industrial Vehicles—Low-Priced Commercial Cars on 1915 Market

TWELVE new electric commercial vehicles have made their appearance during the past year and five new names have been added to the list of electric truck manufacturers. The designs of 1915 electric trucks differ little from those of the past year except in minor details and refinements. The greatest strides have been made by the electric indoor industrial trucks, no less than eight makes of which are manufactured for the coming year. These are listed as full-fledged electric vehicles in the table.

Ninety-one electric commercial vehicles, including the indoor industrial trucks, are listed for 1915. These are manufactured by twenty-five different makers. All of the older standard vehicles are continued for 1915 without radical change.

Interesting new vehicles offered on the 1915 market include a new 5-ton Baker, which follows the same general design of the 1914 models manufactured by the same company; the California-made Beardsley vehicles of 1-2 and 1-ton capacity whose battery boxes are arranged to elevate from the ground; a Couple-Gear tractor having three wheels instead of four; a worm-driven G. V. of 1,000 pounds capacity which has been experimented with for more than a year but which is offered this year for the first time; two stepless Field buses of eighteen and thirty-eight passengers capacity, respectively; the New York-made Voltacar featured by its low price; the three-wheeled Wagenhals electric, similar in design to the three-wheeled gasoline vehicles manufactured by the same company; a 750-pound Ward which sells for $875 complete; a 600-pound Waverley characterized by its final drive through herringbone gears and following the same

Capacities and Prices of 1915 Electric Commercial Vehicles

TRUCKS UNDER ½-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Voltacar.....A&B	500		68	Edison	158		Top wm	Worm drive
Wagenhals....	600	575-c	56	Exide*	165*	25*	Sing chn	Price
Ward.....WJ	750	875-c	88		100	35	S-bevel	Price
Waverley......	600	1,600	87	Opt	165*	53*	Herring.	Herringb. drive

TRUCKS OF ½-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Amer.-Argo. K-10	1,000	1,575	86	Exide-Hy.	137½	50	Bevel	French hood
Amer.-Argo L-10	1,000	1,653	86	Exide-Hy.	137½	50	Bevel	French hood
Atlantic..10B&10C	1,000	1,960*	102	Exide-Hy*			Bevel	Platform type
Baker......	1,000	1,900	86	Opt	112*	45*	Dbl chn	Platform type
Beardsley....10B	1,000	1,900	100	Gould-GC.	168	55	Top wm	Elev. bat. box
C.T............½	1,000	1,640	90*	Opt			Int-g.	Two motors
Dunlap..........	1,000	1,250-c	84	Phi.,WTX-17	204	60	Dbl chn.	Price
GMC.........1B	1,000	1,200-b	106	Edison, A4*	150*	45*	Dbl chn	Bat. aboveframe
G.V............	1,000	1,700	88½	Own	135	45	Dbl chn	Platform type
G.V............	1,000	1,950	106	Own	135	45	Top wm	Worm drive
Walker........G	1,000		121	Edison*			Int-g.	Motor in axle
Walker.....M	1,000		82*	Edison*		40*	Int-g.	Motor in axle
Ward.....EO	1,000	1,250	90		130	45	Dbl chn	Platform type
Waverley......	1,000	1,800	90	Opt	135*	51*	Herring	Herringb. drive

TRUCKS OF ¾-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Urban......15A	1,500	1,500	86	Exide-Hy.	165	19	Dbl chn	Platform type

TRUCKS OF 1-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Amer.-Argo..K-20	2,000	1,720	96	Exide-Hy.	165	45	Bevel	French hood
Amer.-Argo..L-20	2,000	1,795	96	Exide-Hy.	165	45	Bevel	French hood
Atlantic.......1C	2,000	2,200*	103	Exide-Hy*			Dbl chn	Platform type
Baker......O	2,000	2,300	102	Opt	140*	40*	Dbl chn	Platform type
Beardsley...20B	2,000	2,350	108	Gould-ID.	193*	45*	Top wm	Elev. bat. box
Buffalo.....CCA	2,000	2,400	102	Opt	178½*	45*	Spur	Platform type
C.T.........1	2,000	2,065	110	Opt			Int-g.	Two motors
GMC.......2B	2,000	1,300-b	118	Edison, A5*	187½*	42*	Dbl chn	Bat. aboveframe
G.V.......	2,000	2,100	101	Own	162	45	Dbl chn.	Platform type
Old Hickory .20W	2,000	1,900	110	Gould	220	40	Top wm	Worm drive
Walker....K	2,000		94*	Edison*		40*	Int-g.	Motor in axle
Ward.....EA	2,000	1,500	109		150	40	Dbl chn	Platform type
Waverley......	2,000	2,150	104	Opt	189*	45*	Dbl chn	Platform type

TRUCKS OF 1½-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
GMC.........3B	3,000	1,450-b	130	Edison, A6*	225*	40*	Dbl chn	Bat. aboveframe
Urban.....30A	3,000	1,900	102	Exide-Hy.	165	35	Dbl chn	Platform type

TRUCKS OF 2-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Atlantic.......2C	4,000	2,750*	115½	Exide-Hy*			Dbl chn.	Platform type
Baker..........U	4,000	2,800	120	Opt	168*	40*	Dbl chn.	Platform type
C.T............2	4,000	2,725	116	Opt			Int-g.	Two motors
Detroit..........	4,000		128	Edison, A8.	300	50	Dbl chn.	Platform type
GMC.........4B	4,000	1,650-b	138	Edison, A6*	225*	32*	Dbl chn	Bat. aboveframe
G.V............	4,000	2,600	111½	Own	216	45	Dbl chn	Platform type
Walker......L	4,000		107*	Edison*		40*	Int-g.	Motor in axle
Ward.....EB	4,000	1,900	114		230	35	Dbl chn.	Platform type
Waverley....	4,000	3,000	114	Opt	216*	35*	Dbl chn	Platform type

TRUCKS OF 2½-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Urban.......50A	5,000	2,500	118	Exide-Hy.	192	35	Dbl chn	Platform type
Walker.........D	5,000		127*	Edison*		40*	Int-g.	Motor in axle

ABBREVIATIONS: General, *, *other options*; Opt, *optional*. **Price**, -c, *complete with body and battery*; -b, *without battery*. **Load Capacity**, -t, *tractor, carries none or only a part of load*. **Battery Make and Type**, Exide-Hy, *Exide Hycap*; Phil, *Philadelphia*. **Drive, Final Reduction**, Dbl chn, *double chain*; Top worm, *worm gear with worm on top*; Spur, *spur gears*; Int-g, *internal gear*; Sing chn, *single chain*; Herring, *herringbone gear*; Vrt worm, *worm gear with worm vertical*; S-bevel, *spiral bevel* general design of the 1,000-pound Waverley model of 1914; a new 1,000-pound Dunlap, and the Urban line which follows closely the construction of the Old Hickory worm-driven gasoline trucks manufactured by the same concern. The Storms Electric Car Co. was formed in Detroit during the last months of 1914 to engage in the manufacture of electric passenger cars and trucks of 500 pounds capacity to sell at $650.

Few Changes Among Makers

Companies building electric vehicles during 1914 which are not producing for 1915 are few. The Bailey electric truck has been discontinued for 1915, all Bailey models for this year being of the passenger type. The Borland-Grannis company, which formerly manufactured the Borland electric truck, has been consolidated with other concerns to form the American Electric Car Co., represented in the truck field by its Argo models. The Anderson Electric Car Co., which formerly offered three truck models of from 1-2 to to 3 1-2-ton capacity, has reduced its line to but one model of 2 tons capacity. The Van Auken electric truck is now known as the Connersville. The Fritchle, like the Bailey truck, is discontinued, the Fritchle company specializing on the passenger types. The Tiffany and the Milburn are new makes of passenger chassis which may be purchased with commercial bodies for delivery work.

Of the ninety-one electric trucks offered for 1915, fourteen are of 1-2-ton capacity, thirteen of 1-ton capacity and nine each of 2- and 3 1-2-ton capacity. The remainder are divided into four of less than 1-2-ton capacity, one of 3-4, two of 1 1-2, two of 2 1-2, one of 3, two of 4, eight of 5, two of 6-ton capacity, three whose capacities are not given, and twenty-one indoor industrials.

One-half-ton and 1-ton electric trucks are the most popular for the year of 1915, approximately 33 per cent. of all the trucks offered for this year being of these capacities. The final drive of these two sizes is divided into six different kinds. Given in the order of the greatest number using each kind, the trend is as follows: Chain, internal-gear, bevel, worm, herringbone and spur. Practically all of these trucks are of the platform type with the battery location at some point below the frame, thus permitting a clear load-platform space.

Twenty-one Industrial Models

Twenty-one models of electric indoor industrial trucks, made by eight makers, are offered for 1915. These vary in capacity from 2,000 to 10,000 pounds, the 10,000-pounders being tractors which carry either none or only part of the load.

The industrials are known as the Automatic, the Cowan Transveyor, the Electromobile, the Elwell-Parker, the G. V., the Hoagland-Thayer, the Hunt, and the Mercury Pullem. One of the most interesting of these is the Cowan Transveyor which employs a novel type of elevating platform by means of which it loads and unloads itself.

Capacities and Prices of 1915 Electric Commercial Vehicles

TRUCKS OF 3-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
GMC 6B	6,000	1,900-b	150	Edison, A8*.	300*	33*	Dbl chn	Bat.aboveframe

TRUCKS OF 3½-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Atlantic 3C	7,000	3,375*	134	Exide-Hy*			Dbl chn	Platform type
Baker CC	7,000	3,500	137	Opt.	224*	40*	Dbl chn	Platform type
Couple-Gear H	7,000	4,250	90	U.S.L., WBT	300	35	Bevel4	4-wheel drive
Couple-Gear HF	7,000	3,750	120	U.S.L., WBT	325	35	BevelF	Front-whl drive
C.T. 3½	7,000	3,500	115	Opt.			Int-g4.	4-wheel drive
G.V.	7,000	3,250	128½	Own	270	40	Dbl chn	Platform type
Walker E	7,000		140*	Edison*		40*	Int-g	Motor in axle
Ward EC	7,000	2,450	144		275	30	Dbl chn	Platform type
Waverley	7,000	3,400	127	Opt.	270*	35*	Dbl chn	Platform type

TRUCKS OF 4-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
GMC 8B	8,000	2,100-b	156	Edison, A8*.	300*	27*	Dbl chn	Bat.aboveframe
Urban 80A	8,000	3,000	130	Exide-Hy.	275	35	Dbl chn	Platform type

TRUCKS OF 5-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Atlantic 5C	10,000	3,925*	144	Exide-Hy*			Dbl chn.	Platform type
Baker EA	10,000	3,850	137	Opt.	252*	40*	Dbl chn.	Platform type
Couple-Gear A	10,000	4,800	90	U.S.L., WBT	350	35	Bevel4.	4-wheel drive
C.T. 5	10,000	3,945	132	Opt.			Int-g4.	4-wheel drive
GMC 10B	10,000	2,350-b	166	Edison, A10*	375*	27*	Dbl chn.	Bat.aboveframe
G.V.	10,000	3,700	139	Own	324	35	Dbl chn.	Platform type
Ward	10,000	2,950	174		330	25	Dbl chn.	Platform type
Waverley	10,000	3,950	136	Opt.	324*	30*	Dbl chn.	Platform type

TRUCKS OF 6-TON CAPACITY

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Couple-Gear AF	12,000		120	U.S.L., WBT	375	35	BevelF	Front-whl drive
GMC 12B	12,000	2,500-b	174	Edison, A10*	375*	24*	Dbl chn	Bat.aboveframe

CAPACITIES NOT GIVEN

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Couple-Gear, 3-whl		2,650		U.S.L., WBT	175	30	Bevel.	3-wheeler
Field Bus, 18-pass		6,500-c		Edison, A6.	225	100	Top wm	Mileage per ch.
Field Bus, 38-pass		10,500-c	194	Edison, A10.	375	125	Int-g.	Mileage per ch.

ELECTRIC INDUSTRIAL TRUCKS

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	Battery Make	Ampere-Hour Capacity	Mileage per Charge With Load	Final Drive	Feature
Automatic D	2,000		37½	Edison, A4*	150*	30*	Dbl chn	Opt. bat. loca.
Electromobile A	3,000	1,400	55	Exide	126		Dbl chn	Aut. brake lock
Electromobile C	3,000	1,250	50	Exide	100		Dbl chn	Aut. brake lock
Electromobile E	3,000	1,100	43	Exide	100		Dbl chn	Aut. brake lock
Automatic E	4,000		52	Edison, A4*	150*	32*	Dbl chn	Opt. bat. loca.
Automatic M	4,000		72*	Edison, A6*	225*	22½*	Top wm	Low platform
Cowan Transveyor	4,000	1,630*		Opt	7*	4*	Vrt wm.	Self-loader
Elwell-Parker	4,000		85	Edison, A6*	225*		Int-gF	Large wheels
Elwell-Parker	4,000		114	Edison, A6*	225*		Int-gF	Large wheels
Elwell-Parker	4,000		53	Edison, A6*	225*		Int-gF	Front-whl drive
Elwell-Parker	4,000		78	Edison, A6*	225*		Int-gF	Front-whl drive
Elwell-Parker 1B	4,000		52	Edison, B6*	120*		Top wm	Worm drive
Elwell-Parker 1B	4,000		55	Edison, B6*	120*		Top wm	Worm drive
Elwell-Parker 1D	4,000		68	Edison, B6*	120*		Top wm	Worm drive
G.V.	2,000	1,250-c	42½	Own	48	23	Spur	Two motors
Hoag.-Thayer A	4,000	1,500	78	Edison, A6.	225	20	Spur	4-wheel steer
Hoag.-Thayer B	4,000	1,950	84	Edison, A5.	187½	20	Spur	4-wheel steer
Hoag.-Thayer D	4,000	2,025	109	Edison, A5.	187½	20	Spur	4-wheel steer
Hunt	4,000		60	Exide*	110*	25*	Int-g.	Int-gear drive
Hoag.-Thayer MT	10,000	2,900	36	Edison, A6.	225	25	Spur	Tractor
Mercury Pullem			38	Opt			Bevel	Tractor

ABBREVIATIONS: **General**, *, *other options*; Opt, *optional*. **Price**, -c, *complete with body and battery*; -b, *without battery*. **Load Capacity**, -t, *tractor, carries none or only a part of load*. **Battery Make and Type**, Exide-Hy, *Exide Hycap*; Phil, *Philadelphia*. **Drive, Final Reduction**, Dbl chn, *double chain*; Top worm, *worm gear with worm on top*; Spur, *spur gears*; Int-g, *internal gear*; Sing chn, *single chain*; Herring, *herringbone gear*; Vrt worm, *worm gear with worm vertical*; S-bevel, *spiral bevel*.

Specifications of 91 Electric Truck Chassis for 1915

Constructional and Mechanical Features of Electric Commercial Vehicles and Indoor Industrial Trucks Built in the United States by Twenty-Five Manufacturers

NINETY-ONE electric vehicle chassis for 1915 are analyzed in the following table. These are the products of twenty-five manufacturers and comprise both commercial vehicles and indoor industrial types, there being eight makers engaged in building the industrial variety, one of them having entered this field in addition to continuing its commercial cars. To facilitate the understanding of the tabulation and to render the various terms clear a brief definition of some of the latter may be of assistance:

By load capacity is meant the maximum load for regular service in addition to the weight of the body, cab and crew.

The chassis price covers cab and other standard equipment except the body. Some makers, however, sell only complete vehicles, these being indicated in the table by a c following the price. Other makers list their chassis without battery, these being marked with a b.

Wheelbase is the distance between the axle centers and is given in inches.

Tires are measured by diameter and width, the latter being the base width. When a tire is specified as dual, this represents two tires on one wheel.

Motors are located amidships, unit with axle, unit with jackshaft, to the rear of the chassis, in the front wheel where one front wheel is used, and in the wheels. When amidships, drive is by chains or shaft to the rear axle through one or two gear reductions. When unit with the axle it is geared direct through reductions. When unit with jackshaft it is located amidships but incorporated with the jackshaft. At the rear, it drives through the jackshaft with two reductions, but is behind the jackshaft instead of in front. When in the front wheel or in the wheels the motor is inclosed by disks and drives by internal gears.

Two types of winding are employed, series and shunt. In the first the current passes through the armature and then through the field, the same size of wire being used in both. In shunt winding all current flows through the armature and only a portion enters the field, being shunted across the armature circuit through fine wires. To secure the same amount of magnetism in the latter type many turns of fine wire are required.

Reductions are by herringbone gears, bevel gears direct to jackshaft, by roller or silent chain or by direct spur gearing. Direct in the table means there is but one reduction. In the second reduction the forms of gear used in the first are also used with worm gearing, double chains, internal gears and spiral-bevels in addition.

Name and Model	Load Capacity in Pounds	Price of Chassis	Wheelbase	TIRES		MOTOR				BATTERY						CONTROL			DRIVE		SPRINGS	
				Front	Rear	Location	Make	Winding	Horsepower	Make, Type and Number Plates	Number Cells	Ampere-Hour Capacity	Number Trays	Location	Mileage per Charge With Load	Steer	Controller	Speeds Forward	First Reduction	Final Reduction	Front	Rear
American-Argo K 10	1,000	1,575	86	35x3	35x3	Unit-x	West.	Series	3½	Exide-Hy, 11	40	137½	4	Amid-u	50	Wheel-l.	Wheel-t	4	Herring	Bevel	½-Ell	½-Ell
American-Argo L-10	1,000	1,650	86	35x3	35x3	Unit-x	West.	Series	3½	Exide-Hy, 11	40	137½	4	Amid-u.	50	Wheel-l.	Wheel-t	4	Herring	Bevel	½-Ell	½-Ell
American Argo K-20	2,000	1,720	96	35x3½	35x3½	Unit-x	West.	Series	3½	Exide-Hy, 13	40	165	5	Amid-u.	45	Wheel-l.	Wheel-t	4	Herring	Bevel	½-Ell	½-Ell
American-Argo L-20	2,000	1,795	96	35x3½	35x3½	Unit-x	West.	Series	3½	Exide-Hy, 11	40	165	5	Amid-u	45	Wheel-l.	Wheel-t	4	Herring	Bevel	½-Ell	½-Ell
Atlantic 10B&10C	1,000	1,900*	102	31x3*	36x3*	Unit-x	G. E.*			Exide-Hy*	44*			Opt		Wheel.	Wheel-u	4	Direct	Bevel	½-Ell	½-Ell
Atlantic 1C	2,000	2,200*	103	34x3½	36x4		G. E			Exide-Hy*	44*			Amid-u		Wheel.		4	Chain	Dbl chn	½-Ell	½-Ell
Atlantic 2C	4,000	2,750*	115½	34x4	36x3d		G. E			Exide-Hy*	44*					Wheel		4	Chain	Dbl chn	½-Ell	½-Ell
Atlantic 3C	7,000	3,375*	134	36x5	40x4d		G. E			Exide-Hy*	44*			Amid-u		Wheel.		4	Chain	Dbl chn	½-Ell	½-Ell
Atlantic 5C	10,000	3,825*	144	36x6	40x5d		G. E			Exide-Hy*	44*			Amid-u.		Wheel.		4	Chain	Dbl chn	½-Ell	½-Ell
Automatic D†	2,000		37½	16x3	16x3½	Amid.	Own	Series	1½	Edison, A4*	20*	150*	2*	Rear-o*	30*	Lever-r.	Left	3		Dbl chn	Coil	Coil
Automatic E†	4,000		52	16x3	16x3½	Amid	Own	Series	2	Edison, A4*	36*	150*	4*	Rear-o*	32*	Lever-r.	Left	3		Dbl chn	Coil	Coil
Automatic M†	4,000		72*	27x3½	27x3½	Unit-x	Own	Series	1½	Edison, A6*	21*	225*	3*	Front-u	22½*	Lever-r.	Left	3	Direct	Top worm	None	None
Baker X	1,000	1,900	86	36x3	36x3½	Unit-j	G.E.	Series	3	Opt	42*	112*	6*	Amid-u.	45*	Wheel-l	Wheel-u	5	Chain	Dbl chn	½-Ell	½-Ell
Baker O	2,000	2,300	102	36x3½	36x4	Unit-j	G.E.	Series	4	Opt	42*	140*	6*	Amid-u.	49*	Wheel-l.	Wheel-u	5	Chain	Dbl chn	½-Ell	½-Ell
Baker U	4,000	2,800	120	36x4	36x3½d	Unit-j	G.E.	Series	5	Opt	42*	168*	6*	Amid-u.	49*	Wheel-l.	Wheel-u	5	Chain	Dbl chn	½-Ell	½-Ell
Baker CC	7,000	3,500	137	36x6	38x4d	Unit-j	G.E	Series	7	Opt	42*	224*	6*	Amid-u	49*	Wheel-l.	Wheel-u	5	Chain	Dbl chn	½-Ell	½-Ell
Baker EA	10,000	3,850	137	36x7	38x5d	Unit-j	G.E	Series	10	Opt	42*	252*	6*	Amid-u.	40*	Wheel-l	Wheel-u	5	Chain	Dbl chn	½-Ell	½-Ell
Beardsley 10B	1,000	1,900	100	31x4	34x4½	Amid-o	West.	Series	2½	Gould-GC, 13	40	168	8	Amid-u.	55	Wheel-l.	Seat-l.	4	Direct.	Top worm	½-Ell.	½-Ell
Beardsley 20B	2,000	2,350	108	34x4½	34x5	Amid-o.	West.	Series	3	Gould-ID, 15	40*	193*	10*	Amid-u.	45*	Wheel-l.	Seat-l.	4	Direct.	Top worm	½-Ell.	½-Ell
Buffalo CCA	2,000	2,400	102	36x3½	36x5	Amid	G.E	Series	2½	Opt., 15	44*	178½*	10*	Amid-u	48*	Wheel-l.	Seat-l.	5	Bevel	Spur	½-Ell	½-Ell
Couple Gear 3-wheel	....	2,650				F-wheel	Own	Series	5	U.S.L., WBT-15	40	175	4	Amid-u.	30	Wheel-r	Seat-l	5	Direct.	Bevel	Coil	½-Ell
Couple-Gear H	7,000	4,250	90	36x4d	36x4½	In whl-4	Own	Series	3	U.S.L., WBT-25	44	300	8	Amid-u.	35	Wheel-r	Seat-l	5	Direct.	Bevel-4	½-Ell	½-Ell
Couple-Gear HF	7,000	3,750	120	36x4d	64x5½	In whl-F	Own	Series	5	U.S.L., WBT-27	40	325	4	Amid-u.	35	Wheel-r	Seat-l	5	Direct.	Bevel-F	½-Ell	½-Ell
Couple-Gear A	10,000	4,800	90	36x5d	36x5½	In whl-4	Own	Series	3	U.S.L., WBT-29	44	350	8	Amid-u.	35	Wheel-r	Seat-l	5	Direct.	Bevel-4	½-Ell	½-Ell
Couple-Gear AF	13,000		120	36x5d	66x5	In whl-F	Own	Series	5	U.S.L., WBT-31	40	375	6	Amid-u	35	Wheel-r	Seat-l	5	Direct.	Bevel-F	½-Ell	½-Ell
Cowan Transveyor†	4,000	1,650*				Front-o	Wagner		2	Opt	18*	7*		Front-o	4*	Wheel-l.	Right	3	Direct.	Vrt worm	None	None

C.T.	½	1,000	1,040	90*	30x2½	36x3	Unit-x2	G.E	Series	1½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g.	½-Ell	½-Ell
C.T.	1	2,000	2,006	110	36x3½	36x4	Unit-x2	G.E	Series	1½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g.	½-Ell	½-Ell
C.T.	2	4,000	2,725	116	36x5	36x3½d	Unit-x2	G.E	Series	2½	Opt	[illegible]			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g.	½-Ell	½-Ell
C.T.	3½	7,000	3,530	118	36x3½d	36x4d	Unit-x4	G.E	Series	1½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g4.	½-Ell	½-Ell
C.T.	5	10,000	3,935	132	36x4d	36x5d	Unit-x4	G.E	Series	1½	Opt	42*			Amid-u.		Wheel-l.	Wheel-u	4	Bevel	Int-g4.	½-Ell	½-Ell
Detroit		4,000		125	36x4	36x3½d	Amid.	Own	Series	6	Edison, A8	60	300	12	Amid-u.	80	Wheel-l.	Wheel-u	5	Bevel	Dbl chn	½-Ell	½-Ell
Dunlop		1,000	1,250-c	84	30x3	30x2	Rear	G.E	Series		Phil., WTX-17	26	204	4	Amid-u.	60	Lever-r.	Center	5	Chain	Dbl chn	Ellip	Ellip
Electromobile	E	3,000	1,100	43	20x3	20x3	Unit-j	Wagner	Series	2½	Exide, 9	15	100	1	Amid-u.		Lever-r.	Left	4	Chain	Dbl chn	Coil	Coil
Electromobile	C	3,000	1,250	50	20x3	20x3	Unit-j	Wagner	Series	2½	Exide, 9	24	100	2	Amid-u.		Lever-r.	Left	4	Chain	Dbl chn	Coil	Coil
Electromobile	A	3,000	1,400	55	20x3	20x3	Unit-j	Wagner	Series	4	Exide, 9	33	126	2	Amid-u.		Lever-r.	Left	4	Chain	Dbl chn	Coil	Coil
Elwell-Parker†		4,000		85	27½x3½	27½x3½	Unit-x	Own	Series		Edison, A6*	21*	225*	3*	Amid-u.		Lever-r.	Left	3	Spur	Int-g, F	None	None
Elwell-Parker†		4,000		114	27½x3½	27½x3½	Unit-x	Own	Series		Edison, A6*	21*	225*	3*	Amid-u.		Lever-r.	Left	3	Spur	Int-g, F	None	None
Elwell-Parker†		4,000		53	21½x3½	10½x5	Unit-x	Own	Series		Edison, A6*	21*	225*	3*	Amid-u.		Lever-r.	Left	2	Spur	Int-g, F	None	None
Elwell-Parker†		4,000		78	21½x3½	15x3½	Unit-x	Own	Series		Edison, A6*	21*	225*	3*	Amid-u.		Lever-r.	Left	3	Spur	Int-g, F	None	None
Elwell-Parker	1B	4,000		52	15x3½	15x3½	Unit-x	Own	Series		Edison, B6*	42*	120*	6*	Amid-u.		Lever-r.	Left	2	Direct.	Top worm	None	None
Elwell-Parker	1B	4,000		56	15x3½	15x3½	Unit-x	Own	Series		Edison, B6*	42*	120*	6*	Amid-u.		Lever-r.	Left	2	Direct.	Top worm	None	None
Elwell-Parker	1D	4,000		68	15x3½	15x3½	Unit-x	Own	Series		Edison, B6*	42*	120*	6*	Amid-u.		Lever-r.	Left	3	Direct.	Top worm	None	None
Field Bus	19-pass		6,800-c		32x3½	34x3½d	Unit-x	G.E.	Series	10	Edison, A6	110	225		H&s	100	Wheel-l.	Left	7	Direct.	Top worm	Ellip	Ellip
Field Bus	38-pass		10,500-c	194	36x5	33x5d	Unit-x2	G.E.	Series	10	Edison, A10	115	375	23	Rear-o	125	Wheel-l.	Left	7	Spur	Int-g.	Ellip	Ellip
G.M.C.	1B	1,000	1,200-b	106	32x2	32x3½	Rear	G.E	Series	2½	Edison, A4*	60*	150*		U-seat	45*	Wheel-l.	Wheel-t.	5	Bevel	Dbl chn	½-Ell	½-Ell
G.M.C.	2B	2,000	1,300-b	118	32x2½	32x4	Rear	G.E	Series	3½	Edison, A5*	60*	187½*		U-seat	42*	Wheel-l.	Wheel-t	5	Bevel	Dbl chn	½-Ell	½-Ell
G.M.C.	3B	3,000	1,450-b	120	32x4	32x5	Rear	G.E	Series	4	Edison, A6*	60*	225*		U-seat	40*	Wheel-l.	Wheel-t	5	Bevel	Dbl chn	½-Ell	½-Ell
G.M.C.	4B	4,000	1,650-b	138	32x4	36x3½d	Rear	G.E	Series	4	Edison, A6*	60*	225*		U-seat	32*	Wheel-l.	Wheel-t	5	Bevel	Dbl chn	½-Ell	½-Ell
G.M.C.	6B	6,000	1,900-b	150	32x5	36x4d	Rear	G.E	Series	5½	Edison, A8*	60*	300*		U-seat	30*	Wheel-l.	Wheel-t	5	Bevel	Dbl chn	½-Ell	½-Ell
G.M.C.	8B	8,000	2,100-b	156	32x5	36x5d	Rear	G.E	Series	5½	Edison, A8*	60*	300*		U-seat	27*	Wheel-l.	Wheel-t	5	Bevel	Dbl chn	½-Ell	½-Ell
G.M.C.	10B	10,000	2,350-b	166	36x6	36x6d	Rear	G.E	Series	7	Edison, A10*	60*	375*		U-seat	27*	Wheel-l.	Wheel-t	5	Bevel	Dbl chn	½-Ell	½-Ell
G.M.C.	12B	12,000	2,500-b	174	36x6	36x7d	Rear	G.E	Series	7	Edison, A10*	60*	375*		U-seat	24*	Wheel-l.	Wheel-t	5	Bevel	Dbl chn	½-Ell	½-Ell
G.V.		1,000	1,700	86½	36x2½	36x2½	Amid	G.E	Series		Own, 11	44	135	4	Amid-u.	45	Wheel-l.	Center	5	Chain	Dbl chn	½-Ell	½-Ell
G.V.		1,000	1,950	108	36x3	36x3	Amid	G.E	Series		Own, 11	44	135	4	U-hood	45	Wheel-l.	Center	5	Direct.	Top worm	½-Ell	½-Ell
G.V.		2,000	2,100	108	36x3½	36x3½	Amid	G.E	Series		Own, 13	44	162	4	Amid-u.	45	Wheel-l.	Center	5	Chain	Dbl chn	½-Ell	½-Ell
G.V.†		2,000	1,250-c	42½	20x2½	20x2½	Unit-x2	G.E.	Series		Own, 5	44	48	1	Amid-u.	25	Lever-r.	Left	3	Direct	Spur	Coil	Coil
G.V.		4,000	2,600	111½	36x4	36x3½	Amid	G.E	Series		Own, 17	44	216	6	Amid-u.	45	Wheel-l.	Center	5	Chain	Dbl chn	½-Ell	½-Ell
G.V.		7,000	3,250	128½	36x6	36x3½d	Amid	G.E	Series		Own, 21	44	270	6	Amid-u.	40	Wheel-l.	Center	5	Chain	Dbl chn	½-Ell	½-Ell
G.V.		10,000	3,700	129	36x7	36x5d	Amid	G.E	Series		Own, 25	44	324	6	Amid-u.	35	Wheel-l.	Center	5	Chain	Dbl chn	½-Ell	½-Ell
Hoagland-Thayer	A	4,000	1,500	78	20x3½	15x3½	Unit-x	G.E.	Series	1	Edison, A6	21	225	3	Front-o.	20	Lever-r.	Left	3	Spur	Spur	None	None
Hoagland-Thayer	B	4,000	1,950	84	24x3½	24x3½	Unit-x	G.E	Series	1½	Edison, A5	30	187½	5	Amid-u.	20	Lever-r.	Left	3	Spur	Spur	None	None
Hoagland-Thayer	D	4,000	2,025	100	24x3½	24x3½	Unit-o	G.E	Series	1½	Edison, A5	30	187½	5	Rear-u	20	Lever-r.	Left	3	Spur	Spur	None	None
Hoagland-Thayer	MT	10,000-t	2,900	36	20x3½	20x4½	Unit-x2.	G.E	Series	2	Edison, A6	48	225	6	Amid-o.	25	Lever-r.	Left	3	Spur	Spur	None	None
Hunt†		4,000		60	20x3½	20x3½	Unit-o	Diehl	Series	1½	Exide, MV-11*	20*	140*	4*	Amid-u.	25*	Lever-r.	Left	2	Spur	Int-g.	None	None
Mercury Pullem†				38	15x3½	21x3½	Amid-u.			2	Opt				Rear-c		Lever-r	Right	4	Spur	Bevel	None	None
Old Hickory	20W	2,000	1,900	110	33x3½	33x4	Amid	West*	Series		Gould, 17	32	220	4	Amid-u.	40	Wheel-l.	Left	4	Direct.	Top worm	½-Ell	½-Ell
Urban	15A	1,500	1,500	86	36x3	36x3	Amid	G.E	Series		Exide-Hy, 13	30	165	6	Amid-u.	40	Wheel-l	Wheel-u	4	Chain	Dbl chn	½-Ell	½-Ell
Urban	30A	3,000	1,900	102	36x3½	36x5	Amid	G.E	Series		Exide-Hy, 13	44	165	6	Amid-u.	35	Wheel-l.	Wheel-u	4	Chain	Dbl chn	½-Ell	½-Ell
Urban	53A	5,000	2,500	118	36x4	36x4d	Amid	G.E	Series		Exide-Hy, 15	44	192	6	Amid-u.	35	Wheel-l.	Left	4	Chain	Dbl chn	½-Ell	½-Ell
Urban	80A	8,000	3,000	130	36x5	40x5d	Amid	G.E	Series		Exide-Hy, 21	44	275	8	Amid-u.	35	Wheel-l.	Wheel-u	4	Chain	Dbl chn	½-Ell	½-Ell
Voltacar	A&B	500		65	30x2	30x2	Amid	G.E			Edison, 11*	24*	158*	3	U-seat		Wheel-l.	Wheel-u	4	Direct.	Top worm	Ellip	Ellip
Wagenhals		600	575-c	56	28x2	30x2½	Rear	G.E	Shunt		Exide, 13*	14*	165*	2*	Amid-o.	25*	Wheel-c	Left	4	Spur	Sing chn	½-Ell	½-Ell
Walker	G	1,000		121	34x3	36x3½	Unit-x	West.	Series		Edison*	60*			Amid&h.		Wheel-l.	Left	5	Spur	Int-g.	½-Ell	½-Ell
Walker	M	1,000		82*	34x3	36x3½	Unit-o	West.	Series		Edison*	60*			Amid-u.	40*	Wheel-l	Left	5	Spur	Int-g.	½-Ell	½-Ell
Walker	K	2,000		94*	34x3½	36x4	Unit-x	West.	Series		Edison*	60*			Amid-u.	40*	Wheel-l.	Left	5	Spur	Int-g.	½-Ell	½-Ell
Walker	L	4,000		107*	36x4	36x5	Unit-x	West.	Series		Edison*	60*			Amid-u.	40*	Wheel-l.	Left	5	Spur	Int-g.	½-Ell	½-Ell
Walker	D	5,000		127*	36x5	36x3½d	Unit-o	West.	Series		Edison*	60*			Amid-u	40*	Wheel-l	Left	6	Spur	Int-g.	½-Ell	½-Ell
Walker	E	7,000		140*	36x6	36x4d	Unit-x	West	Series		Edison*	60*			Amid-u.	40*	Wheel-l	Left	6	Spur	Int-g.	½-Ell	½-Ell
Ward	WJ	750	875-c	88	32x2½	32x2½	Amid	West.	Series	2			100	2	U-seat	35	Wheel-l	Wheel-u	4	Direct.	S-bevel.	½-Ell	½-Ell
Ward	EO	1,000	1,250	90	32x2½	34x4	Rear		Series			42	130		Amid-u.	45	Wheel-l	Seat-l	4	Chain	Dbl chn	½-Ell	½-Ell
Ward	EA	2,000	1,500	99	34x3	36x4	Rear		Series			42	150		Amid-u	40	Wheel-l	Seat-l	4	Chain	Dbl chn	½-Ell	½-Ell
Ward	EB	4,000	1,900	114	36x4	36x6	Rear		Series			42	200		Amid-u	35	Wheel-l.	Seat-l	4	Chain	Dbl chn	½-Ell	½-Ell
Ward	EC	7,000	2,450	144	36x6	40x3½d	Rear		Series			42	275		Amid-u.	30	Wheel-l.	Seat-l	4	Chain	Dbl chn.	½-Ell	½-Ell
Ward		10,000	2,950	174	40x3½d	42x5d	Rear		Series			43	350		Amid-u.	25	Wheel-l.	Seat-l	4	Chain.	Dbl chn.	½-Ell	½-Ell
Waverley		600	1,600	87	32x2½	32x2½	Rear	Own	Series	3½	Opt	28*	165*		Amid-u.	50*	Wheel-l.	Seat-l	4	Chain	Herring	Ellip	Ellip
Waverley		1,000	1,900	90	34x2½	34x2½	Rear	Own	Series	4	Opt, 11*	42*	135*		Amid-u.	50*	Wheel-l.	Seat-l	4	Chain	Herring	Ellip	Ellip
Waverley		2,000	2,150	104	35x4	35x5	Rear	G.E.	Series	4½	Opt, 15*	42*	180*		Amid-u.	45*	Wheel-l.	Seat-l	4	Bevel	Dbl chn	½-Ell	½-Ell
Waverley		4,000	3,000	114	37x5	37x4d	Rear	G.E	Series	5	Opt, 17*	42*	216*		Amid-u.	35*	Wheel-l.	Seat-l	4	Bevel	Dbl chn	½-Ell	½-Ell
Waverley		7,000	3,400	127	37x6	37x5d	Rear	G.E	Series	6	Opt, 21*	42*	270*		Amid-u.	35*	Wheel-l.	Seat-l	4	Bevel	Dbl chn	½-Ell	½-Ell
Waverley		10,000	3,950	136	37x7	37x7d	Rear	G.E	Series	6	Opt, 25*	42*	321*		Amid-u.	30*	Wheel-l.	Seat-l	4	Bevel	Dbl chn.	½-Ell	½-Ell

† Indicates indoor vehicles.

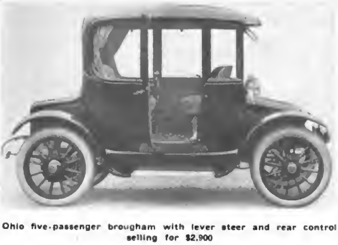
ABBREVIATIONS: General, *, *other options.* Opt, *optional.* **Price**, -c, *complete with body and battery.* -b, *without battery.* **Load Capacity**, -t, *tractor, carries none or only a part of load.* **Tires**, d, *dual.* s, *steel.* **Motor Location**, Unit-x, *unit with axle.* Unit-j, *unit with jack-shaft.* Amid, *amidships.* F-wheel, *in front wheel.* Rear, *suspended from rear of frame.* -2, *two motors used.* -4, *four motors used.* -f, *motor located so that it drives front wheels.* **Horsepower**, *is for single motors, where two or more motors are used, it represents the power of each.* **Battery Make, Type and Number of Plates**, Exide-Hy, *Exide Hycap.* Phil, *Philadelphia.* **Battery Location**, Amid-u, *amidships underslung.* Amid-o, *amidships over frame.* Amid&h, *amidships over frame and under hood.* Rear-o, *to the rear, over frame.* Rear-u, *to the rear, under frame.* Front-u, *at the front, under frame.* Front-o, *at the front, over frame.* U-hood, *under hood.* H&s, *under hood and under seats.* U-seat, *under seat.* **Steer**, Wheel-l, *wheel on the left side.* Wheel-r, *wheel on the right side.* Lever-l, *lever on the left side.* Lever-r, *lever on the right side.* Wheel-c, *wheel in center.* **Controller**, Wheel-t, *on top of steering wheel.* Wheel-u, *under steering wheel.* Seat-l, *to the left of seat.* Seat-r, *to the right of seat.* **Drive, First Reduction**, Herring, *herringbone gears.* Direct, *only one reduction.* Spur, *spur gear.* **Drive, Final Reduction**, Dbl chn, *double chain.* Top worm, *worm gear with worm on top.* Spur, *spur gears.* Int-g, *internal gear.* Sing chn, *single chain.* herringbone, *herringbone gear.* Vrt worm, *worm gear with worm vertical.* S-bevel, *spiral bevel.* **Springs**, ½-Ell, *half-elliptic.* Ellip, *elliptic.* ¾-Ellip, *three-quarters-elliptic.* Plat, *platform.*

Chassis Simplified and Lightened — Increasing Use of Worm, Spiral-Bevel and Herringbone Gear Final Drive—Aluminum Bodies—Greater Mileage

ALTHOUGH many people are apparently settled in the belief that the electric passenger car has reached perfection and that no further improvement is possible without some radical departure from accepted construction, the car makers themselves are far from sharing this view of the matter. Each one is constantly striving for lighter and stronger chassis and bodies, less power loss through friction between the parts, greater battery efficiency and, above all, greater mileage per charge and reduced operating and maintenance cost to the owner.

Then, too, the manufacturers are each year surpassing themselves in the improvement of appearance and in luxurious fittings, finish and equipment. These features, developed in some cars to such an extent that they might be referred to as boudoirs on wheels, render the electric passenger car, as built today, especially attractive to women, and at the same time not too ornate for the every-day use of even the most conservative business men.

During the past year there have been many improvements in both chassis and body design. Chassis have been simplified, lightened and made more accessible wherever possible without impairing the solidity of construction which characterizes practically all the electric passenger cars on the market. The increased use of worm, spiral-bevel and herringbone gears in the final drive has done much to promote efficiency and at the same time to make the operation of the cars more quiet. Weight reductions due to chassis simplification and the use of aluminum for bodies, together with the elimination of resistance from the presence of dirt and grit in the working parts by the provision of improved protection, and the more thorough utilization of battery equipment have done much towards increasing the mileage per charge of the vehicles and at the same time towards cutting down operating expense for the owner.



Ohio five-passenger brougham with lever steer and rear control selling for $2,900

One of the chief features of the year was the fact that a number of new concerns have entered the field, including the makers of the Columbian, Milburn, Storms and Ward, two of them building cars at less than $1,000. The Milburn Wagon Co., a well-known wagon manufacturer, is the maker of the Milburn, while the Ward is a product of the electric truck manufacturer of that name. The other two are new companies. Another electric truck company which has entered the passenger car business in addition to continuing in the commercial car branch is the Walker Vehicle Co., which purchased the factory and business of the Chicago Electric Motor Car Co. in December and announced its intention of continuing the manufacture of electric passenger vehicles under the name Chicago. Another important event early in the year was the formation of the American Electric Car Co. as the result of a merger of the Argo Electric Vehicle Co., Saginaw, Mich., the Borland-Grannis Co., Chicago, Ill., and the Broc Electric Co., Cleveland, O.

The other well-known makers are making cars as in previous years, though, like those already mentioned, each has incorporated into its product the refinements and improvements of the past 12 months. Herewith are described and illustrated the leading American electric passenger cars on the 1915 market, while the detailed specifications appear in tabulated form on pages 134 and 135.

Besides the increased use of aluminum for body work, another factor tending towards lightness is the larger glass area, windows being for the most part of the sashless variety and easily lifted and lowered. Accessiblity, chiefly in respect to the batteries, has been generally improved.

American-Argo in Three Models

The Argo models of the American Electric Car Co., Saginaw, Mich., are three in number, a forward-drive brougham, seating five, at $2,800, a rear-drive brougham, seating four, at $2,650, and a rear-drive roadster, seating four, at $2,350. The chassis for these three models is the same, except that the forward-drive brougham has 110-inch wheelbase, whereas the other two models have 108½-inch wheelbase. All are equipped with 36 by 4 tires, either pneumatic or cushion. There are five forward speeds. Steering is by wheel.

The battery equipment is the same for all three cars and consists of forty cells of Exide eleven-plate MV Hy-Cap; in the front-drive brougham model this is divided twenty-four cells in front and sixteen in the rear, and in the other models the batteries are all in front. The ampere-hour capacity is 137½ and the mileage per charge varies from 75 to 90 at 20 miles per hour.

The motor is a Westinghouse, series-wound machine and is located on the rear axle, driving through a combination of herringbone and bevel gears. There are two reductions, the final gear ratio being 4 to 1. Two sets of brakes are fitted on rear wheel drums, both being operated by pedal. Springs are semi-elliptic in front and three-quarter in rear. Tires are optional.

American-Borland Uses Double Reduction

The Borland models of the American Electric Car Co., Saginaw, Mich., differ in a number of respects from the Argo models, the most prominent difference being the use of double reduction by Renault silent chain to the propeller shaft and bevel gears in the rear axle. Three models are produced, these being a forward-drive limousine, seating seven and selling for $5,500, a rear or forward coupé, for five, at $2,550, and a roadster for two at $2,250. Steering is by wheel, except on the coupé, which uses a lever.

The chassis for these three models is the same except that the limousine has a wheelbase of 123 inches and the other models are 96 inches. The limousine is equipped with forty-two cells of seventeen-plate thin type Exide battery, the complete installation being at the front. The roadster has 42 cells, of eleven plates, equally divided between front and rear, and in the coupé there are forty cells of eleven plates similarly divided. Ampere-hour capacity is 137½ and mileage per charge at 20 miles per hour is 75 to 90.

The motor is a General Electric series-wound machine suspended from the center of the chassis with Renault chain drive through the propeller shaft to bevel gears in a tubular axle. Both sets of brakes are pedal-operated and are located on rear wheel drums. Springs are semi-elliptic in front and underslung elliptic in rear, the frame being a channel steel section. Tires are optional.

American-Broc Line Is Three Broughams

There are three Broc models in the line of the American Electric Car Co., Saginaw, Mich., and they are all broughams mounted on the same chassis, with a wheelbase of 96 inches and either 34 by 4 cushion or pneumatic tires. The three models are a rear-drive at $3,100 for five passengers, a front-drive, also for five passengers, at $3,150, and a five-passenger double-drive at $3,200. Steering is by lever on all models.

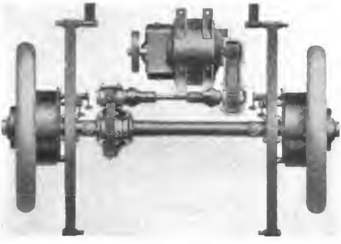
The drive system in the Broc models is somewhat similar to the system used in the Argo. The motor is a 54-volt series-wound Westinghouse machine, centrally suspended in the chassis, whence it drives by shaft to a double-reduction combination bevel and spur gear in a floating axle. The battery equipment is the same for all three cars and consists of forty cells, of eleven-plate Exide Hy-Cap, giving an ampere-hour capacity of 137½ and a mileage of from 75 to 90. In each case, a drum type controller, operated by lever, gives five speeds forward and five reverse.

The brake system is quite different in this model from the system in the Argo and Borland. There are two sets of brakes, one set being located on the driveshaft and operated by hand lever and the other set being on rear wheel drums and operated by pedal. The former are external contracting and the latter internal expanding. The frame is a channel

Rauch & Lang five-passenger coach with lever drive and double control on 102-inch chassis selling for $3,200

New Baker four-passenger coupé on 90-inch wheelbase which sells for $2,800. Steer and control are optional

Left—New Detroit cabriolet with wire wheels which are optional. It carries four passengers and sells for $2,650. Right—Duplex-drive Detroit five-passenger brougham selling at $3,000 with lead battery



High efficiency shaft drive system used on Waverley cars. Note herringbone gears for driving rear axle

steel section, supported in front on semi-elliptic springs and in rear on three-quarter-elliptic springs attached above the axle. Tires are optional.

Baker Coupé of Light Construction

For 1915 the Baker Motor Vehicle Co., Cleveland, O., is concentrating its energies upon a four-passenger coupé which has either wheel or lever steering and sells at $2,800. There are three other models. The main feature of the coupé, designated as Model DA with lever steer and as DB with wheel steer, is that it is a lighter construction as compared with many electrics of the coupé form.

This lightness of weight is said to have been brought about by a simpler chassis construction, though strength has not been sacrificed.

Due to weight reduction, the new Baker is claimed to be capable of 23 miles an hour, which is probably about the highest speed ever built into an electric coupé.

This Baker model has a thirty-two cell, eleven-plate MV Hy-Cap Exide battery supplying a motor hung amidships of the chassis, the controller being of the continuous-torque, drum type with seven speeds forward and three reverse.

The wheelbase is 90 inches and tread standard. Cantilever rear springs and semi-elliptic fronts support the pressed-steel frame, which has a kick-up at the rear to give clearance over the rear axle. There are two sets of internal-expanding brakes on the rear wheels, operated independently by two pedals. An automatic circuit breaker cuts off the current when the emergency brake is applied.

Optional tire equipment on all models makes possible the use of either cushion tires of 34 by 4 size or special electric pneumatics, 32 by 4.

After observing hundreds of electrics on city streets during both afternoon and evening hours, the Baker company states that it has found that more than 98 per cent. of the vehicles carry from one to four passengers. This has been largely responsible for the four-passenger type of coupé body fitted to the new chassis. The seating arrangement is unique in that the front seats are constructed to fold back into recesses in the front of the body, making the car a commodious two-passenger type at will.

The new car has a graceful exterior due to the lowering of the body and the long wheelbase. The curves are full and sweeping. Body panels are of aluminum and sashless windows are used throughout. The door windows are operated by mechanical means with lever control. Another distinctive touch is the use of crowned fenders which follow closely the curves of the wheels and slope gracefully to the running boards.

The upholstery may be in blue, green or maroon leather or broadcloth, and the fittings are in accordance with the usual practice in electrics, including such items as toilet set, silver mounted cut glass flower vase and 8-day clock.

The equipment includes two head lamps, colonial side

Specifications, Prices, Etc., of Electric Passenger Cars for 1915

Name and Model	Body Style	Seats	Price	Position of		Wheel base	Tires, Kind	Battery		Mileage per Charge at 20 M.P.H.	Make of Motor	Final Drive	Forward Speeds
				Steer	Control			Make and No. Cells	Amp. Hr. Capacity				
American Argo, B	Roadster	4	$2,350	Wheel.	Rear	108½	Opt	Exide, 40	137½	75-90	Westinghouse	Bevel	5
American Argo, A	Brougham	4	2,650	Wheel.	Rear	108½	Opt	Exide, 40	137½	75-90	Westinghouse	Bevel	5
American Argo, C	Brougham	5	2,800	Wheel.	Front	110	Opt	Exide, 40	137½	75-90	Westinghouse	Bevel	5
American Berland, 52	Roadster	2	2,250	Wheel.	Rear	96	Opt	Exide, 42	137½	75-90	Gen. Electric	Bevel	7
American Berland, 50	Coupé	5	2,850	Lever	Opt	96	Opt	Exide, 40	137½	75-90	Gen. Electric	Bevel	6
American Berland, 60	Limousine	7	5,500	Wheel.	Front	123	Opt	Exide, 42	204	75-90	Gen. Electric	Bevel	6
American Broc, 33	Brougham	5	3,100	Lever	Rear	96	Opt	Exide, 40	137½	75-90	Westinghouse	Bevel	5
American Broc, 34	Brougham	5	3,150	Lever	Front	96	Opt	Exide, 40	137½	75-90	Westinghouse	Bevel	5
American Broc, 36	Brougham	5	3,200	Lever	Double	96	Opt	Exide, 40	137½	75-90	Westinghouse	Bevel	5
Bailey, F	Roadster	2	2,900	Wheel.		112	Pneu.	Edison, 60	187½	100	Gen. Electric	Chain	6
Bailey, F	Touring	4	3,300	Wheel.		132	Pneu.	Edison, 60	225	100	Gen. Electric	Chain	6
Baker, WA & WB	Roadster	2	2,300	Opt		88	Opt	Exide, 34			Gen. Electric	Bevel	6
Baker, VAE & VAF	Coupé	4	2,600	Opt		88	Opt	Exide, 34			Gen. Electric	Bevel	6
Baker, DA & DB	Coupé	4	2,800	Opt		97	Opt	Exide, 32			Gen. Electric	Worm.	7
Baker, BBD	Brougham	5	3,350	Lever	Double	100	Opt	Exide, 42			Gen. Electric	Worm.	6
Beardsley, 200B	Roadster	3	2,600	Wheel.		103	Pneu.	Gould, 42	168	90	Westinghouse		5
Beardsley, 300B	Victoria	5	2,750	Lever	Double	103	Pneu.	Gould, 36	193	75	Westinghouse		5
Beardsley, 100B	Brougham	5	3,000	Lever	Double	103	Pneu.	Gould, 36	193	75	Westinghouse		5
Buffalo, 36	Brougham	5	3,250	Wheel.	Front	102	Opt	Opt, 42	140	50	Own	Sp. Bevel	5
Century, LB	Brougham	5	3,250	Opt	Opt	104	Opt	Willard, 42	165	85-95	Gen. Electric	Sp. Bevel	4
Chicago, 151 & 153	Brougham	5	2,650	Lever	Rear	98	Cush.	Exide, 40	165	70-80	Westinghouse	Sp. Bevel	4
Chicago, 152	Limousine	5	2,850	Lever	Front	104	Cush.	Exide, 40	165	70-80	Westinghouse	Sp. Bevel	4
Columbian, R	Roadster	2	950	Lever	Rear	98	Pneu.	Opt, 26	135	75-85	Optional	Worm.	5
Columbian, B	Brougham	4	1,450	Lever	Rear	98	Pneu.	Opt, 26	135	75-85	Optional	Worm.	5
Columbian, C	Coupelet	3	1,250	Lever	Rear	98	Pneu.	Opt, 26	135	75-85	Optional	Worm.	5
Detroit, 55	Brougham	4	2,000	Lever	Rear	94	Opt	Own, 40	168	70	Own	Bevel	5
Detroit, 50	Cabriolet	4	2,650	Lever	Rear	100	Opt	Own, 42	178	75	Own	Worm.	5
Detroit, 51	Brougham	4	2,850	Lever	Rear	100	Opt	Own, 42	178	75	Own	Worm.	5

ABBREVIATIONS: Opt, optional, Pneu, pneumatic; Her'b'ne, herringbone; Sp. Bevel, Spiral bevel.

lamps, and rear quarter lamps which light automatically when the right-hand door is open. There is also a ventilator, combination voltmeter and ammeter and shaft odometer.

As to the steering mechanism, either wheel or lever type controls from the rear seat. In the wheel form the speed controller is on the steering column below the wheel-spider. With the lever type the controller is carried on a controller post at the left of the body and is operated by the left hand. Steering is done with the right.

The other models are a roadster, called WA with lever steer and WB with wheel, a four-passenger coupé, called VAE with lever steer and VAF with wheel, and a five-passenger brougham BBD with double control. Wheelbase is 88 inches on the first two, which are worm-drive models with six forward speeds and 100 inches on the brougham, which, like the coupé known as DA or DB, is bevel driven. General Electric motors are employed on all models. The roadster and coupé models VAE and VAF have thirty-four cell Exide batteries, the other coupé has a thirty-two cell equipment, and the brougham forty-two cells.

Bailey Employs Countershaft

Two chassis, mounting two bodies and differing only in passenger capacity, wheelbase and battery equipment, will constitute the line produced by S. R. Bailey & Co., Amesbury, Mass., for the coming season. The first of these is a two-passenger roadster finished in English purple lake with black leather upholstery, at $2,900; and the second is a four-passenger touring model with the same finish and selling at $3,300. The former has a wheelbase of 112 inches and is mounted on 33 by 4 pneumatic tires, front and rear, and the latter has 132-inch wheelbase and is mounted on 34 by 4 pneumatic tires. Both have wheel steer.

In both chassis the distinctive Bailey transmission system, which incorporates motor drive to a countershaft and thence by side chains to the road wheels, is retained practically without change. The motor is a series-wound General Electric machine controlled through a drum type controller with the lever mounted on the steering wheel and giving six forward speeds and three reverse. The battery equipment is Edison exclusively and in the roadster consists of sixty cells, of A-5, with a rated ampere-hour capacity of 187.5, and giving a mileage of 100 at 20 miles per hour; the maximum speed is 25 miles per hour. In the touring model the same number of cells is used, but the size is A-6, the ampere-hour capacity being 225 ampere-hours.

Waverley four-passenger brougham with lever steer and rear control on 106-inch chassis and selling at $2,750

Frames are wood braced with steel and are mounted in front on semi-elliptics and in rear on elliptic springs. There are two sets of brakes, the service set operating by pedal on the rear wheel drums and the emergency set operating by pedal on countershaft drums.

Beardsley Uses Wire Wheels

The Beardsley Electric Car Co., Los Angeles, Cal., is marketing three models for the forthcoming season. These are

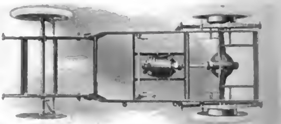
Specifications, Prices, Etc., of Electric Passenger Cars for 1915

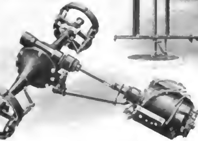
Name and Model	Body Style	Seats	Price	POSITION OF		Wheelbase	Tires, Kind	BATTERY		Mileage per Charge at 20 M.P.H.	Make of Motor	Final Drive	Forward Speeds
				Steer	Control			Make and No. Cells	Amp.-Hr. Capacity				
Detroit, 53	Brougham	3	2,950	Lever	Front	100	Opt	Own, 42	178	75	Own	Worm.	5
Detroit, 54	Brougham	3	2,950	Lever	Rear	100	Opt	Own, 42	178	75	Own	Worm.	5
Detroit, 52	Brougham	5	3,000	Lever	Double	100	Opt	Own, 42	178	75	Own	Worm.	5
Flanders, K	Colonial	4	1,750	Lever	Rear	100	Pneu.	Willard, 30	135	75	Wagner	Worm.	6
Grinnell, S	Coupé	5	3,000	Lever	Rear	100	Opt	Own, 40		90	Own	....	5
Grinnell, R	Brougham	5	3,400	Lever	Double	105	Opt	Phila. 40	....		Own	....	5
Milburn, 151	Roadster	3	1,285	Wheel		100	Opt	Phila. 17	205	50-75	Gen. Electric	Worm.	4
Milburn, 15	Coupé	4	1,485	Lever	Rear	100	Opt	Phila. 20	180	50-75	Gen. Electric	Worm.	4
Ohio, 11	Coupe	4	2,400	Lever	Rear	94	Pneu.	Own, 36	....	75	Westinghouse	Bevel	4
Ohio, 21	Roadster	3	2,650	Lever	Rear	98	Opt	Exide, 42	....	75	Own	Opt.	3
Ohio, 41	Brougham	5	2,900	Lever	Rear	98	Opt	Exide, 42	....	75	Own	Opt	5
Ohio, 51	Brougham	5	3,000	Lever	Double	98	Opt	Exide, 44		75	Own	Opt	5
Ohio, 61	Coupé	5	3,250	Leve	Double	98	Opt	Exide, 44	....	75	Own	Opt	5
Rauch & Lang, RS	Roadster	2	2,600	Lever	Rear	92	Opt	Exide, 41	130	80-100	Hertner	Worm.	6
Rauch & Lang, CRS	Roadster	3	2,850	Lever	Rear	92	Opt	Exide, 41	130	80-100	Hertner	Worm.	6
Rauch & Lang, BS-BXS	Brougham	4	2,950	Lever	Rear	92	Opt	Exide, 41	130	50-100	Hertner	Worm.	6
Rauch & Lang, JS	Brougham	5	3,200	Lever	Double	102	Opt	Exide, 42	130	50-100	Hertner	Worm.	6
Rauch & Lang, TCS-TXCS	Limousine	7	4,000	Wheel	Front	106	Opt	Exide, 42		40-90	Hertner	Worm.	6
Standard, M4	Coupé	4	1,900	Lever	Rear	96	Opt	Exide, 32	137½	60-75	Westinghouse	....	6
Sterns	Roadster	2	750	Opt	Front	90	Opt.	Opt, 16		....		Bevel	4
Ward, ES	Coupé	4	2,100	Lever	Front	96	Pneu.	Own, 40	180		Gen. Electric	Bevel	4
Waverley, 90	Cabriolet	3	2,000	Wheel	Front	104	Opt	Opt, 34	137	75	Own	Her'b'ne	5
Waverley, 104	Brougham	4	2,400	Lever	Front	106	Opt	Opt, 42	162	75	Own	Her'b'ne	4
Waverley, 100	Brougham	4	2,750	Lever	Rear	106	Opt	Opt, 42	162	50-90	Own	Her'b'ne	4
Waverley 106	Limousine	5	3,000	Lever	Front	111	Opt	Opt, 42	162	75	Own	Her'b'ne	4
Woods, 1522	Brougham	4	2,575	Lever	Rear	100	Cush.	Own, 40	160	80	Own	Worm.	5
Woods, 1503	Brougham	3	3,150	Lever	Front	110	Cush.	Own, 42	170	80	Own	Worm.	5
Woods, 1504	Brougham	5	3,150	Lever	Rear	110	Cush.	Own, 42	170	80	Own	Worm.	5
Woods, 1501	Brougham	5	3,250	Lever	Double	110	Cush.	Own, 42	170	80	Own	Worm.	5

ABBREVIATIONS: Opt, optional; Pneu, pneumatic; Her'b'ne, herringbone; Sp. Bevel, Spiral bevel.

Right—Chassis of Rauch & Lang, showing bottle-neck frame. Note motor suspension and overhead worm drive

Below—Another view of the drive system on Rauch & Lang cars, showing overhead worm drive shaft and motor as well as torsion shaft





a Victoria, at $2,750, a five-passenger brougham at $3,000, and a three-passenger roadster at $2,000. All three bodies are mounted on the same chassis, which has a wheelbase of 100 inches, either cushion or pneumatic tires, 33 by 4 being fitted.

In the case of the roadster there are forty-two cells of thirteen-plate Gould battery, mounted 60 per cent. in front and 40 per cent. at the rear; the ampere-hour capacity is 168 and a mileage of 90 per charge is given. The Victoria and brougham models have thirty-six cells of fifteen-plate Gould battery, equally divided front and rear. The ampere-hour capacity is 192 and these cars are capable of 75 miles, at 20 miles an hour, on one charge.

The motor is a 84-volt special series wound Westinghouse machine, driving by shaft to bevel gears. The controller, of the drum type, is pedal-operated and gives five forward and five reverse speeds. The roadster model has a wheel steering gear and in the other two there is a lever. Two sets of brakes are fitted on rear wheel drums both mechanically operated. Springs are three-quarter elliptic in the rear and semi-elliptic in front, slung over the axles in both cases. One of the features of Beardsley cars is that wire wheels are used exclusively.

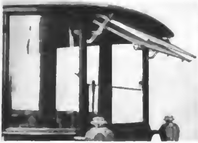
Buffalo Has Cantilever Springs

A five-passenger brougham with center steer and control is the feature of the line made by the Buffalo Electric Vehicle Co., Buffalo, N. Y. Some departures from previous practice in this model are: Cantilever rear springs; double-dropped frame; ball-and-socket support for the front end of the motor; and a new streamline type of body. The method of regulating the motor by means of a lever on the steering wheel, in addition to a foot controller operated in conjunction with the service brake, has been retained.

The motor is of special design and is so wound that the driving speed of the car is largely automatic, irrespective of the grade over which the car is traveling. This feature is obtained by using the motor as a brake on down grades, the braking effort being controlled automatically by the speed at which the car attempts to run. The current generated by the motor when thus acting as a generator passes as charge into the battery, giving greater mileage per charge than is ordinarily obtained. The winding is shunt and the control is arranged so that the armature is never broken while changing speeds, the variation being effected only by resistances inserted in the fields. The controller is circular and very compact, being mounted at the base of the steering column and operating through a radial brush arm actuated by a lever on the steering wheel. Reverse is thrown on by a knob on the steering wheel, the sliding contact switch being situated immediately below the controller. By the use of a sliding key, the reverse switch is always locked except when the control lever is in the neutral position.

The pedal-operated switch is under the floor and is connected by linkage to the emergency brake pedal. It is a three-point regulating switch affording all necessary resistance for starting, stopping and all speeds up to 9 miles per hour. Thus, the car may be started by the foot.

Motor suspension consists of a bronze ball hung in a steel socket hung from a cross-member. No universals are used,



Left—The patent windshield construction used on Detroit electrics, the upper half consisting of two panes which may be arranged in various ways to protect and ventilate the car. Right—Interior view of double drive Detroit brougham. Note accessibility of seats

Left—Waverley five-passenger limousine with lever steer and front control, mounted on 116-inch wheelbase at $4,000. Right—Illustrating the double drive system on Rauch & Lang model J-5 brougham

The torque being taken by the driveshaft housing which connects the motor rigidly with the rear axle housing. The Timken axle has a spiral bevel drive, giving quiet running. The only reduction is that in the differential, which has a ratio of 5.33 to 1 with the motor shaft. Both sets of brakes act on 14 by 2 1/4-inch drums on the rear axle.

No particular battery is specified, the battery space being large enough for any make. When the Edison type is used, seventy A4 cells are carried, forty in front and thirty behind. With lead battery there are forty-two fifteen-plate cells with a capacity of 130 ampere-hours.

The driver occupies a seat directly in the middle of the floor, thus leaving two swivel seats in front and the rear seat accommodating three passengers. All bodies are made at the company's factory. There are many refinements included in the equipment, among them being: double rain vision windshield, mechanical window lifter, automatic step light, instrument board, adjustable pedals and lock switch which cuts off the current and prevents the car from being started. The car sells for $3,550.

Century in One Model

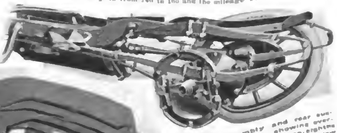
The latest model to come from the plant of the Century Electric Car Co., Detroit, Mich., is a five-passenger brougham finished in blue and black, with a choice of cords or Bedford cloth upholstery, at $3,250. As heretofore, the battery is divided, half being in front and half at the rear; the ampere-hour capacity is given as 165 and the mileage per charge as 75 to 95 at 20 miles per hour. The battery equipment consists of forty-two cells of Willard fifteen-plate thin type, though any other standard make is optional. Control is vested in either lever or wheel steering and a magnetic type controller, giving four speeds forward and four reverse.

The motor is a series-wound General Electric machine centrally located in the chassis, whence it drives direct to spiral bevel gears with but one reduction. There are two sets of service brakes, one internal expanding and mechanically operated and the other electrical, the emergency brakes are pedal operated. The standard wheelbase is 104 inches with either 36 by 4 1/2-inch cushion tires or 34 by 4 1/2-inch pneumatics. The frame is a channel steel section underslung in front on elliptic springs and overslung at the rear on platform springs, the lower members of which attach below the axle.

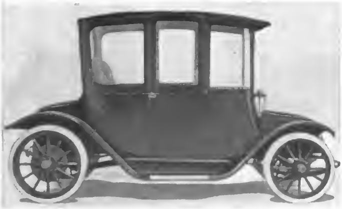
Chicago Makes Three Models

Three Chicago electric models will be made in 1915. These will be known as models 151, 152 and 153. The first and third are identical except as to seating arrangement. Both are five-passenger limousines with rear seat drive and selling for $2,850. Model 151 has a front seat extending clear across the car, while in model 153 the right front seat is revolving. Model 152 is a five-passenger front-seat drive limousine and sells for $2,850.

The latter is equipped with a Westinghouse series-wound slow-speed motor which drives the floating rear axle through a single spiral bevel reduction gear having a ratio of 5.07 to 1. The battery is carried at front and rear, there being twenty cells in each compartment. The ampere-hour capacity is from 140 to 165 and the mileage from 70 to 90



Above—Brake assembly and rear suspension on Rauch & Lang showing overhead worm drive. Note seven-eighths elliptic springs. Left—Phantom view through Waverley, showing springs



Woods five-passenger brougham with lever steer and double control on 110-inch wheelbase and listed at $3,250

Milburn three-passenger roadster with wheel steer and control mounted above wheel. Wheelbase is 100 inches. Price $1,285

Waverley front and rear drive four-passenger brougham, selling at $2,500. The same car with front drive is $2,400

There are five forward speeds of 5, 8, 15, 18 and 22 miles per hour and one reverse of 5 miles per hour. The controller is a drum type situated in front. Steering is by lever. Two brakes are fitted. One is an external contracting type acting on the driveshaft and the other an internal expanding set on the rear wheels.

Springs are three-quarter elliptic front and rear and are overslung. The frame is channel steel, the front axle is an I-beam, and the rear is pressed steel.

Cushion tires are standard equipment and the size is 36 by 4.5 all around. Silvertown Cord tires and wire wheels are optional. Wheelbase is 104 inches and tread 56.

Upholstery may be either leather or Bedford cord, and the color is optional. Standard body colors are blue, maroon and green.

The chassis specifications of models 151 and 153 are identical with model 152 except that the wheelbase is 96 inches and control is rear.

The Chicago electric is now made by the Walker Vehicle Co., Chicago, Ill., maker of electric commercial cars. This concern purchased the Chicago electric a few weeks ago.

Columbian Feature Low Prices

Three models are being placed on the market by the Columbian Electric Vehicle Co., Detroit, Mich. The first of these is a two-passenger roadster, listing at $950, the second a three-passenger coupelet, selling for $1,250, and the third a four-passenger brougham, listing at $1,450. All are mounted on the same chassis and in each case the standard body color is dark blue with silver-gray whipcord upholstery. Steer is by lever and control is at the rear in all models.

Twenty-six cells of either Willard or Gould battery is standard equipment, though any other make will be supplied at extra cost, and these are divided into four trays—two trays of twelve cells being in front, with the remainder in the rear. Each cell has eleven plates. The ampere-hour capacity is given as 135 and the average mileage per charge 75 to 85.

A motor which operates normally at approximately 2,600 revolutions per minute is mounted above the springs and beneath the body, where it is fully protected. The drive is direct by shaft to worm gearing in a pressed steel semi-floating axle. The front axle is tubular. Steering is effected by lever, and a drum type controller gives five forward speeds and two reverse, the controller handle being at the rear seat. There are two sets of pedal-operated brakes, both operating on rear axle drums. The frame is a channel steel section carried both front and rear on the conventional cantilever springs. The wheelbase is 98 inches on 30 by 3 1-2-inch pneumatic tires in front and 31 by 4-inch in the rear.

Detroit Has Two Chassis

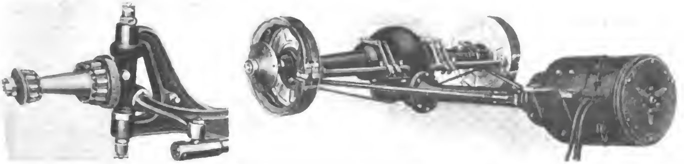
The 1915 Detroit electric offering will be six body types, five of which are broughams mounted on a chassis of 100 inches wheelbase and the sixth, a cabriolet, is fitted to a chassis with 94-inch wheelbase. All of the models on the longer wheelbase have worm drive with the worm underneath the wheel, and their batteries are slightly larger than that of the shorter model which is fitted with a bevel gear rear axle. Wood wheels with either Goodrich Silvertown Cord or Motz cushion tires or wire wheels with Silvertown Cord tires are optional.

Prices are slightly increased, due to greater refinements and finish, Model 55 selling for $2,600; Model 50 for $2,650; 51 for $2,850; 53 and 54 for $2,950 and 52 for $3,000.

Battery capacity has been enlarged by increasing the plates from thirteen to fifteen. The number of cells has not been altered. The 100-inch wheelbase cars have forty-two cells and the 94-inch car forty cells.

A feature of importance is the metal compartment ahead of the motor and accessible to a trap door in the floor, in which is mounted the controller mechanism brake, Klaxet horn, ammeter shunt and throw-over switch. The horn replaces a bell signal, and the throw-over switch is used to change the lighting connections from one half of the battery to the other. For additional protection the controller has an extra cover of its own which can be removed by loosening two clips. To remove the controller from the car it is only necessary to disconnect the cables and loosen three screws.

Steering continues to be by a horizontal lever mounted parallel with the control lever, the latter being operated by the left hand. There are two brake pedals, each of which operates independently a pair of internal expanding brakes on the rear hub. Between these pedals is a smaller pedal which actuates the emergency cut-out switch and sets the brake ratchet. A pressure of the foot on the three pedals



Left—Front wheel spindle and mounting on Detroit electric showing bearings. Right—Drive unit of Detroit, showing underneath worm and inclosed shaft from motor together with brake bands and rods

at once cuts off the power, regardless of the position of the control lever, and locks both hub brakes. The brakes cannot be released until the control lever is returned to neutral. A Yale locking device is also provided.

In the duplex control models the inter-locking cutout feature also prevents starting the car from either driving position unless the pedals are in position to operate from that seat. In these models there are two sets of steering and control levers and two sets of brakes. The operation of shifting pedals from one driving position to the other has been simplified. This is accomplished by pushing forward the small lever at the side of the front masthead, which releases the brake pedals so that they can be pushed with the foot flush to the toeboards. This automatically re-locks the pedals which have been pushed down and raises the other set of pedals to the operating position.

The motor is series-wound and is said to have high torque and low internal resistance. It is held on the under side of the supporting rails by large steel bolts, and may be readily lowered to the ground.

The Manchester type of worm gear is used on all the larger models. Axles are floating, and the housings have been somewhat redesigned to give them greater strength with reduced weight. Brakes are 16 by 1.25 inches.

The controller affords five forward speeds, which are 5, 8, 13, 17 and 20 miles per hour. The double voltage system of control is used, the battery connection being changed so that a low voltage is applied to the motor for the first three speeds and a high voltage for the last two.

Flanders Concentrates on Colonial

The Flanders Electric Co., Pontiac, Mich., is producing a single four-passenger colonial coupé model finished in blue with whipcord or broadcloth upholstery and selling for $1,750.

Interior view of the new Baker four-passenger coupé showing wheel steer and control

From the motor, drive is direct by shaft to a worm axle with a final reduction of 9.8 to 1. Energy is furnished by a Willard battery disposed in six trays of five cells each, ten at the rear and twenty in front; each cell has eleven plates, and the ampere-hour capacity is given as 135, the mileage per charge being 75. The motor is a compound-wound Wagner, which is mounted directly on the rear axle and drives through an extremely short shaft. The steering gear is lever operated, and a second lever operates a six-speed-forward-and-reverse drum type controller. Both sets of brakes are internal expanding on rear wheel drums, and are manually operated. Springs are semi-elliptic, both front and rear, overslung on the axle.

Grinnell Employs Unit Control

The Grinnell Electric Car Co., Detroit, Mich., is continuing both its Model R French brougham, which incorporates the distinctive Grinnell one-unit transfer control system, and the Model S coupé, in which all four passengers face forward; the former lists at $3,400 and the latter at $3,000, both being finished in blue with gray Bedford cord upholstery. Except for a difference in wheelbase lengths, the size of tires and battery are identical.

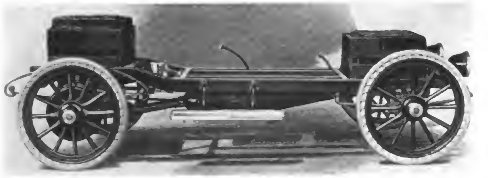
The dual drive model, in which a single set of control levers is used from either the front seat or the rear seat, pivoting from one bearing at the lower end, is equipped with forty cells, of seventeen-plate Philadelphia battery evenly divided between front and rear compartments. The coupé model, however, has forty cells, of fifteen-plate thin type Grinnell battery, the mileage per charge being given as 80. In both, a drum-type controller gives five forward and three reverse speeds.

The motor, which bears the Grinnell nameplate, is mounted in the center of the chassis, whence it drives direct by shaft and two universal joints to the axle. The service brakes are mounted on the propeller shaft, and the emergency set operates in 16-inch rear wheel hubs. A channel steel frame is mounted on 42-inch front and rear elliptic springs, in the case of the dual control model; in the coupé the springs are of the same type but measure 38 inches in length. In both cases, they are overslung on the axle.

Milburn Enters the Field

The Milburn Wagon Co., Toledo, O., is new to the field of electric vehicle makers, though it has long been a vehicle producer. The two new passenger models which it has brought out are modern creations which have as features comparatively light weight and low cost, the roadster model selling for $1,285 and the coupé for $1,485.

The chassis is the same for both, the wheelbase being 100 inches and the rear springs cantilevers. In each case a General Electric motor in conjunction with a Philadelphia battery



Chassis of Detroit electric, showing division of battery equipment in accordance with customary practice

furnish power through direct worm gearing, controllers also being of General Electric make. The standard battery equipment consists of twenty cells, which, according to the makers, gives the roadster a mileage of 60 to 75 and the coupé about 70.

The cars are well fitted and finished, the coupé having modern sashless windows with mechanical lifters and French fabric upholstery. The doors are exceptionally wide and the bodies are low hung.

Steering is by wheel except in the coupé which has a lever, with a lever type controller handle operating a non-arcing drum mechanism giving four forward and two reverse speeds. By way of conserving the battery, an alarm is fitted which sounds if the brakes are applied with the current on. Liberal use is made of anti-friction bearings throughout the chassis, front wheels being mounted on Bower rollers and the rear axle is three-quarter floating on heavy-duty Hyatts.

Ohio Adds Coupé

Ohio electrics, made by the Ohio Electric Car Co., Toledo, O., are in five models for 1915, designated as 11, 21, 41, 51 and 61. The main differences over the models of the previous year are a still further refinement of body lines and the use of arched fenders, hammered by hand, from one piece of aluminum. A high stage in the body building art is reached in these new models. In the closed types the rear of the top rounds over into the back, while the sides have the same sweeping curves.

Model 11 is a new four-passenger coupé on a 94-inch wheelbase chassis and using a thirty-six-cell, thirteen-plate battery, Westinghouse motor, bevel drive and pneumatic tires.

Mechanically there is practically no change in the other cars, which are furnished either with worm drive or helical-bevel gear drive in the rear axle, with the shaft running direct from the electric motor and completely inclosed.

The motor used in Models 21, 41, 51 and 61 is a specially-designed type for Ohio electrics. An ingenious feature of transmission unit is the fact that the torsion tube is supported between the motor and the rear axle at a point very near to the center of inertia. The idea of this is to put all the weight of these members on the frame of the car and above the springs so that they are sprung weight, effecting a saving in tires and power and make for a greater factor of safety. Thus, it is pointed out that the Ohio electric has unsprung weight only at the front axle.

The propeller shaft is of nickel-steel, the torsion tube and main axle tube, differential gears, also being made of this material. Springs, which are three-quarter elliptic in the rear and half-elliptic in front, are made of vanadium steel.

As already mentioned, the floating rear axle is furnished either in the worm drive or helical-bevel gear type. In the worm design the worm is carried below the wheel, which construction is said to give better oiling and greater efficiency. This axle is modified from the type using the other form of gearing only in those respects made necessary by the different form of gears. A truss rod in either design goes beneath the housing and runs to the outer ends of the axle tubes as a strengthening feature. These tubes are riveted to the center portion or differential housing. Double external contracting brakes in addition to the magnetic transmission brake are fitted.

Ohio electrics use a distinctive control which was brought out last year. Though steering is by a lever, the different speeds are attained by turning a compact hard rubber disk at one side of a small controller head which is provided with a lock to prevent its operation by any other than the owner of the car. There are four forward speeds and three reverse in addition to the magnetic brake and bell button, all operated by parts of this small controller head.

The battery equipment is of a special eleven-plate make and carried in front and rear compartments. Models 21 open roadster and 41 coupé have forty-two cells, while Models 51 and 61, also closed types, have forty-four cells.

The wheelbase of all models, except the new coupé is 98 inches. Tire equipment of the roadster, Model 21, calls for 34 by 4 1-2-inch electric pneumatics, or 36 by 4 cushion solids, while the other models, though they use the same size of pneumatic tires, are equipped with 36 by 4 1-2 solid cushion tires. On either car the tire equipment is optional.

The Model 11 sells for $2,400, Model 21 for $2,650; Model 41, $2,900; Model 51 for $3,000, and 61 for $3,250.

The roadster and Models 11 and 41 have single drive from the rear seat, whereas the other two models are fitted with dual drive, making it possible to control the car from either rear seat or front seat.

Excellence of the coach work cannot be overlooked. The entire body is made of aluminum, which is seamless except where the sections come together. This aluminum sheet construction is in combination with a wood frame in accordance with modern ideas of the coach builder.

To give an idea of the elaborateness of the interior equipment, two commodious pockets are placed one on each side of the body, instead of in the doors where they would be somewhat in the way. A toilet case slips into a pocket at the side while on the opposite side there is a smoking set. Win-

Chicago five-passenger brougham with lever steer and rear control on 96-inch wheelbase and selling at $2,650 dows are sashless and operated by handles which turn to bring the glass up or down. These handles are on the doors.

Rauch & Lang Has Larger Models

Seven models, all of worm drive type, and known as the V series are the 1915 product of the Rauch & Lang Carriage Co., Cleveland, O. These range from $2,600 for the roadster model to $4,000 for the town car type, and they show no great change other than refinements of details over the cars of 1914. Certain body lines have been lengthened and curves added which give even more grace and beauty. Interior appointments have been made even more refined and what changes have been made in the chassis are simply to add to the efficiency.

According to Rauch & Lang, its trend is toward a larger type of car and with this in view the company has included in its new line four cars of a size somewhat larger than the average electric. These are designated as the BX-5 brougham the J-5 coach, the T-C 5 town car and the TXC-5 town car.

These two town car models at $4,000 have two compartments, the drive part being separated from the more luxurious interior passenger compartment. The drive is by wheel rather than a lever, and in one there is a roof over the drive seat while it is unprotected in the other.

Two other wheelbases are used, Model J-5 having a 102-inch wheelbase and selling at $3,100 in either front or rear control, and at $3,200 with dual control. The four other models, consisting of B-5 and BX-5 broughams at $2,950; CR-5 club roadster at $2,800 and the R-5 open roadster at $2,600, have a 92-inch wheelbase. All of these models, however, adhere to the same general chassis design throughout.

The battery equipment is of the eleven-plate Mv Hy-cap Exide, all cars except the coach model and the two town car models having forty-one cells, while the last-named cars are provided with forty-two cells. The drive is of the straight type with the worm mounted over the wheel and incorporated in a floating rear axle. The motor, hung amidships of the frame, drives straight back through a shaft fitted with a universal joint at either end.

The Rauch & Lang company employs a motor of Hertner make which is substantially the same as used for a number of years. It is a comparatively light weight, high-speed type, having four poles with laminated pole pieces and rectangular copper wire windings. The large commutator and brush surfaces are features and ball bearings are fitted throughout.

In using worm drive the Rauch & Lang company is in line with the latest developments in electric car practice.

By having the worm mounted over the wheel the concern claims a safer transmission unit due to greater clearance and more efficiency. The worm is of the straight type of hardened steel and the worm wheel of a bronze alloy.

Buffalo five passenger brougham with spiral-bevel drive, 102-inch wheelbase and selling at $3,250

Rauch & Lang two-passenger roadster with lever steer, fitted with top and windshield and selling at $2,600

Milburn four-passenger coupé with lever steer and rear control on 100-inch chassis and listed at $1,485

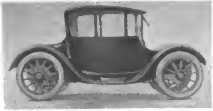
The spring construction makes for maximum easy riding qualities on account of the use of seven-eighths elliptic rear springs, the ends of the upper portions of which shackle to the side rails of the frame while the center is pivoted farther back on the frame. The end shackles to the longer lower portion and thus a combination of cantilever with the ordinary type of spring is obtained. The front springs are semi-elliptic.

Control of the Rauch & Lang cars in all but the town car models is by lever while one model, called the coach type and designated as J-5 may be had with either front or rear control or the later developments, dual control, which is selective from either front or rear seats.

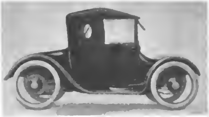
The tire equipment on all models is 33 by 4 1-2-inch special electric pneumatics with the option of solid cushion tires. If these are supplied they are of the 36 by 4 1-2-inch size on the three heavier cars, models J-5, TC-5 and TXC-5, while the other models carry 36 by 4 cushion tires.

Beautiful coach work has been attained in all of the new models and some of the niceties of body equipment are not to be overlooked.

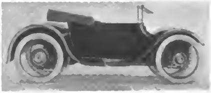
A new coach-built all-aluminum body is the greatest change that has been made. The entire rear top paneling is cut from one sheet of aluminum and designed so as to give rigidity to that part which supports the upper rear quarters and the rear glass. The lower part has been built to give flexibility as well as strength.



Four-passenger Columbian brougham with lever steer and rear control, mounted on 98-inch wheelbase and listed at $1,450



Columbian three-passenger coupelet selling at $1,250. All Columbian models are worm driven. Note wire wheels



Columbian two-passenger open roadster fitted with top. It lists at $950. Note wire wheel equipment

A new window-lifting device of handle form operates the sashless windows. Other equipment features are a lamp attachment so arranged that its rays may be projected wherever desired with the wires at the same time hidden from view. On the motor shaft a meter is attached which gives data on mileage, speed and trip distance.

Standard a Coupé Model

A single coupé model, listing at $1,900, will be marketed by the Standard Car Mfg. Co., Jackson, Mich. This is styled the Model M-4 and provides accommodations for three persons facing forward, with an auxiliary seat for a fourth passenger. The body is finished with blue and black panels, with either whipcord or broadcloth upholstery in gray or blue. The wheelbase is 96 inches, and the tire equipment consists of 32 by 3 1-2 pneumatic or 33 by 4 cushion tires, Motz tires being $65 extra. Steering is by lever, control being at rear.

The motor is a Westinghouse series-wound machine carried in the center of the chassis and driving by shaft to a double reduction rear axle, the final gear ratio being 4 to 1. The battery is a thirty-two-cell eleven-plate Hy-Cap Exide with twelve cells in the rear and twenty cells in front. A drum type controller gives six forward and three reverse speeds. The ampere-hour capacity is given as 137 1-2 and the mileage 60 to 75. Both sets of brakes are internal expanding on rear wheel drums. A channel steel frame is mounted on 36-inch front semi-elliptic springs and 48-inch rear three-quarter-elliptic members.

Storms with 44-Inch Tread

The Storms Electric Car Co., Detroit, Mich., of which William E. Storms, formerly of the Anderson Electric Car Co., is the moving spirit, is a newcomer in the electric vehicle field and will place on the market two models, a coupé at $950 and a roadster at $750. Both will be modern creations on a 90-inch wheelbase with a tread of but 44 inches, which, therefore, places them in a class by themselves. The battery, which consists of sixteen cells of any standard make, lead type, is located in two compartments, front and rear, and has an ampere hour capacity of 45-60 at 18 miles per hour. A special motor is located in the center of the chassis, whence it drives direct by shaft to bevel gears in a tubular full-floating rear axle; the front axle also is tubular. The controller gives four forward and three reverse speeds and is of the drum type. There are two sets of brakes, external and internal on rear wheel drums, both operated by pedal. The frame is a channel section mounted on semi-elliptic front rear spring and three-quarter-elliptic rear members.

The standard body color is blue with either broadcloth or leather upholstery to match. Both front and rear wheels are shod with 28 by 3-inch cushion or pneumatic tires.

Ward's New Coupé

A new passenger model has been added by the Ward Motor Vehicle Co., New York City. This is a four-passenger coupé which sells for $2,100. Contrary to the usual practice, the battery—forty cells of fifteen-plate lead—is in a single compartment at the front, where it is all instantly accessible; the mileage is given as from 35 to 45 miles per charge. The body is roomy, and by way of ensuring the maximum of comfort it has been mounted on 64-inch coach springs and 34 by 4 1-2-inch pneumatic tires. The wheelbase is 96 inches, and the upholstery is deep and yielding, the rear seat accommodating three passengers; two additional passengers are accommodated on individual swivel chairs in front.

The car is driven from the left side through a lever type steering arm and lever controller handle. The motor is a General Electric series-parallel machine rated at 8 1-2 horsepower and located amidships, whence it drives direct by shaft to a single pair of bevel gears in a Timken floating axle. There are two sets of expanding foot-operated brakes.

Waverley Is 7 Inches Lower

Model 100 will be the new offering of the Waverley Co., Indianapolis, Ind., for next year. No mechanical changes of note have been made but the body has been refined in design. The new car is of the brougham type and is fitted with a four-chair body. In addition to this car, which sells for $2,750 there are three other models, a front-drive four-passenger car at $2,400, which, with double drive is $2,500, a cabriolet for $2,900 and a five-passenger limousine for $3,000.

The entire exterior appearance of the body is new. The rear corners are rounded instead of carried to an edge. The battery boxes are lower and smaller and more delicately curved. Larger windows are used and they are of the sashless type. Oval corners on the windows and decorative window shades add to the effect.

A departure is noted in the use of aluminum in the roof and panels. Another feature is the curved sill which gives a low body suspension and yet does not alter the road clearance. The floor is 7 inches nearer the ground.

The same motor is retained and the same drive and spring suspension. The latter is a feature of Waverley design, being a five-quarter elliptic all around.

On the new model a forty-two cell lead battery with eleven or thirteen plates is supplied. Any standard make may be had. The battery compartments are lined with an acid-proof material.

A knife blade controller is fitted. When the handle is pushed forward the knife blade switches are picked up one by one. Each blade of the switch is brass and the contact is made on both sides of the blade by means of copper blocks which are sprung apart on the entrance of the blade. A Yale lock is fitted on the controller handle to guard against theft. The car cannot be started except on the lowest speed, on account of an interlocking device.

The motor is a medium-speed four-pole series-wound design with a rated speed of 1,800 revolutions per minute. It is suspended just forward of the rear axle, the drive being taken through a double reduction. The first reduction is through a silent chain from the armature shaft of the motor to a shaft parallel to the rear axle. From the latter the drive is transmitted by means of a silent herringbone gear to the rear axle.

The rear axle is floating, the shafts being 3.5 per cent. heat-treated. One end of the axle shaft floats in the differential and the other is connected to the wheels by a clutch through which the drive passes.

The front axle is an I-beam. A feature is the outward slant of the steering knuckles and the downward tilt to counteract this given to the spindle. The result is a semi-irreversible steering gear as there is a greatly reduced tendency of a road shock to swing the front wheel about the tilted pivot-pin.

The upholstery work is optional, it may be had in any of the imported corded fabric or of special limousine leather. The standard color is black with majestic blue panels but other colors may be had to suit individual tastes.

Tires are 34 by 4 front and 34 by 4.5 rear. Cushion or pneumatics may be had at the same price.

Woods Adopts Worm Drive

The single chassis produced by the Woods Motor Vehicle Co., Chicago, Ill., has been almost completely reconstructed, and in the process has been made entirely different from any previous Woods vehicle. Four new body styles have been brought out. Instead of bevel drive, the cars now have underslung worm drive; the braking system, the motor support and the spring suspension are all new. For the first time the company has placed on the market a model with double control. The line includes Model 1501, which is the new dual drive car, $3,250; Model 1503, front drive, $3,150; and 1504 rear drive, $2,150, all of these being five-passenger broughams; Model 1522, at $2,975, a rear drive four-passenger brougham.

The spring suspension of the chassis is one of its distinctive features and is different from anything else of its kind. Instead of being mounted at the side of the chassis frame, or beneath it, the spring members are housed directly in the channel; in the rear support the lower spring member instead of being mounted on the axle is mounted on radius beams. Both front and rear springs are elliptic.

The reduction by herringbone gears between the motor and the axle has been eliminated and in its place there is now a motor supported on ball joints in a sub-frame and driving direct by shaft without intermediate reduction to an underslung worm. The brakes have been re-designed with the bands increased in size from 14 by 1 3-4 inches to 16 by 2 inches.

Formerly battery equipment consisted of forty cells, of eleven plates, but this has been increased to forty-two cells, except in Model 1522 where forty are still used. All cars have five forward speeds, with five reverse, the controller being of the drum type. All models are equipped with 34 by 4-inch cushion tires in front and 36 by 4 1-2 in the rear, the wheelbase of the five-passenger brougham being 110 inches and of the four-passenger car 100 inches.

In the dual control car the mechanism is so arranged that one set of control elements automatically becomes inoperative when the other set is in use; if the brake should be applied from the front control system it is immediately released when the rear controller is placed in the first speed position. The same applies if the brake is set from the rear and the operator is in the front seat.

Ware four-passenger coupé which has its forty fifteen-plate lead cells in a single compartment at the front. It sells for $2,180

Rauch & Lang four-passenger brougham with lever steer and rear control which sells at $[illegible]. All of the Rauch & Lang cars are worm driven

Rauch & Lang club roadster for three passengers mounted on a 88-inch chassis and selling at $2,800

Starting and Lighting for 1915

Trend Is Toward Single-Unit Systems—New Machines Improved in Appearance and Simplified—Efficiency and Torque Increased—Weight and Dimensions Cut

Part I

1915 Developments

¶ **Motor - Generators have been brought out by General Electric, Westinghouse, Aplco, Bijur, Gray & Davis, Leece - Neville and Simms - Huff.**

* * *

¶ **One or more single units are also made by Remy, North East, Delco, U. S. L., Allis-Chalmers, Disco, Dyneto and Jesco.**

* * *

¶ **Ford outfits are made by Aplco, North East, Gray & Davis, Simms - Huff, Disco, Fisher, Wells and General Electric.**

* * *

¶ **Universal systems for attachment to old cars are manufactured by Kemco, Jesco and North East.**

* * *

¶ **The 6- and 12-volt controversy is still undecided, although the former leads in popularity. Both single and double-wiring systems are popular.**

THE prominence of the motor-generator is the feature of 1915 starting and lighting development. Many makers, heretofore making only two-unit systems, have developed single-unit designs especially for motors of low and moderate horsepower. These include Westinghouse, General Electric, Aplco, Bijur, Gray & Davis, Leece-Neville and Simms-Huff, a newcomer in the field. Companies which have continued the single-unit idea include Remy, North East, Delco, U. S. L., Allis-Chalmers, Disco, Dyneto, Jesco and Chalmers and White who are building their own. Many of these are making Ford outfits. Aplco, North East, Gray & Davis, Simms-Huff, Disco, Fisher, Wells and General Electric are in this class. Hartford and Kemco are manufacturing two-unit Ford systems. Universal systems for old cars are made by Kemco, Jesco and North East.

The motor-generator which is becoming more popular, is materially simplified both electrically and mechanically. In general there is only one drive from the crankshaft, by silent chain, the ratio being about 3 to 1. On a great many machines regulators and cutouts are not used. The field regulation is inherent and the machine automatically becomes a motor at low engine speeds. Some outfits are, however, fitted with cutouts, and others have voltage regulators of various types, but the use of these is very perceptibly reduced as compared with a year ago.

How Cutout Works

The cutout is to prevent the storage battery discharging through the generator when the voltage of the latter is below that of the former, a condition which exists at low speeds. The cutout is simply an automatic switch which breaks the circuit when the voltage of the generator falls below that of the battery. As shown herewith it consists of an iron core with two windings, one of many turns of fine wire P and the other a few turns of coarse wire S. Ordinarily the cutout switch is held closed by the magnetism generated by the current flowing through these windings, but when the current reverses, the magnetic field set up by the fine winding is opposed to that of the coarse winding and the net strength of the attraction of the magnet for the cutout switch member is the difference of the two. This pull is not sufficient to prevent the spring attached to the switch from pulling it out of contact and breaking the circuit.

Simplicity is notable in the new Gray & Davis generator design in which the constant-speed, governor-controlled generator has been superseded by a variable-speed machine with inherent voltage regulation. Another example of parts reduction is in the Bijur starter drive where the armature pinion meshing with the teeth in the flywheel is keyed to its shaft; the over-running clutch has been discarded; and the armature is built to stand the excessive speed it may be subjected to.

Refinement and simplicity are distinctly perceptible in the exterior appearance of almost every model. There is hardly one that has not better lines and greatly improved appearance.

Weight and overall dimensions have been reduced in some cases, and the torque and efficiency have been improved in other instances with or without reduction of weight.

Refinement in the wiring and insulation has reduced the current losses and increased the life of the machine in many cases so that the electrical end may be said to be more durable on the whole. Sections are of increased diameter, and the quality of insulation has been improved.

The 6- and 12-volt controversy is still undecided, although the former voltage is more popular. Practically all the makers are ready to produce either 6- or 12-volt systems according to the dictates of the automobile manufacturers and several companies carry both in stock.

Single and double wiring systems, now officially designated, as the insulated and grounded return systems, have held their own during the year and most manufacturers stand ready to furnish equipment for either method.

Types of drive are also left to the automobile manufacturer largely, the outstanding types being manual, including the Bendix, and the electro-magnetic. On practically all motor-generator systems the armature is linked to the crankshaft without clutches of any type.

Where the two-unit system is in vogue, the flywheel drive for the motor and pump shaft drive for the generator are most common.

The common types of voltage regulation

are by a differential field winding consisting of series and shunt fields arranged to oppose each other; by a vibrating regulator which inserts and cuts out resistance in the shunt field many times each second; by a solenoid which varies the shunt field resistance; and by third brush. The latter method is the least understood. A small brush is placed halfway between the two main brushes and in the ordinary design a wire is run from this brush to the mid-point in the field winding, that is, the point in the wiring that is equidistant from either of the ends which connect with the main feed wires. At low speeds no current flows from this third brush but as the speed of the generator increases armature reaction distorts the field so that the passage of current weakens it in proportion to the rise in speed and therefore the voltage remains practically constant regardless of speed.

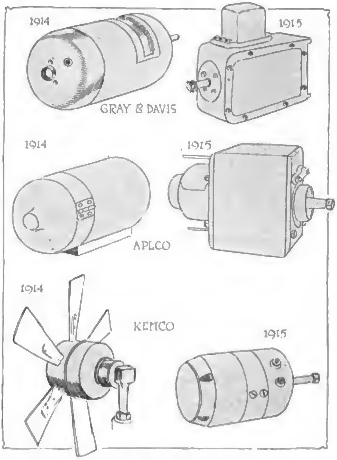
Bendix Starter Drive

The Bendix type of drive is commonly used in connection with a flywheel gear. In principle it consists of a pinion gear mounted on a helical shaft extension of the starting motor armature. The gear has a disk attached to it with a weight on one side. The closing of the starting switch starts the helical shaft revolving but the inertia of the disk attached to the pinion tends to hold the pinion stationary and prevent it from revolving freely with the shaft and therefore the gear is drawn in by the helical shaft until it is fully meshed with the teeth in the flywheel. When the engine has started it tries to drive the armature but this only results in unscrewing the pinion on the shaft and throwing it out of mesh with the flywheel gear.

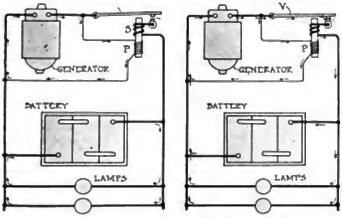
Bijur Makes Motor-Generator

A motor-generator built in four different sizes and for both 6 and 12 volts is the newest model of the Bijur Motor Lighting Co., Hoboken, N. J. It is designed to crank motors up to 25 horsepower S. A. E. rating. Separate motors and generators in sizes to suit the manufacturer will be continued.

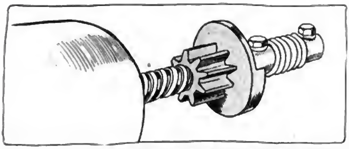
On three of these starting motors a feature is the direct pinion drive, in which the pinion keyed to the armature shaft meshes directly with the flywheel, thus dispensing with over-running clutches and intermediate gearing. These machines are high-speed types and are designed to rotate as fast as the gasoline engine may drive them without danger of injury. Two motors with gear reduction and over-running clutch are also made.



Changes in shape noted in some of the units



Diagrams showing operation of cutout. Left shows the circuit open and right, the circuit closed



Sketch illustrating Bendix starter drive which provides automatic engagement and release of the pinion

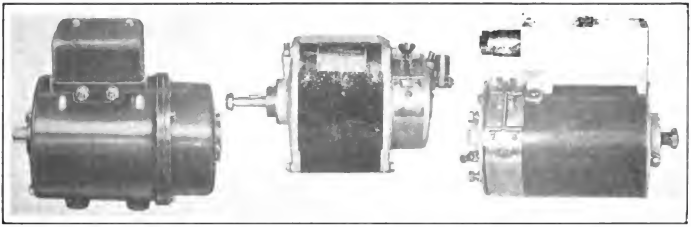
Improvements have been made in manufacturing methods, but no improvements either in the principles of the mechanical or electrical construction have been introduced. The machines are practically the same size, but the torque has been increased.

Six volts is preferred, but both 6 and 12-volt systems are made. The method of wiring is optional with the manufacturer.

The speed of cranking and the current draw naturally differ, but on a certain 4.5 by 5.5 six-cylinder motor the cranking speed varies from 120 to 140 revolutions per minute under normal conditions. It is aimed to start the motor in the coldest weather on the magneto, and this requires a speed of 80 to 100 revolutions per minute. The current draw depends on the motor, temperature and oil viscosity, but it varies from 75 to 150.

Voltage regulation is by a vibrating switch mounted in an aluminum case on the generator. This box also contains the cutout. Projecting from the rear of this box is a disconnecting and reversing plug. Due to the reversible characteristics of this machine, the battery may be connected without regard to polarity.

This vibrating switch automatically inserts resistance in the field circuit when the voltage rises above the prescribed value. This reduces the field current, there is a drop in voltage and then the switch automatically opens again. This operation occurs with extreme rapidity, so that there is



Left—Wagner generator with voltage regulator mounted on top. Center—Bijur starting motor used on Packard. Right—Standard Bijur lighting generator with voltage regulator mounted on top

actually no perceptible fluctuations in the voltage generated.

The vibrating contacts are so designed that no adjustment is necessary. The passage of current between the points is reversed every 2 weeks by hand by a reversible plug on the dash, so that any metal that is carried from one side to the other when the current is flowing in one direction is brought back when the current flow is changed. Even during the interval when the current is flowing past the contacts in a fixed direction there would be danger of uneven wear due to metal building up at one point on the surface of one contact, a hole developing at the opposite point on the other contact. To prevent this the contacts are attached to long reeds which allow a certain amount of lateral vibration so that the two contacts never meet in quite the same position.

In the motor-generator one armature and one set of field windings are employed, both for running the machine as a motor and operating it as a generator, and it is geared to run at a fixed rate of speed with respect to the motor regardless of whether it is using or generating current. There is no cut-out and no voltage regulator; the system consists merely of the motor-generator, the storage battery and a switch, which is generally connected to the ignition switch or else is incorporated with it. Closing this switch, therefore, turns on the ignition and allows current to flow from the battery to crank the motor. A compound-field winding is employed. This arrangement keeps the voltage within practical working limits regardless of the speed, for as the speed rises the proportional increase in strength of the series field is largely offset by neutralizing effect of the shunt field, so that even at maximum speed the voltage is not too great. The motor-generator is connected to the motor either by silent chain or gear, the ratio ordinarily being somewhere between 2.5 and 3 to 1. At very low speeds the voltage generated is not equal to that of the battery and hence current must flow from the battery, and the device becomes a motor.

As long as the voltage generated by the instrument is below that of the battery the device continues to operate as a motor and aids the motor in its rotation, the amount depending on how near the generated voltage is to the battery voltage. Ordinarily the device operates as a motor only for a few seconds, as the speed of the engine soon becomes so great that the generated voltage rises above that of the battery and then current flows from the motor-generator to the battery and the machine becomes a generator. The direction of current when operating as a motor and as a generator is shown herewith. In the former the flow through the fields is in the same direction and in the latter in opposite directions.

Wagner Units Smaller

In general, the starter made by the Wagner Electric Mfg. Co., St. Louis, Mo., is smaller for 1915 and weighs less. In the lighting generator, which is a separate unit, some slight changes in mechanical design have been made due to differences in methods of mounting. No alterations in the electrical characteristics, however, have been made.

Definite models with stock names are not made by this concern but special units to fit each car are produced. For instance, in determining the size of starting motor, tests are made to ascertain the torque necessary to start it from rest and keep it running at various speeds.

The method of connecting the cranking motor to the engine is left to the motor car manufacturer. Both chain drive with over-running clutch and flywheel drive have, however, been used. Likewise within certain limits the manufacturer may specify the voltage. To date only the double-wire system has been built and at the present time starting and lighting machines are separate units although a single-unit system similar to that which was manufactured 2 years ago will be furnished, when desired.

Westinghouse Adds Three Motors

Three new starting motors are made by the Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa. These are a 12-volt motor-generator, of .5 horsepower, a 1 horsepower, 12-volt motor and an .875-horsepower starting motor. The motor-generator is a new departure in Westinghouse practice, separate starting motors and lighting generators having been made heretofore. The .5 horsepower, .625 and .75 models are continued. Lighting generators, with and without ignition, for both four- and six-cylinder machines are also to be continued. The motor-generator is built only on order.

The new motor-generator is designed especially for small cars and positively driven from the crankshaft by a chain or

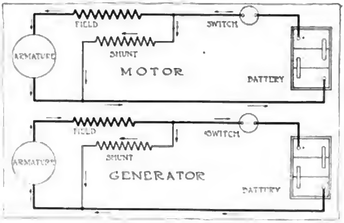


Diagram of wiring of Bijur motor-generator. The upper illustration shows the machine as a motor and the lower one as a generator gear, the ratio being 2.5 to 3 to 1, depending on engine size.

Improvements in the line consists mainly in refinements in insulating lubrication and assembly. No changes have been made in the size or torque of the motors, but 10 per cent. current increase has been obtained in the generators. Both 6- and 12-volt systems are produced but the former is preferred. An important feature is that either 6- or 12-volt instruments may be had in the same machine frames. Single wiring is used almost exclusively but double wiring will be had when specified.

Starter drive may be by chain from the crankshaft, by gearing manually controlled and operating through the gearset, or by flywheel drive, in which case the meshing of the pinion may be by hand, by magnetic control and Bendix drive.

The Westinghouse motors are rectangular in shape and entirely enclosed. The shape makes them easy to locate and gives a rigid mounting. The motors are of the four-pole, series-wound type, the field winding being placed on two of the four poles. This type of motor has a high starting torque.

Westinghouse electric generators are designed to operate at engine speed on four-cylinder cars and one and one-half crankshaft speed on six-cylinder cars. The center line of the armature is the same as the magneto standard

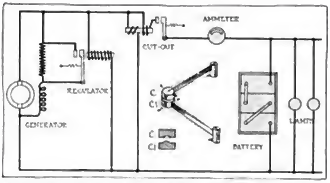
Automatic Cutout

An automatic cutout is provided inside the generator which breaks the circuit when the generated voltage falls below that of the battery. The switch is so adjusted that it disconnects the generator at a speed 25 to 30 per cent. lower than the cut-in speed. This prevents the switch operating continuously at the speed at which the switch closes the circuit.

When the generator is connected to the battery by the automatic switch, the current rises rapidly with the speed until a moderate speed is attained. Above this value the charging current rises slowly as the speed increases but does not reach an excessive value. This regulating feature is secured by connecting the battery through a reversed compound field winding.

Current for the lights does not pass through the compound field winding, however, and when the lights are turned on, the output of the generator automatically increases to supply them. With the usual lamp equipment this increase in generator capacity is sufficient to operate the lamps without any demand on the battery at normal running speeds. At low speeds the battery supplies a certain proportion of the lighting current and when the engine is not running the battery supplies the entire demand.

Dual ignition is obtained in the Westinghouse system, that is, the battery is an independent source of supply, as well as the generator operating with the battery, while the interrupter, ignition coil and distributer are common to both.



Bijur vibrating type of voltage regulator. The construction of the points is shown in the center

Automatic spark advance is featured, the advance working over a range of 45 degrees. Provision is made for manual operation also and it is recommended that the spark lever be connected but ordinarily it will not be needed.

Magnetic Pinion Shift

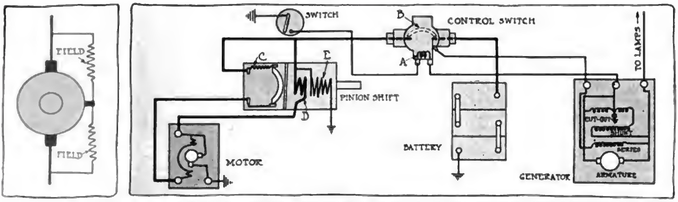
A recent development is the magnetic pinion shift for engaging the starting motor. When the motor is to be cranked the ignition switch is closed, a button on the dash is pressed and the motor is cranked. The whole operation is automatic.

The pressing of the button closes a control switch which allows the starting current to flow through the starting motor. At the same time the pinion is engaged by the action of a solenoid.

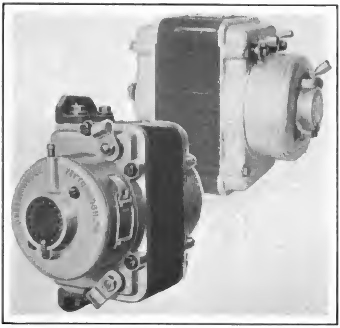
As is shown in the accompanying diagram, when the button is pressed, a current flows through the solenoid A, thus drawing the control switch B down and closing the main circuit. This allows part of the current from the battery to flow to the fields of the motor; the current is small, however, because of the resistance C. The remainder of the current passes through the two coils D and E, that part going through the coil D passes through the armature and starts it rotating slowly. The presence of the current in the coils D and E moves the armature of the solenoid and brings the starting pinion into mesh. The movement of the solenoid armature also closes the switch at C and cuts out the resistance so that full current can flow to the fields.

As the starting motor gets up speed it generates a counter-electro-motive force and this reduces the current flowing through the coil D and the magnetic pull of this coil becomes insufficient to hold the gears in mesh. For this reason the coil E, which consists of many turns of fine wire, is also used as it exerts a strong pull even when the counter-electromotive force is high.

When the gasoline engine has started, its minimum speed is sufficient to generate 3 or 4 volts in the generator and this is enough to cause a passage of current through the switch



Left—Wiring diagram showing third brush system of voltage regulation. Right—Wiring of Westinghouse magnetic engagement of starter



Left—Westinghouse starting motor for flywheel drive. Right—Lighting generator

A in the reverse direction, thus releasing it. Then current dies down in the starting circuits and the armature of the solenoid flies back, impelled by a spring, and releases the starting pinion.

Bosch Builds Four Starters

Four sizes of starting motors and two types of generators in sizes to suit the individual needs of the car manufacturer are produced by the Bosch Magneto Co., New York City. Bosch generators are made in 12 volts and Bosch-Rushmore machines in both 6 and 12 volts. The starting motors are all products of the Rushmore factory and all use the sliding armature engagement in which a pinion on the armature meshes directly with teeth in the flywheel. The motors are made in four sizes, known as A, B, C and D and each is built for both 6- and 12-volt operation. Both the insulated and grounded return systems may be used.

The Rushmore generators have a combination of constant current and constant-voltage regulation. A bucking coil, which is merely a series coil opposing the shunt field coil, is placed in parallel with a ballast coil. Any increase in amperage causes a rise in the resistance of the ballast coil, thus allowing a greater current to flow through the bucking coil. The field set up by the bucking coil opposes that of the main shunt field coil, the net field strength is reduced and the voltage and the current maintained at a constant value.

The Bosch generators, which operate at 12 volts, maintain the voltage at this point as the speed of the armature increases by weakening the field by inserting resistance in it automatically. In circuit with the shunt field winding, there is a variable resistance made up of carbon particles. At low armature speeds these particles are pressed together by a metal plate which is acted upon by a spring. The pressure holds the particles in close contact, reducing the resistance to the passage of the field current to a minimum and thus allowing a maximum current to flow.

There is a solenoid connected across the generator mains so that as the speed of the armature increases, the voltage starts to rise forcing a greater current through the winding surrounding the solenoid which is placed between the spring, and the disk which is in contact with the carbon particles. The increasing current exerts an upward pull on the solenoid, relieving the pressure proportionately and thereby increasing the resistance in the field. This results in a decrease in the field current so that the voltage is brought to normal. In actual practice this device maintains the electrical pressure at 12 volts at all speeds.

Gray & Davis Make Single Unit

Two starting motors, two lighting generators and a motor-generator for Fords are made by Gray & Davis, Boston, Mass. The single-unit Ford system is a departure for this concern, and besides the motor-generator the outfit includes a 6-volt battery, indicator for dash, regulator, cutout, switches, wiring and all the necessary connections. The engagement of the crankshaft is by means of a silent chain neatly housed. The new system is easily installed. It is mounted on the left of the motor. The price complete is $75.

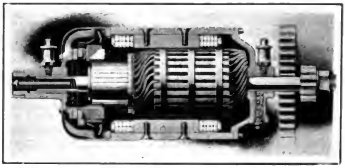
The most important change found in the line continued from last year is in the generators which are now of the variable-speed type. Both generators and motors have been reduced in size, the accessibility improved and detail mechanical and electrical changes made in both systems.

For 1915 the flywheel drive will be standard. The speed reducing gears and starting switches are integral with the motor casing and arranged so that a single movement of the starting pedal simultaneously meshes the sliding pinion with the flywheel gear and closes the starting switch.

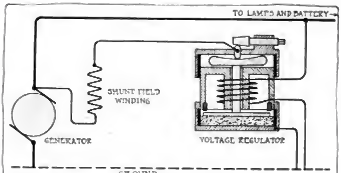
Cranking Speeds

Cranking speeds vary according to the motor but the following table showing the speeds of various sizes of motors will give an idea:

Number of Cylinders	Bore	Stroke	Cranking Speed
4	2.87	4	210
4	3.5	5	132
4	3.75	5	124
4	4.12	4.5	135
6	3.38	5	108
6	3.75	5.5	104



Bosch-Rushmore starting motor showing sliding engagement of starting pinion. When the circuit is closed the armature is attracted to the left



Voltage regulation used on Bosch generators. As the speed increases the field resistance is made greater by reduction of the pressure on the carbon particles in the bottom of the voltage regulating device

With normal conditions the draw on the battery varies from 65 to 110 amperes. Under adverse conditions such as a cold motor and a chilled battery the initial kick may be as high as two and one-half times the normal running current but this maximum draft is only for a fraction of a second.

Only 6-volt systems are built and the single wire is standard construction.

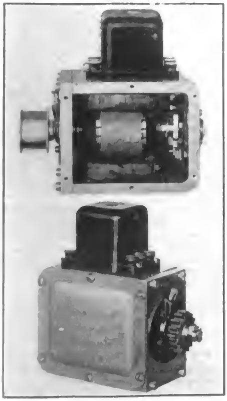
The two types of lighting generators are the T rated to give a current output of 10 amperes at 6.5 volts and 1,000 r. p. m. and the S which gives 10 amperes at 6.5 volts at 650 r. p. m. Starting motors are the Y and H-1, the former being new.

Most important of the changes in the generator is the method of voltage regulation. In the machines of last year voltage regulation was accomplished by maintaining the speed of the armature constant by the use of a centrifugal governor. In the new machine there is a combined regulator and cutout which rests on the top of the generator and which not only maintains the voltage constant regardless of speed variation but also breaks the circuit when the speed of the generator drops so low that the voltage it generates is less than that of the battery.

The new machines have a rectagular or magnet-shaped frame which is constructed of one flat piece of low carbon steel formed into a U shape.

Bosch lighting generator

The type T generator gives a 6.5-volt, 10-ampere current at 1,000 r. p. m., is intended for four-cylinder cars and is designed to run at approximately two and one-half times crankshaft speed, or in short, to be driven at its rated speed at a car speed of about 10 miles per hour on high gear.

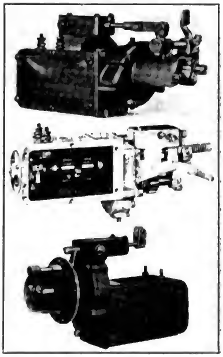

Gray & Davis model T lighting generator. The upper uses belt drive and the lower chain. The Y construction of the magnets is clearly shown. Armature and fields are exposed by removal of side cover. The voltage regulator is mounted on the top

The type S generator for six-cylinder machines is to be driven directly from the magneto shaft, at one and one-half crankshaft speed. This gearing allows the generator to run at its rated speed of 650 r. p. m. at 10 to 12 miles per hour.

The generators are similar in appearance to the type Y starting motor, being of the longitudinal yoke design. This construction has enabled the production of the same current at the same speed as heretofore but with a smaller and lighter machine.

The type T generator complete with regulator cutout weighs 20.5 pounds, a reduction of 6.5 pounds. It measures 4.13 by 5.34 by 8.62 inches, while the G-1 generator which it replaces measures 5.5 by 6 by 11.67 inches.

Likewise the new type S generator which takes the place of the type E has been reduced 1.25 pounds in weight and the dimensions reduced from 5.5 by 6 by 12.5, to 4.63 by 5.97 by 10.75 inches.


Gray & Davis model Y motors with different types of gear drive. The upper and middle are for open flywheel installation, and the lower for inclosed flywheel

The type Y starting motor is standard equipment for all except the largest cars. This motor is a new design and is rated at 6 volts, 100 amperes at 2,800 r. p. m. Cars with motors of extreme size will use the type H-1 motor, which was a standard model last year. It carries its full load when operating at 1,500 r. p. m, at which time it draws a current of 150 amperes. It operates only on the 6-volt circuit.

Accessibility Improved

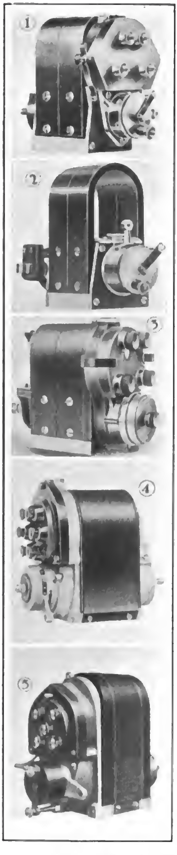
Mechanical improvements in the starting motor have been directed chiefly towards accessiblity and ease of inspection of parts and to the refinement of details to give greater strength. For accessibility, the new Y motor has the longitudinal type of field yokes which readily permits access to the interior of the motor by the removal of the cover plate from the side. The entire interior mechanism of the motor can be reached by removing these side cover plates by taking out six screws.

Electrical improvements in the Y motor have given it better torque than the type K motor of this year and it weighs only two-thirds as much, the new motor weighing 19.75 pounds and the old one 31 pounds. While the type K motor was rated to develop normal load at 3,600 r. p. m. with a current draw of 100 amperes, the type Y develops the same torque with the same current consumption at 2,800 r. p. m. The type Y motor is 4.312 by 4.72 by 8.16 inches. These dimensions compare favorably with the K motor which was 5.75 inches in diameter and 8.875 inches long.

Ford Motor-Generator

The new Gray & Davis Ford outfit is a single unit mounted at the right of the motor and driven by silent chain which is inclosed. Besides the motor-generator there is a 6-volt battery, indicator for dash, regulator, cutout, switches, wiring and all the necessary connections. The system is easily installed; the radiator is removed, a driving sprocket placed on the crankshaft and then the unit is bolted to the motor. The price is $75.

(To Be Continued)



EXTERIORS OF 1915 MAGNETOS

1—Bosch DU4
2—Bosch NU4
3—Bosch ZR4
4—Splitdorf Cunningham
5—Remy

Magnetos for 1915

¶ Waterproofing and better electrical efficiency are the two points in which magnetos have been improved for the past season. The magneto for the small car which made its appearance a year ago has been continued and is distinguished for its elimination of a number of parts. Better electrical efficiency has been obtained by obtaining a faster break in the primary circuit and a better electrical connection between the magnetic field and the pole pieces.

BROADLY, there are three fields in which magneto progress has been made during the past year. If all magnetos could be thrown into a common melting pot there would emerge a machine that would be better in electrical efficiency, better mechanically and better in its ability to resist the attacks of the arch enemy of electrical machinery, dampness.

Waterproofing Universal

Throughout the entire magneto field the tendency has been towards rendering the new products waterproof. This movement, started 2 years ago, is rapidly becoming general practice. The new Bosch magnetos are completely housed in waterproof casings, and while not otherwise different from the older open types they have been given a new series designation. The new Splitdorfs, Remys, Eisemanns and so on throughout the entire gamut have housings which cover every vulnerable part. There is often one housing entirely enclosing the magnets and another for the breaker and distributer mechanism in other instances the magnets are ground to form a water-tight fit.

Water in the breaker box becomes harmful when it reaches the platinum points, thereby cutting down the efficiency of the break and having an ill effect on the spark. When water reaches the windings it is apt to soak through the insulation, breaking this down and cutting down the number of effective turns of wire. As the amount of step-up given the current depends on the number of turns of the high-tension wire, the reduction in the number of effective turns reduces the electromotive force and the result is a weaker spark.

In a high-tension magneto there are two direct factors which are all-important in delivering the best possible spark at the plug points: They are, first, the field strength which produces the magnetic lines of force and which when severed generate the primary current in the armature, and, secondly, the abrupt breaking of the primary circuit which induces the high-tension current in the secondary winding. These are the two steps that electrically are responsible for good ignition. If a magneto is to be made better electrically for a given size it must have stronger fields, and for any size the break of the primary circuit must be more abrupt as upon the rapidity of break of the primary circuit depends the strength of the high-tension current.

The fields or magnets transmit their magnetism to the pole pieces. A magnet can only hold a definite quantity of magnetism, which is termed its point of saturation. When the magnets are charged to saturation the amount they will hold depends on the retentiveness of the magnet material. Tungsten steel is used because it retains more magnetism than any other steel. In common practice the magnets of a good magneto retain 92 per cent. of full saturation. The manufacturer magnetises to more than 100 per cent. saturated and then allows the magnetism to drop gradually to its running condition, which is about 92 per cent.

The loss in the transmission of the magnetism from the magnets to the poles is one of the factors in reducing the efficiency of a magneto. In improvements made this year there is a tendency towards making a better connection between the magnets and the pole pieces to reduce these losses, which, in good practice, should not be more than 2 or 3 per cent. In one instance, the U-H, the poles are cast integrally with the magnets. In another, the Eisemann, the armature is always in contact with the pole pieces, taking the part of a magnetic keeper.

Faster Breaker Mechanism

Sharpness of break in the primary circuit is most often obtained by a spring release timed by a cam. The opposing element to the suddenness of break is the inertia of the parts to be moved, which depends directly on weight, and hence the tendency towards lightening the moving breaker box elements. The breaker box parts have been reduced in weight by Remy, Splitdorf, Eisemann. Others who have sought to eliminate the use of heavy springs in removing the effects of centrifugal force by having the break occur axially instead of radially, are the Kingston and the U-H.

Indicative of the trend towards a greater magnetic field is Splitdorf, with a double set of magnets as compared with single ones a year ago. On the other hand, there is a school represented by Eisemann who has cut down on the amount of magnetic field and made up the difference by increasing the efficiency of the armature winding.

Another goal towards which all are striving is to have the spark occur at the point of maximum current regardless of the amount of advance. Shaping of the pole pieces is the principle method used to obtain this end. Most magnetos employ a distinctive type of pole piece in which an effort has been made to have the maximum number of lines of magnetic force cut at the time that the interrupter breaks the primary circuit. In some the poles are cut by a series of slots similar in appearance to a comb, and likewise in other magnetos different forms are made use of to coincide with the magnetic lines. In the Mea the magnetic field is rotated about the armature when the timing is advanced and retarded, so the break occurs at the same relative time as regards the position of armature and field.

Mechanically improvements have been towards simplifying the magneto construction, and the use of unit castings is one of the steps and the reduction in the number of parts is another. The new Bosch for small cars is a good example. In this model the collector ring has been utilized as the distributer by making it of insulated material with segmental inserts to distribute the current. Another improvement is in the standardization of the base and couplings which now follow S. A. E. measurements in both high-tension and low-tension machines.

Bosch Waterproofs Construction

With one exception, Bosch has been following the general trend by the replacement of open by waterproof types, the exception being NU4, an entirely new magneto for small fours.

Every zone of motor size in automobile work is covered by a Bosch magneto especially designed for that particular field. Starting with the small four, the new NU4 is used; for intermediate fours, the DU4 and the ZU4, and for heavy duty work the ZR and Z types. The six-cylinder field is covered in the same way. When used for a six the DU4 becomes DU6, and so on throughout the range of models.

In Bosch nomenclature the letter Z stands for a waterproof construction, and in general a Z magneto has replaced a D of the same general design, except not waterproofed. Thus ZU4 is the waterproofed prototype of DU4, etc. Eventually the waterproofed designs will altogether replace the open models to which they correspond, as they have now done practically in such instances as the ZR instead of DR and Z instead of D.

The new NU4 is a distinctive small car design, in which reduction in weight has been made by the elimination of the distributer as an independent part. With the elimination of this part that of several other components has followed as a matter of course, thus the work of the distributer has been given to the slip ring, which, in this model, is double instead of single and has two grooves into which bear four brushes in sets of two. Each groove has two brushes at a distance of 180 degrees apart.

Two Sparks per Revolution

Imbedded in the ring are two metal segments, one in each groove at 180 degrees apart. The segments take the place of the distributer and pass the high-tension current to the brushes from which it is taken direct to the plugs. With this arrangement of the distributer and collector ring there are two sparks to a revolution, and as the magneto is arranged to be driven at crankshaft speed there is an ineffective spark in each cylinder 360 degrees behind the effective spark. It should be remembered on this account that the timing has to be so arranged that the inlet valve is not open when this spark occurs and that the exhaust valve is preferably still open. This is easy to secure if the general scheme of arranging the timing so that the magneto is at full retard at the time No. 1 cylinder is on upper dead center. At this time the metal segment on the slip ring should be in contact with the brush marked 1.

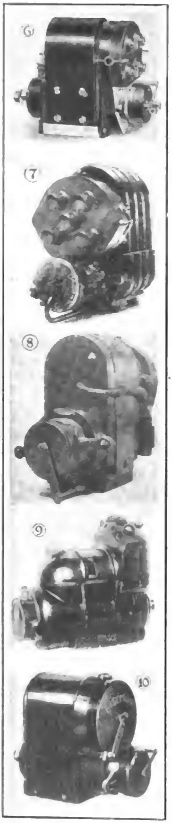
In waterproofing the Bosch magnetos they have not been changed electrically. The waterproofing is embodied in the construction of the magnets, which are ground to fit tightly together, and the endplate carries an inserted felt packing between it and the magnet. The same breaker box mechanism as used a year ago is continued. —Bosch Magneto Co., New York City.

Remy—New Breaker Box

Remy is an example of where the magneto maker has endeavored to increase electrical efficiency by a faster break of the primary circuit and hence a more powerful high-tension spark and the means used is the lightening of the breaker box parts, thus reducing inertia.

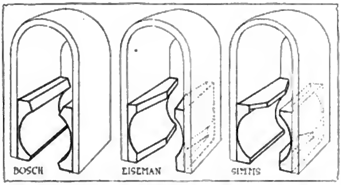
A year ago Remy introduced its present type with the low-tension H-shaped or shuttle armature, which replaces the inductor design previously used. The armature carries only a low-tension winding, the coils for producing the high-tension current being separate and generally mounted behind the dash. The switch is preferably in a unit with the coil and protrudes through the dash or instrument board.

The armature is made up of laminations of soft Norway iron to secure the maximum of magnetic permeability. The armature heads are hard bronze and the shaft is cast integrally with the head, this providing an

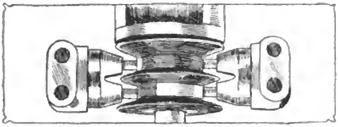


EXTERIORS OF 1915 MAGNETOS

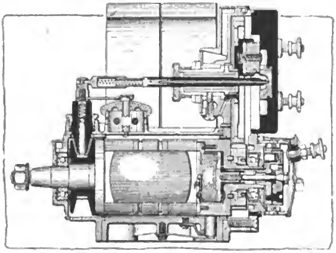
6—Simms
7—Heinze
8—Berling
9—Mea
10—Eisemann



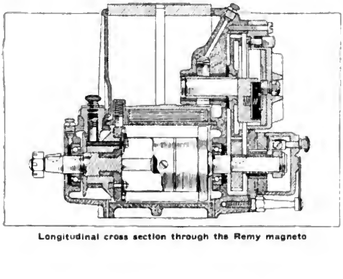
Distinctive pole pieces employed by Bosch, Eisemann and Simms. The Bosch at the left shows the straight pole construction, Eisemann in the center has a tapered construction to bring the magnetic lines of force to the center and Simms at the right has the extended pole shoe



Bosch NU4 for small cars has a double collector ring as shown above. The segments act as the distributing points. There are two of these 180 degrees apart



Longitudinal cross section through the Bosch DU4 magneto showing arrangement of armature and method of conducting the current from the collector ring to the central point of the distributor block



Longitudinal cross section through the Remy magneto

unusual construction in that two different metals are joined in a rigid manner with minimum weight.

Another improvement is the use of a new design of distributer cover plate made as a bakelite block, so arranged as to provide a water-tight and dust-proof housing to the distributer parts. In addition to the tightness of the cover the arrangement of the terminals, which are fastened to the outside of the cover, aid in rendering the instrument accessible.

One of the minor improvements is the use of a device known as the timing button, by means of which the circuit breaker is brought into proper position, and the proper sable for each terminal is also located. The process is to turn the engine over until No. 1 cylinder is on top center on the compression stroke when the timing button at the top of the distributer is pressed in and the magneto shaft is turned until the plunger of the timing button is felt to drop into the recess of the distributer gear. With the magneto in this position it can be coupled to the motor, and no attention has to be paid to the circuit breaker in doing this work as it is brought automatically in position when pressing the timing button.—Remy Electric Co., Anderson, Ind.

Splitdorf

Of the three new Splitdorf designs two are entirely new and the other is an improved and more powerful edition of the EU4 of last season. In addition to these three the EU4 is continued in its present form, bringing the complete line to four models. All Splitdorf magnetos are high-tension types, the armatures carrying primary and secondary windings.

The improvements are in line with the general striving on the part of magneto makers to secure a hot spark at low rotative speeds. The EU4-2 models aims to accomplish this result by a double set of magnets, in fact, other than in the use of two sets instead of one this product does not differ in any important manner from the EU4 announced a year ago. By doubling the field strength, however, the magneto naturally provides a spark of greater intensity, especially at low speeds.

The other two new models, the Dixie and the Cunningham, are entirely different from the other Splitdorfs and the maker claims that with them a sufficient spark is produced for perfect ignition at cranking speeds, which are lower than a motor would be able to turn over on its own power.

The Dixie is distinctive in exterior appearance owing to the housing of the field coil in the arch of the magnets. The platinum points are external and are not in the main breaker box, as is the case in general magneto construction, but are covered by a separate housing. Another distinctive feature is that there is no wire on any of the moving parts.

The Cunningham model is especially adapted for slow-speed, six-cylinder motors and is so arranged that it is possible to secure an advance of 70 degrees.

The construction of the EU4 embodies an aluminum base to which the pole pieces are secured, and the armature is carried between these on annular ball bearings. The circuit breaker attaches to one end of the armature shaft and revolves with it. Waterproof conditions are obtained by the ribbed aluminum cover, which fits over the end plates, covering all the operating parts.

The circuit breaker on Splitdorf magnetos is different from others in that centrifugal force is utilized to a large extent in keeping the breaker contact points together—Splitdorf Electrical Co., Newark, N. J.

Eisemann

Eisemann has added an entirely new single-ignition magneto design, type G, which, like other Eisemann's, is a high tension instrument with both the primary and secondary windings on the armature. Single magnets are used and the loss in magnetic field is made up by the efficiency of the winding, which is increased by using a greater number of turns. The distinctive tapered pole pieces of which Eisemann has made a specialty has been continued on this model. The theory of these pole pieces, which are tapered and have their most extended portion opposite the theoretical axis of the core of the armature, is that the lines of magnetic force are not diffused to as great a degree as in straight pole pieces, and hence the armature cuts a greater number of lines of force with the result that a greater effective current is generated.

The interrupter is new and has a light spring which keeps the contact points normally together. The arm which carries the points is also light and is in the form of a spring, and is actuated by a fiber cam. There is no bearing in this form of breaker box.

Another feature, which helps towards making the magneto waterproof, is that the leads for the high-tension circuit are not connected externally to the distributer block, but enter holes at the top of this, where they are connected so as to exclude water.

For dual ignition there is the EM type, in which a strong attempt has been made to make the two systems as separate as possible and still not have a double system. Thus the parts which are subject to damage are not used in common if it can possibly be prevented. In carrying out this policy the contact breaker and windings are not the same on the battery and on the magneto sides, but the same switch and distributer are used.

A feature of the Eisemann magnetos which is distinguishing is that at no time is the armature separated from the magnets, and so the armature acts as an efficient keeper to prolong the life of the magnets.—Eisemann Magneto Co., Brooklyn, N. Y.

Simms

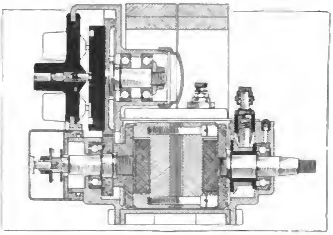
American Simms magnetos remain the same in general as a year ago and are distinguished from other types by the extended pole shoe which is used to produce an intense spark at low speed, with the timing lever at full retard. It is particularly desired to keep the spark constant over the entire timing range and to do this pole pieces are notched back from the center to concentrate the lines of magnetic force at the pole ends, thus producing the hot spark at all degrees of advance. This feature is supplied on those intended for any but fixed ignition and when the ignition is fixed the conventional straight pole pieces suffice.

Another new Simms feature is the model D dual system, by means of which any single system Simms magneto can be converted into a dual type. The outfit comprises a coil, switch, commutator, stud screw and a dual contact breaker. To convert the independent magneto to a dual it is only necessary to exchange contact breakers, substitute the dust cover for the commutator, and install the coil and switch.—Simms Magneto Co., Bloomfield, N. J.

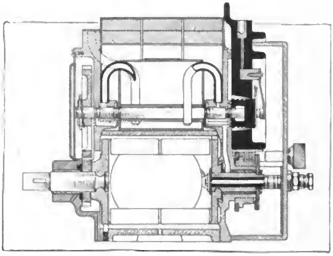
Mea

No alterations have been made in the Mea magneto, which was put out in improved condition late last season. The distinguishing Mea feature which is a high-tension instrument with primary and secondary windings on the armature, is its bell-shaped magnets placed horizontally in the magneto frame. Another feature is that it is the only type which has the magnetic field arranged so that it is moved about the armature when advancing or retarding the timing. With this it is possible to secure the spark at the peak of the current wave regardless of the position of the spark advance.

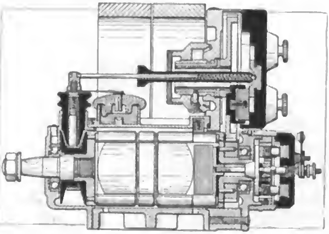
The instrument is made in waterproof form and with its tightly sealed housing has an exterior appearance which differs materially from that it presented 2 years ago. The armature rotates within the magnets in the conventional manner but owing to the fact that the magnets are horizontal the armature shaft passes through the closed end, being held in a bearing at that point.



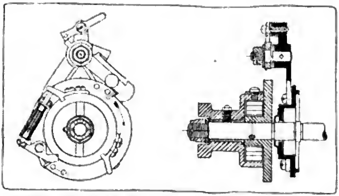
Longitudinal section through the Kingston magneto showing ball bearing support for armature and distributor shafts. The armature is the H-type with laminated center, and at each end of the armature are oilers. The Kingston is a low-tension instrument and is noted for the fact that the breaker box mechanism acts in an axial line instead of the usual radial direction, thus eliminating the effects of centrifugal force on the action.



Longitudinal section through the Briggs magneto showing the plain bearing armature and the method of conducting the oil to the armature bearings.



Longitudinal section through the American Simms magneto. This is a ball bearing construction throughout the armature shaft being carried on a row of these at either end. The high tension current is conducted to the distributor by a brush on the collector ring and thence by a bridge to the central distributer point.



Impulse starting device on the K. W. magnetos for heavy engines which are difficult to crank. This operates on a spring and ratchet principle

The breaker box is mounted on the closed end of the magnet and the distributer plate at the other end. The collector ring is at the breaker box end, the current being carried over to the central point on the distributer by a bridge. The distributer housing carries the high-tension leads at the top.—Marburg Bros., New York City.

Briggs

The Briggs magneto is a low-tension instrument having but one winding on the armature, and with the transformer coil generally carried on the dash. The magneto, though a low-tension construction, is standardized in accordance with the S. A. E. measurements and may be interchanged with a high-tension instrument.

The horseshoe magnets are of tungsten steel and the breaker points are a platinum-iridium composition, protected by a condenser.

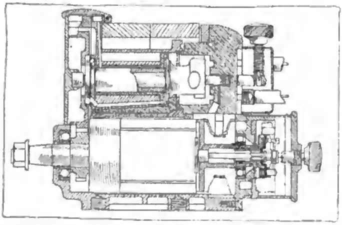
A Briggs feature is a 6-ounce oil tank for lubrication, which contains enough for 15,000 miles. The oil is led to the various magneto bearings through wicks from the tank located in the arch of the magnets. Another feature is that the entire breaker mechanism can be detached without removing a nut.

An automatic advance feature can be added if desired and is a centrifugal device by which the advance is governed in accordance with the rotative speeds of the motor.—Briggs Magneto Co., Elkhart, Ind.

K. W.

No changes have been made in K. W. magnetos intended for automobile use. This concern concentrates largely on magnetos for tractors and heavy stationary machinery. Model H is for automobile motors and is distinctive in that it is fitted when desired with an impulse starting device. This is a spring-operated mechanism which, when released spins the armature at a sufficient speed to provide a suitable spark for starting. It is used on motors which are extremely difficult to crank.

The method of operating this device and of correctly seting the trigger is to place the circuit breaker in retard position so that when the tripping device is set in its final position the spark will not be set too early. The device operates on a spring-and-ratchet principle. A dog picks up the ratchet, and when the motor is turned the armature does not revolve until the ratchet is suddenly released by a cam allowing it to spring forward producing the spark. This device is of great advantage in machines that are hard to crank and hence, must be turned over very slowly.



Longitudinal section through the U-H magneto which has several features new to magneto practice. The poles are integral castings with the fields

The K. W. magnetos are distinctive in that the windings do not rotate. They are entirely separate from the armature. The winding is concentric with the armature shaft and is mounted between halves of a rotor. The rotors collect the magnetism from one pole piece and conduct it through the winding to the other pole piece, in this way cutting the magnetic force by the winding and producing the electric current. The K. W. magnetos are made both in low and high-tension designs, and when the latter is manufactured the two windings are placed together and the primary circuit is broken by a circuit breaker in the customary manner.—K. W. Ignition Co., Cleveland, O.

Kingston

The Kingston magnetos have heretofore been in the low-tension class but they will be shortly augmented by a high-tension type. In the mean time the line consists of the same instruments as for last year. There are more than twenty, embracing every size motor from that usd in the motorcycle to the heaviest installations.

A new breaker box was introduced on the Kingston magnetos a year ago and this has worked out satisfactorily and been retained. It is actuated by a flat-faced circular cam which has two depressions in its surface. Twice in every revolution the cam follower dips into the depressions on the surface of the cam and cause the contact points to break apart. This breaking action takes place in a line parallel to the shaft of the armature and is not affected by the centrifugal force.

Ordinary construction is followed in the details of the Kingston magneto. The two magnets are horeshoe shape.—Kokomo Electric Co., Kokomo, Ind.

Heinze

Heinze magnetos are low-tension and are distinctive in the use of magnets of a round section although bent into horseshoe shape in the same manner as that used with the flat magnets. The object of using the round magnet is to gain greater efficiency in the poles through the better juncture of the magnets to the pole pieces. The pole pieces are drilled and reamed to take the ground extremity of the round magnet. This metal-to-metal juncture of the magnets with the pole pieces will produce a stronger magnetic field, it is claimed, and hence give the instrument a higher efficiency.

Another feature in which the Heinze magneto differs from others is that both ends of the primary circuit are grounded. This is in accordance with Heinze practice for 2 years. The advantage of the grounded primary current is claimed to be in its simplicity and elimination of current losses. The breaker mechanism interrupts the current in the same manner as in the usual method of wiring. The breaker box cover is made of steel tubing upon which is shrunk a band of fiber insulation.—Heinze Electric Co., Lowell, Mass.

Herz

The Herz magneto which is a high-tension design having both primary and secondary windings on the armature has but one minor alteration in the revamped magneto put out a year ago. This small change is in the attachment of the breaker box to the armature. Instead of making this connection by two screws, three are now used to give greater rigidity.

The latest product of the Herz company whose magnetos are made in Stuttgart, Germany, is the 4-U-4 which was brought out a year ago to take care of small cars. It will furnish suitable ignition for motors up to the size of that used in the Ford. The weight of the instrument has been kept to the lowest limit in order to render it particularly adaptable to the lighter cars.

When the revised Herz magnetos made their appearance they had been improved by increasing the size of the platinum points for the sake of durability and the bearing surface for the distributer shaft was increased for the same purpose. The insulated cover carrying the distributer segments was also made heavier to render it stiffer and hence more apt to keep water from penetrating the instrument. The timing advance lever is another of the parts that were strengthened and besides being made of a heavier section it was also increased in rigidity by fastening it to the distributer by two screws instead of one.

An automatic advance feature can be had on Herz magnetos if desired. The device consists of two plates which are each hollowed out by six spiral grooves. The two plates with their grooves are brought face to face and are held apart by steel balls which are in the grooves. As the speed of the armature shaft increases these balls are thrown by centrifugal force away from the centers of the disks and by means of the spiral grooves produce a twist that moves the disks in relation to one another thus providing the advance.—Herz & Co., New York City.

U-H

The U-H is a high-tension instrument made by Unterberg and Heimle, of Durlach, Germany. It is notable for the fact that an effort has been made toward gaining greater efficiency by increasing the transmission of electric energy from the magnets to the poles by having the latter cast integrally with the magnets. Generally the magnets are drilled and the pole pieces are fastened to them by means of screws.

Another point in which this magneto is designed with a view towards increasing its efficiency is the breaker mechanism. This is cam actuated in the usual manner but instead of the points separating radially they separate in an axial direction. According to the makers who submit certified tests on this matter made at the Institute of Technology, Karlsruhe, Germany, the blow on the platinum points is 230 grams as compared to 1,200 grams on a magneto using a different form of breaker mechanism with the opening in a radial direction. The difference is stated to be due to the centrifugal action of the weight of the interrupter arm.

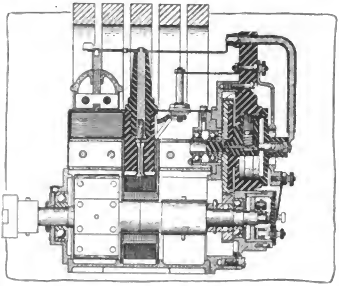
On the U-H magnetos there is an automatic starting device which makes the first spark occur in the retard position to avoid the possibility of a kick back. There is a coupling interposed between the driving gear and the armature, the two halves of which are connected by a spring. The driving half is free to turn a short distance beyond the point of induction where the action of the coiled spring is arrested and the armature end of the coupling is released and by the energy stored in the spring the armature is rapidly rotated, producing a hot spark for starting.

The magnetos are entirely inclosed in a waterproof housing. This covers the magnets, distributer box and breaker mechanism. The high-tension leads are carried into the top of the distributer and have no entrance through which water can find its way.—U-H Magneto Co., New York City.

Swiss

No changes have been made in the Swiss magnetos for this season. There are two types, both of which are high-tension instruments and similar except that E, the smaller, has single magnets and D, for larger motors, has double magnets.

Other than in the arrangement of the breaker box the magneto follows orthodox construction. In the breaker mechanism several parts have been eliminated by having the cam bear directly on the interrupter arm. There are no fiber inserts or bushings and the result is a much simplified design.



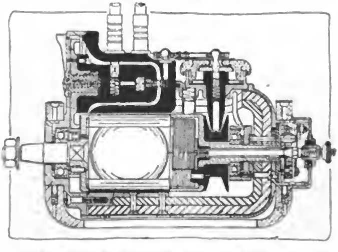
Section through K. W. type-H magneto showing the five magnets and method of housing the primary and secondary windings

Berling

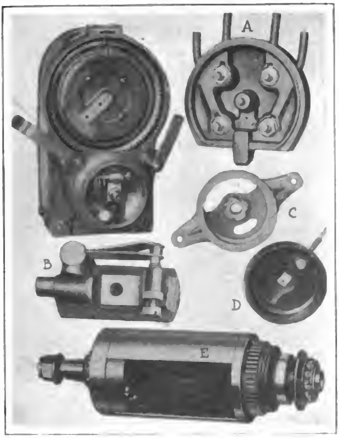
A high-tension magneto for small four-cylinder motors makes up the line of the Ericsson company in this field. The instrument is noteworthy for several departures from standard practice in magneto design. The distributer is housed under the arch of the horseshoe magnets and the interrupter cams are solid with the housing. The entire frame work is in one piece and the magneto is entirely housed with a waterproof covering that embraces the armature, magnets and breaker box. The distributer being located beneath the arch of the magnets is also proof against the inroads of dampness.—Swiss Magneto Co., Chicago, Ill.

Connecticut

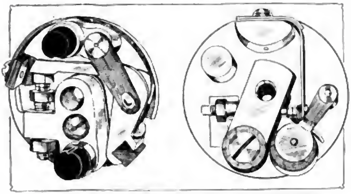
While specializing on their battery ignition system the Connecticut company continues the manufacture of its high-tension magnetos. The Connecticut magneto is different from any other high-tension instrument in that while it is self-contained in every respect, still the armature carries only one, and that the primary winding. The transformer coil



Section through the Mea magneto in its waterproof form. The breaker box is mounted on the closed end of the magnet and the distributor plate is at the other end. The collector ring is shown at the breaker box end of the armature winding



Eisemann magneto. A—distributor box; B—breaker mechanism; C—breaker adjusting arm; D—breaker box cover; E—armature



Breaker mechanism for the Simms and Hertz magnetos

A. C. A. Tests Tireseal and Multiple Rings

(*Continued from page* 110)

was again reinflated to 80 pounds and the rear was left at 63 pounds. The car was then taken on a test run to Bridgeport, Conn. from the clubhouse in New York City, a run of 56.8 miles over good roads. After arriving here the tire pressures were again measured and that of the rear still remained at 63 pounds while the front had dropped to 76, a loss of 4 pounds.

Before starting on the return trip five of the nails in the rear tire were removed and the pressure fell to practically atmospheric. A considerable quantity of Tireseal squirted from the punctures on the removal of the nails. It was found impossible to reinflate the tire until three of the nails were replaced. This was done, the tire was inflated to 70 pounds and the car was started on its journey back to New York.

After again reaching the clubhouse the left front tire showed a pressure of 70 pounds per square inch, a drop of 6 pounds during the run and the right rear 39 pounds, a loss of 31. Another period of 14 hours was allowed to lapse and measurements taken showed that the front tire retained the 70 pounds pressure and the rear tire had dropped 3 pounds more, to 36 pounds.

The tires were then deflated and examined. It was found that the punctures were not enlarged in the tubes, but in the rear casing the holes had been considerably enlarged through running with the nails still in the punctures. In the front tires where the nails were not in the casings during the runs there was no enlargement of the holes in the casings. As the tires would not hold inflation after this no further tests were made. A summary of the results of the test is given in the accompanying table.

	Pressure in Pounds per Square Inch	
	Right Rear	Left Front
Before puncture	65	80
After puncture	63	78
Reinflated to	*..	80
After standing approximately 15 hours	63	55
Reinflated to	*..	80
After running 56.8 miles	63	76
After running 113.6 miles	39	70
After standing approximately 14 hours	36	70
After examining tubes inflated to	66	50

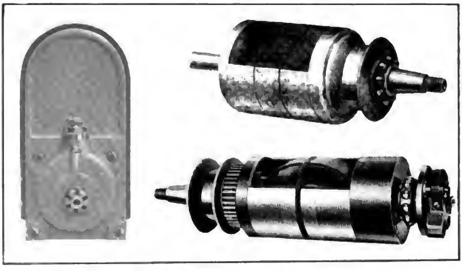
*Not reinflated.

Reo Highway Offer Is Accepted

LANSING, MICH., Jan. 14—The proposal of the Reo Motor Car Co., offering a reward of $300 per mile for all state reward roads built on the Lansing to Detroit trunk line during the years 1915 and 1916 has been accepted by the board of supervisors of Ingham county. According to officials it will mean an outlay by the automobile company of at least $12,000. In return the road between Lansing and Detroit will be known hereafter as the Reo Highway and the company will have the privilege of erecting suitable signs or posts bearing the name of cities and towns and distances to and from one to another. It is hoped that the example will be followed by other manufacturers, as it will greatly assist in the improvement.

which steps up the current is carried in the arch of the horseshoe magnets. The high-tension coil is in a cylindrical housing in the form of a cartridge and is threaded at the interior extremity, thus screwing into place in the magnet arch. It is removable by unscrewing it by the knurled head on the protruding end of the cylindrical housing.

This magneto is made in two syles, for single and dual ignition. It is the same in the way of material as in the past. Brass castings are used for the base, front and rear frames, interrupter housing and front bearing retainer. The other principal parts such as the armature heads gears, etc., are of bronze.—Connecticut Telephone & Electric Co., Meriden, Conn.



Left—Remy housing Top right—Remy armature; Botton right—Swiss armature

New Low Two-story Motor Busses with Novel Seating System Introduced in Vienna

COMPARISON WITH OTHER OMNIBUS TYPES—THE MUNICIPAL EXPERIMENTS AND CONTROL

DOUBLE-DECK motor omnibuses have been developed in Vienna which have the following advantages: The roof seats can be entirely enclosed or partly open, according to season and weather; the vehicles are lower and present less wind area than other omnibuses with enclosed roof space; the bodies are narrow and thereby suited for narrow streets and dense traffic; the weight is moderate; all seats are easily reached without jostling the passengers.

The evolution by which these omnibuses have come to be adopted, at least provisionally, lends additional interest to their construction and arrangements, as other well-known types were tried in competition with them and were found less satisfactory, largely in view of the indifferent pavements of Vienna and the necessity for operating partly in narrow and crowded streets.

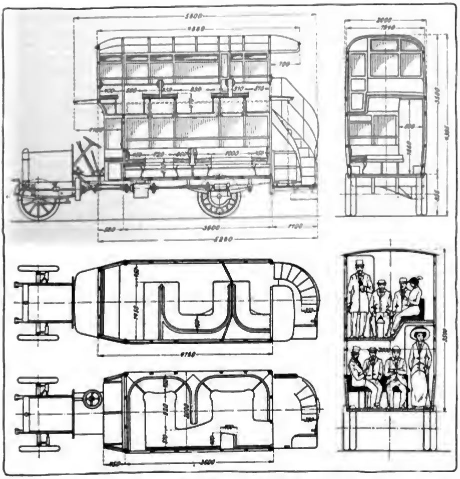


Fig. 1—Side and end views of Spängler omnibus. Plans of upper and lower decks, showing seating arrangement. Fig. 2—Means for keeping structure low

The principal peculiarity of the new type lies in the arrangement by which passengers below sit on one side of the vehicle and those on the roof nearer to the other side, as this permits the ceiling to be low over the passengers seated on the lower deck while raised over the aisle where they pass in and out, as shown most plainly in Fig. 2.

The number of passengers can be 14 below and 15 above, and no standing room is provided. The design is by Ludwig Spängler, technical manager of the municipal street railway system of Vienna.

Dimensions and Seating Plan

The height of the usual two-story omnibus body with enclosed roof space is at least 3,900 mm (153.5 inches), but for the Spängler type it is only 3,500 mm (137.8 inches), which makes the height of the whole vehicle 4,250 to 4,500 mm (167 to 177 inches) with the chassis frame from 750 to 1,000 mm (29.5 to 39.4 inches) from the ground.

The height of the ceiling over the seats below is 1,470 mm (57.9 inches), but over the aisles it is 1,870 mm (73.5 inches). Other dimensions are given in Figs. 1 and 2, while Fig. 3 offers a comparison with an omnibus that has open roof seats. The plan views of Fig. 1 show the seating arrangements of the upper and lower compartments; all the seats are comfortably upholstered, which makes the small space above them more acceptable. [The dimensions would perhaps not be suitable without modification for a race averaging taller than the Viennese.] In the roof compartment the rear end panels are moved forward, so as to leave a space between the door and the stairway, and the four seats located in this space communicate directly with the atmosphere though roofed over.

Both the upper and the lower decks have high windows and are lighted at night and heated in the winter. The motor exhaust is led away over the top roof. The side windows can be taken out for the summer on the side where the aisle is and replaced with rain curtains.

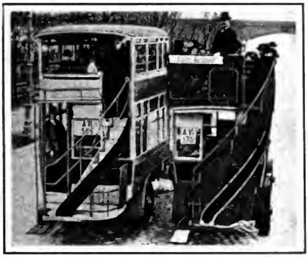
The body is only 2 meters broad (78.7 inches), and its weight is by means of combined wood and steel construction reduced to 1,450 kilograms (3,190 pounds), which is only 350 kilograms more than for a vehicle of similar size with open roof seats. The heating plant adds 90 kilograms.

A great advantage of the low ceiling over the lower seats, which means a low floor for the upper-deck aisle, is that the stairway becomes 400 mm (15.7 inches) shorter than ordinary and therefore can be made of easier grade. Centrifugal action at turns is also considerably reduced by the low seating of the roof passengers.

It is to be noted that while the ceiling over the seated passengers below is not higher than needed it rises dome-like to the height of the aisle ceiling over the central spaces in front of the seats, these spaces coming directly under the seat divisions above, and there is therefore no difficulty in getting into the seats from the aisle or out of them.

Experiment Extended

One of these omnibuses has been in operation in Vienna since July, 1913, and two since September of the same year, and, while experiments have not yet been brought to a close, 60 new bodies have been ordered. These have a wheelgauge of 1,800 mm (70.8 inches), a wheelbase of 4,500 mm (177 inches), a chassis frame 790 mm (31.1 inches) high, and the total height will be 4,290 mm (169 inches). At the same time 25 bodies will be arranged on the London plan of open roof with cross-seats. The chassis will be alike for both types and 75 chassis are being built in all, leaving a reserve of 10 bodies.



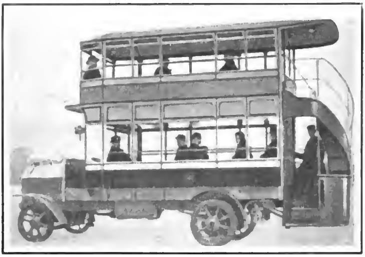


Fig. 3—Comparative heights of Spängler and London types. Fig. 4—Safety stairs tried and abandoned

A Question of Stairs

During the progress of experiments it was thought that the stairway, as shown in Fig. 3, was open to the criticism that passengers could fall from it directly to the street by accident, and some vehicles were built on the model shown in Fig. 4, with safety stairs starting from the right-hand side of the platform instead of from the left side opposite the step. This arrangement made the stairs still more comfortable, giving almost the whole width of the vehicle for the rise, but added some weight and made it take longer for passengers to get off and on. It also made the entrance less inviting, as the top of the stairs extended over it, leaving but little surplus space overhead. And, as no accidents occurred with the stairs starting opposite to the step, that construction was re-adopted.

Trying Other Types First

A summary of the development by which this type was reached is, according to data furnished by Mr. Spängler, substantially as follows:

In 1908 the municipality of Vienna took over the horse-omnibus system of the city, whose principal object was to provide transportation from the old city proper, where street railways are severely restricted, to the suburban street railway lines. It was found that a horse-omnibus kilometer cost the city 15.5 cents and brought an income of less than 11 cents, and in the hope of bettering this showing a trial service with electric omnibuses was established, this form of power being chosen largely because the city could furnish cheap current from its electric lighting plants and because the Austrian automobile industry was strong in the production of electric vehicles. Absence of noise and odors was also considered, as well as the undesirable fluctuations of gasoline and benzol prices.

Thirteen storage-battery omnibuses were placed in commission in January, 1912. They weighed 3,300 kilograms empty and had 13 seats and 5 standing spaces. An operating company took charge, receiving about 14.5 cents per kilometer, with the city furnishing the conductors and regulating the time schedule and fares. These were made higher than street railway fares, as the city wanted to protect its investment of about 40 million dollars in electric street railways and the transportation by omnibus was superior in speed. This venture has given smaller loss than the horse-omnibus lines, and it may give a small profit in the future, as the fares have been raised again for this purpose, but the vehicles have been found too small to meet the traffic conditions and the popular preference.

Reports of more favorable experience with gasoline and benzol omnibuses in London, Paris and Berlin made the city look into this system. An offer from a London company to supply the entire service was declined, as the city wanted to retain control. Bids were asked for from a number of manufacturers and were considerably lower for the gasoline motor than for the electric system, but no final decision was reached, as the city wanted to experiment with different constructions of chassis and bodies,. Trial services were established with British Daimler chassis with Knight motors, with Dion-Bouton omnibuses of the Paris type, with N. A. G. omnibuses from Berlin and, further, with omnibuses from Büssing of Brunswick, from the Austrian Saurer works and from the Austrian firm which is a consolidation of the Daimler, the Fiat and the Gräf & Stift manufactures. Electric firms requested to produce omnibuses of large capacity were not able to give prompt delivery.

Faults Found

The British worm-drive Daimler vehicles, notable for their noiselessness, were considered too light for Vienna pavements. The same objection was raised against Dion-Bouton vehicles. The N. A. G. construction is heavier. The Büssing omnibuses with double gear reduction from the drive-shaft to the rear wheels were of the design which has been adopted for the city of Leipsic in considerable number. Two Saurer chassis which originally had been intended for overland work and had only simple gear reduction nevertheless behaved acceptably in the Vienna service. The three consolidated firms used worm-drive, armored wood frames and silent-chain gearboxes after British pattern.

The experiments were largely concerned with the body design. With the Büssing, N. A. G., Sauror and Daimler chassis the bodies were of London pattern which gives interior seats for 16 and open roof seats for 14, but for Vienna conditions the roof seats were reduced by 4, leaving a total of only 26, of which 10 were undesirable in bad weather when the traffic demands most. The width of this type of body, which is 1,840 mm below and 2,030 mm above, was found suitable. The height is 3,930 mm; the weight, including heating apparatus, 1,150 kilograms. The one-story body for Dion-Bouton chassis is 2.36 meters (92.80 inches) broad as used in Paris and makes room for 30 to 35 passengers, according to the length, but this is reduced to 19 seats and 6 standing places, in all 25 fares, when the width is reduced to 2 meters (78.74 inches), as was considered necessary in Vienna. The weight is 1,175 kilograms, including heating apparatus. Any recourse to standing room to increase capacity was found undesirable for Vienna pavements, the shaking being objectionable.

The N. A. G. bodies differed a little from those used in Berlin, having the step at the side of the platform instead of at the rear of it and no standing room on the platform. They afforded 15 seats and 3 standing places below, all interior, and 18 open roof seats. The width of 2.15 meters (84.64 inches) was considered too large. The weight was 1,250 kilograms.

Control by City

Among the results arrived at by trying out the different types one only was final, to the effect that only with a single type could operation be systematized economically. The larger stores of spare parts needed for a diversity of vehicles and the lesser chance for utilizing each type at its best were here decisive. It was also concluded that omnibus design was still in its infancy and that it would be best to secure the co-operation of a single manufacturing concern to take care of the city's interests in the matters of construction, innovations and operation. The contract was awarded to A. Fross, the Austrian branch of the Büssing manufacturing company, and this concern works in conjunction with the Nesseldorfer Wagenbau Fabrik in the building of the bodies and the operation. The award was influenced to some extent by the fact that a subsidy is accorded Büssing chassis by the army authorities for complying with military requirements.

The municipal system of control provides that the city purchases the vehicles and establishes the garages, while the contractors take their drivers and conductors from the personnel of the city's horse-omnibus lines and pay them stipulated wages. The contractors receive 13.5 cents per kilometer service, so long as gasoline of .74 to .75 specific gravity costs 9 cents per kilogram and rubber prices and the wage scale remain unchanged. Variations are provided corresponding to changes in these factors of the cost. Profits are shared by city and contractors. The life of vehicles is guaranteed in a general way to reach 300,000 kilometers. Time schedules and routes are prescribed by the city, but the working schedules of the personnel by the contractors. The city assumes the responsibility for accidents. The contract runs for 6 years but can be abrogated by the city before its expiration.

Experiments with electric omnibuses of large capacity are to be continued on two separate routes.—From *Automobil-Rundschau*, November, and *Zeitschrift des Vereines Deutscher Ingenieure*, November 14.

Lubricating System for F. N. Motors Made in Belgium

DEVICES for measuring off the oil feed in automobile motors somewhat in proportion to the power produced per second, and not only in proportion to the motor speed, have now become a not unusual part of standard equipment in high-class cars, but in the same cars the oil not consumed in the cylinders is in nearly all instances returned to the oil sump and used over again, this circulating system having been found decidedly more economical, so far as the oil consumption is concerned, than direct force feed to all bearings without circulation or the splash system.

At the same time it has been found that aviation motors and racing car motors, which are usually operated at full power when operated at all, show a falling off in power and reliability after running for several hours, and this result

Stepless Bus With Electric Transmission

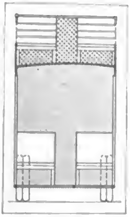
STEPLESS and double-decked motor buses, propelled by a gasoline-electric power plant, are now being turned out for the New York Motor Bus Co., 1 Wall street, New York City, on Roland chassis. It is stated that the first year's output has already been contracted for.

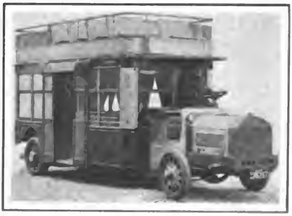
As shown in the accompanying illustration, the bus is of the double-decked type, but much lower than the usual type. It has no stairs to the first deck, but entrance is effected directly through the side through large sliding doors, the floor being but 12 inches from the road when under load, or 13 inches empty. The side door is 40 inches wide and is in the middle of the right side. The stairway to the upper deck is inside. The stairway is 28 inches wide with 11-inch treads of 9 inches rise each.

The upper deck is 7 feet 11 inches from the ground, and the vehicle is 7 feet 4 inches wide. It has an overall length of 23 feet.

The bus has a capacity for forty-one passengers all told, twenty on the lower deck and twenty-one above.

The engine of the bus is located under a hood well forward, with the cab just behind it. The power plant comprises the Hexter system of a gasoline engine and generator under the hood and a motor on the rear axle, driving by worm gears. The control is by means of a foot throttle and a two-notch controller. The driver is seated to the left.





New Stepless Motor Bus brought out by New York Motor Bus Co.

has naturally been ascribed to the oiling system where it could not be charged to insufficient cooling, as these two factors are the only ones in which the elapsed time has an accumulative function which might affect the running and the power.

In a few German aviation motors improved reliability has been secured, it is reported, by a scant oil feed from a separate tank and pump to the cylinders, with the very small surplus returned to another small special tank, and a circulation system, with filter, for the oil fed to the crankshaft, camshaft and camgear bearings, this arrangement being based on the theory that the oil sent to the cylinders and not consumed undergoes certain subtle changes by being subjected to very high temperatures which reduce its value materially for lubricating heated bearing surfaces again. On the same theory there is now mentioned the method, for automobiles, of allowing no return of cylinder oil to the supply from which the motor is fed and of leading the surplus, instead, to a reservoir from which it may trickle to the gearbox, the differential, the universal joints, contributing to keeping these parts supplied to some extent even if they are neglected otherwise.

F. N. Oiling System

Certain improvements of the lubricating system which are noticed in F. N. motors are not of this radical nature involving a theory on the chemistry of the oil, but intended above all to obviate damage from carelessness in keeping the oil supply sufficient. Fig. 5 is a diagrammatic sketch from which the general arrangement can be readily understood, and the mechanical details do not seem to be important. One of them is quite smart, however, consisting in having a small gear driven visibly by the oil flow in the sight glass G. to indicate that the feed is regular. The action is probably shown more plainly in this manner than by any of the sight methods in general use.

The oil sump A is in the lowest portion of the crankcase, as usual, but is supplemented by a tank of twice its capacity divided in two compartments B and C, and these not only take the place of a separate oil supply but can be brought into service for the feed when needed, and, even if a thick oil is used in winter, their contents will usually be in condition for immediate use, as the tank is mounted under the motor hood. The oil pump is conveniently located at D and is driven from the camgear in the usual manner. A valve E is controlled from the dash by the lever F, the different positions and effects of which are indicated by a dial. When it points to C on the dial the oil in sump A flows through the main channel of valve E, from here through the measuring and sight device G to the crankshaft and other bearings, with the surplus draining back to the sump through filter K. If the oil supply in A gives out the gear in G ceases to rotate, and this is soon noticed. If lever F is then moved to R-1 the oil in compartment B is admitted to the circulation. Eventual failure of this supply is again indicated in the sight device. Lever F can then be returned to position C, as meanwhile the surplus oil feed has accumulated in A. When this is exhausted lever F can be turned to R-2, and compartment C then comes into action.

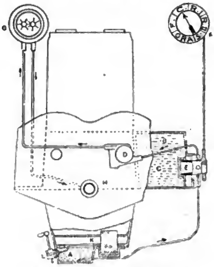


Fig. 5—F. N. lubricating system

If the motor smokes, the lever F can be placed in position F which throttles any feed that is in action. The height of the oil in A can be told by the cock L; if oil flows from it when it is opened, F should be placed at C to reduce the level.—From *Auto-Technik*, December 12.

Power Formulas Used for Taxation in Different Countries

THE formulas used in the principal countries as a basis for classification and taxation are given in the 1914 *Jahrbuch* (Annual) of the Imperial Automobile Club of Berlin, the information being obtained from the leading automobile club in each of the countries listed. In some instances the taxation, or a portion of the taxation, to which the vehicles are subject is also specified.

Countries Following Germany

Germany, Denmark, Holland, Norway, Russia and Switzerland have the same formula

$$H.P. = 0.3 \times i \times d^2 \times s$$

in which 0.3 is a constant, *i* the number of cylinders, *d* the bore in cm (centimeters) and *s* the stroke in m (meter).

Germany divides the cars in four classes and the tax rate

up to 6 H.P. = 25 mark + 2 mark per H.P.
6 to 10 H.P. = 50 mark + 3 mark per H.P.
10 to 25 H.P. = 100 mark + 5 mark per H.P.
more than 25 H.P. = 150 mark + 10 mark per H.P.

Denmark taxes automobiles belonging in foreign countries: For 1 day 3 kroner, for 2-5 days 8 kroner, for 6-14 days 15 kroner, for 1 month 25 kroner. (1 krone is about 27 cents.) The sojourn need not be continuous.

Norway has the following yearly tax rate: Up to 6 H.P. 5 kroner per H.P., 6 to 12 H.P. 6 kroner per H.P., more than 12 H.P. 7 kroner per H.P. One-seated motorcycles are not taxed.

Russia has a maximum tax in the home city of a car of 3 rubles per H.P.

Switzerland has different taxation in the different cantons. The insurance companies uniformly use the German power formula.

Belgium

Belgium uses this formula:

$$H.P. = K\ (d^2C\ Nn)$$

in which K varies from 3 to 3.5 for motorcycles and from 4.5 to 5 for all other motor vehicles; *d* is the bore in m, C the stroke in m, N the number of cylinders and *n* the number of revolutions per minute.

Provisional rating can be made with $K = 3$ and $n = 1000$ for motorcycles and with $K = 4.5$ and $n = 1000$ for automobiles, subject to correction by closer examination.

France

France uses the formula

$$H.P. = K \times n \times D^2 \times L \times V$$

in which K is a variable, being 0.00020 for single-cylinder cars, 0.00017 for two-cylinder cars, 0.00015 for four-cylinder cars and 0.00013 for six or more cylinders. N is the number of cylinders, D the bore in cm, L the stroke in m and V the motor speed in revolutions per second.

Great Britain

Great Britain has adopted the American formula for inch measurements, namely

$$H.P. = D^2N : 2.5$$

in which D is the bore in British inches, N the number of cylinders and the divisor 2.5 a constant. The equivalent for metrical measurements is

$$\text{H.P.} = D^2N : 1613$$

in which D is the bore in mm (millimeters).

For taxation, the automobiles are divided in six classes, making the tax

up to 65 H.P. = £2 2s.
6.5 to 12 H.P. = £3 3s.
12 to 16 H.P. = £4 4s.
16 to 26 H.P. = £6 6s.
26 to 33 H.P. = £8 8s.
33 to 40 H.P. = £10 10s.
40 to 60 H.P. = £21
more than 60 H.P. = £42

Sweden

Sweden, according to Kungliga Automobil Klubben of Stockholm, uses

$$\text{H.P.} = \frac{z \times d^2 \times s \times n}{c}$$

in which z = number of cylinders, d = bore in cm, s = stroke in cm, n = r.p.m., c = 180,000 for two-cycle motors using either gasoline or kerosene, 220,000 for four-cycle gasoline motors and 240,000 for four-cycle kerosene motors.

Italy

Italy has for pleasure cars

$$\text{H.P.} = 0.0525 \times n \times D^2$$

in which 0.0525 is a constant, n the number of cylinders and D the bore in cm.

The tax on pleasure cars is (1 lire = 1 franc = 19.3 cents):

Up to 9 H.P. = 90 lire
9 to 12 H.P. = 140 lire
12 to 16 H.P. = 180 lire
16 to 24 H.P. = 220 lire
25 to 60 H.P. = 5 lire per H.P.
More than 60 H.P. = 500 lire

(For 25 to 60 H.P. the rate given is evidently wrong; should probably be 100 lire plus 5 lire per H.P.)

Public vehicles are taxed: For 4 seats 36 lire, for 10 seats 60 lire, for more than 10 seats 400 lire.

For commercial vehicles the constant of the formula is changed to 0.0350, and the taxation is one-third of the rates for pleasure cars.

Japan

Japan follows the formula devised by the Nippon Automobile Club:

$$\text{H.P.} = D^2 \times n : 3$$

Spain

Spain uses $\text{H.P.} = 0.0007 \times n \times d^2$, in which n is the number of cylinders and d the bore in mm.

Hungaria

Hungaria, according to the Kiralyi Magyar Automobil Club of Budapest, uses for gasoline vehicles:

$$\text{H.P.} = i \times d^2 : 20$$

in which d is bore in cm and i the number of cylinders. For electric vehicles the formula is

$$\text{H.P.} = K \times G : 8$$

in which G is the weight of vehicle fully loaded and K the number of kilometers covered in 1 hour on a level street.

Of interest in this connection is also the formula recently adopted for taxation purposes by the California State Motor Vehicle Dept.:

$$\text{H.P.} = D + DSN \times 0.224$$

in which D is bore in inches, S stroke in inches, N the number of cylinders. The special purpose of this formula is to get the power gained by long stroke represented in taxation, as reported in THE AUTOMOBILE of Dec. 10, page 1087.

Pennsylvania Has Systematic Registration

By George A. Quickel

UNDER the system of registration in force in the automobile division of the Pennsylvania State Highway Dept., devised and perfected by the Registrar, T. C. Boyd, it is possible to ascertain full particulars about motor vehicle registration in the state almost instantly upon application. An elaborate and economical system of card index has been established and cross references are maintained. The minuteness in detail in this respect can be seen in that fact that the index files contain 2,100 divisions of the alphabet. Having the bore of the motor, the department can always check up the horsepower given on the application.

Incorrect Applications Returned

When an application for license is received it is examined for possible errors, if such are found it is returned for correction; if not the applicant is assigned a registration number and also receives a number which is henceforth known in the books and records of the division. A cash book entry is made at the same time. The registration card is then typewritten in duplicate and the license tags are forwarded to the applicant by insured parcel post. The same number is used for the parcel post insurance as the license tag bears. The name and address of the applicant are required to be written three times, once on the package and twice on the insurance tag. By the use of stickers and carbon copies, a system has been devised which performs this triple inscription simultaneously.

Money to State Treasury

The money received with the application is sent to the state treasury daily through the state highway department auditor and the auditor general. A statement is issued daily by the automobile division and the cash is balanced.

Check on Addresses

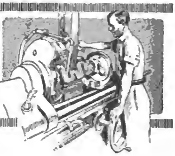
An innovation to be introduced in handling next year's applications will do away with the necessity of addressing envelopes containing the license cards. The name and address of the applicant, to whom the license card is granted, will be so written that the card can be sent in an outlook envelope. This will serve as a check to the correctness of the name and address in the files of the automobile division. Thus, if the license card is delivered the file is thereby automatically proved to be right.

The growth of the industry in Pennsylvania is shown by the interesting figures compiled by the automobile division of the state highway department. From a total of nearly 11,000 registrations in 1906, the number had grown to 122,773 for the year 1914 up to October 1. This brings to a close a record breaking year, the number of registrations being three times those in 1910.

10,958 Cars in 1906

In 1906, the first year that automobiles were licensed under the state law, 10,958 cars brought in the sum of $42,460.42 was collected and it was considered that this was an enormous sum to be derived from such a source of income. On September 30 of the current year the records of the automobile division of the state highway department showed that $1,165,675 had been collected for the registering and licensing of all types of motor vehicles since January 1. This enormous sum practically doubles the figures of 1912, when the amount collected was $597,728.19. Prior to 1906 the automobile was a registration tax.

The Rostrum



A Continuous Carbon Remover

EDITOR THE AUTOMOBILE:—I was particularly interested in the letters published in a few recent numbers, where different motorists have expressed their experiences in the results obtained in removing carbon from the combustion chamber by running water through the air-intake of the carbureter. My experience over a period of 10 years is that water is the best carbon remover a motorist can use. Being so simple a process it is surprising that many many dollars are spent for other solutions, that are not one whit better.

The question now then arises: Why not prevent the formation, or at least accumulation of this carbon by a similar process? How? Why simply by saturating the in-going air with moisture. All motorists agree that the motor works and delivers more power at night and this has been at various times ascribed to the fact that there is more moisture in the atmosphere. Now then, how supply additional moisture? Through the simple process of passing the in-going air through water. Supposing a tube, with a somewhat bell shaped opening, faced forward just rear of the radiator. Air already heated by having passed over the warm tubes or surfaces of the radiator would be drawn and forced toward the rear end of the tube. Now then, the openings or opening of this tube would be under water, contained in a casing so adapted. The water in this casing could be held at a predetermined height by means of a float, etc., and could also be warm by reason of being taken from the water jackets. The air would bubble up through the water and would then be saturated with moisture and be ready to be taken into the carbureter to perform its usual function. In addition to the advantages just enumerated, by passing the air through the water as described, it would be further heated and all road-dust, etc., removed. Motorists strain the gasoline; why not the air? Analysis of the carbon in the combustion chamber shows the presence of a considerable amount of silica, evidently from the road dust.

Still other advantages would be, first by suitable cocks the water in the casing could be drained and water intake pipe to the casing being closed, the casing would be partly filled with a more volatile fluid, say half and half gasoline and ether, and thus facilitate starting in extreme cold weather. Further, by suitable piping this warm, moist air could be taken from the top of the casing and conducted to the intake pipe above the carbureter, after the manner of several economizers now on the market, and with a control on dash or steering wheel, the motorist could under certain conditions obtain still further economy.

Elizabethville, Pa. F. T. ROMBERGER, M. D.

—It is a question whether the addition of water in small amounts in the manner you suggest would remove carbon and it is also doubtful whether the trouble of the apparatus you have outlined would be justifiable. It is probably more satisfactory to remove the carbon periodically rather than continuously. Under normal conditions of operation carbon troubles are hardly of sufficient magnitude to justify the installation of such an apparatus.

Regarding your statement that moisture increases power we would say that although this is a popular impression it is erroneous. As far as increasing the power is concerned the water is just as inert as the nitrogen in the air. When combustion occurs, the water is dissociated into its elements, hydrogen and oxygen, and a certain amount of heat is absorbed by these gases during this process. When the temperature drops a certain amount, these two elements unite and give off the same amount of heat that they absorbed.

The idea that a motor develops more power in a moist atmosphere may be just an impression or it may be explained by other physical facts. For instance when the air is noticeably moist, so moist that certain motorists maintain that their cars are developing more power because of this moisture, it is generally the case that this day is cooler, therefore the motor takes in more air per stroke and with a rich carbureter adjustment it is quite possible that such a motor will give more power. Cooling is much improved on a damp day and a motor that has an insufficient cooling system will naturally give more power. Not only is the improved cooling due to the lower temperature, but the specific heat of the atmosphere is much higher because of the large amount of moisture carried by it and therefore the air is capable of carrying much more heat away from the radiator than when the air is dry.

Soak Cylinders in Kerosene

Editor THE AUTOMOBILE:—I have an air-cooled engine and wish to thoroughly clean it of carbon. Would it be possible to clean carbon out by putting cylinders into a pail of kerosene and leaving same for about a day? Thought possible this would be better than cleaning with tools as there are so many corners which are very difficult to reach and clean thoroughly.

New York City. A READER.

—As long as you are going to remove the cylinders it is best to first soak them in kerosene, as you suggest. This will not remove the carbon, probably, but will merely loosen it. It should be taken off by scraping with a soft, blunt metal tool such as a screw driver. It should not be hard to reach the corners when the cylinders are removed.

Believes in Neat Motor

Editor THE AUTOMOBILE:—Fig. 1 shows a motor design, submitted in the hope that some will agree and that those who do not will offer instructive criticism.

The crankshaft is mounted on two ball bearings, driving an overhead camshaft through spiral gears and vertical shaft, the latter having irreversible couplings, a helical gear near the lower end and spiral at the top for driving the commutator and fan. The commutator is advanced automatically and waterproofed. The fan gearing is protected from shock by a spring in the hub. The cylinders resting on the jacket and head and valve covers are held by studs from the crankcase. With the power plant carried by the main frame, the subframe is absent, and on removal of the side cover the connecting-rod bearings are got at easily without draining the oil. Exhaust and intake manifolds are one, bolted to the head, made tight by copper-asbestos gaskets. The carbureter gets hot air from a stove cast on the manifold, but draws the main supply through a tube from the combined filler and breather opening on the other side, thus heating the air and cooling the oil. Submerged, at the lower end of the vertical shaft, the oil pump connects to the back of the crankcase by a concealed pipe, thence by way of the dash to the hollow perforated camshaft, flowing on past the driving gears to splash troughs in the base and overflowing into the sump. Water connections for the thermo-syphon cooling system are interchangeable.

In the details, the fewer wrench sizes needed the better, even by using bolts larger than necessary, with all capscrews slotted for a screwdriver; copper-asbestos gaskets where possible, strainers in the gasoline and oil systems and the cylinders chamfered for easy piston replacement. Dimensions, say 3.25 by 5. An attempt has been made to design simply, accessibly and efficiently.

Los Angeles, Cal. A. K. Watcher.

Dead Gas Does Not Affect Compression

Editor The Automobile:—1—Is it possible to have the dead gas in the clearance of a gasoline engine lower than atmosphere at the end of exhaust stroke?

2—If it were at 15 pounds the square inch at the end of the exhaust stroke and the compression 60 pounds, would the gas drawn in be compressed to equal only 45 pounds, the other 15 pounds being a dead gas, and if it were not for the dead gas in the clearance, could the charge taken in be compressed still more?

DuShore, Pa. Allen Meehan.

—1—The pressure of the gas which remains in the cylinder when the exhaust valve closes may drop below atmosphere under just one condition. If the motor is running at a high speed with throttle wide open the gas will flow out into the exhaust pipe at a very high speed, so that when atmospheric pressure is reached the gas will still be flowing at a high speed with the result that the pressure of the gas will be slightly reduced the flow is stopped. This is entirely due to the inertia of the out-going gas and is aided by the shape of the exhaust pipe and the muffler.

2—No, all the gas in the cylinder is compressed the same amount whether it be fresh charge or burned gas. If there were no dead gas in the clearance no difference would be made in the pressure, but it would be possible under ordinary operating conditions to obtain a slightly larger charge and also more perfect running at slow speed would be obtained because there would be no dead gas to dilute the fresh charge coming in.

First American V-Eight

Editor The Automobile:—There seems to be a popular impression that the Cadillac company is building the first eight-cylinder car in the American market of American manufacture.

If my memory does not fail me, it was in 1906 or 1907 that Wm. Hewitt, manufacturer of the Hewitt truck, put out an eight-cylinder pleasure car with a two-speed planetary gearset at a price which I think was $3,500. The engine had V-cylinders similar to the De Dion eight.

A criticism I would like to make about many of the present day cars is concerning the placing of the emergency brake lever so far away that the driver has to lean forward a considerable distance to grasp it, thus making it practically useless in an emergency.

While on the subject of this lever I would like to add that I have a strong personal dislike for the prevalent thumb ratchet latch and infinitely prefer the old-fashioned ones worked by the palm of the hand.

New York City. A. H. W., Jr.

—You are right, this Hewitt eight was brought out in 1906.

Undoubtedly there are many cars with the emergency brake not as well located as it might be but this is not as serious as you think.

The term emergency brake is misleading. It is not, as a great many people think, a powerful brake which should be used when a quick stop is to be made, but it is an emergency brake in the sense that, should the service brake fail, the driver has another brake to fall back on. When a driver is called upon to make a quick stop he invariably uses the foot brake first because he can apply it quicker, second because it is a more natural movement, and third because it generally happens that it is a better brake.

A brake, whether service or emergency, should be able to lock the rear wheels and if the foot brake will do this there is no advantage in using the emergency. In making this statement it is realized that a car will not stop as quickly when the wheels are locked as when they are almost locked, but the point is that if a brake is capable of locking the wheels it is as powerful as a brake can be made and if the foot brake will do this then there is no advantage in using the emergency. In fact, it is bad driving to use the emergency brake, when in a tight corner, if the foot brake is in good condition, for the reason that in order to operate it one hand must be removed from the steering wheel and accidents are more often avoided by quick steering than quick stopping. Quick steering requires that both hands be on the wheel and that the body be braced for steering and not for tugging at the emergency lever.

Oil Causes Spark Plug Trouble

Editor The Automobile:—1—I have a model 31 Buick and would like to know whether I could use any other spark plug than an A. C. to advantage?

2—Will you tell me where the oil works out of front gears?

3—I have had to cut several sand blisters on my smooth tread tires. Will you advise me what to buy to close the cuts to keep them from getting larger?

Pine Bluff, Arkansas. E. W. Hightower.

—1—Any standard make of spark plug, including the A. C. should be satisfactory. If you are having trouble with your spark plugs get in touch with the maker as they should give satisfaction. Possibly your spark plug trouble is due to too much oil. If you will give us more details we can probably tell you what is wrong.

2—Most likely a new gasket is needed between the timing gear cover and the crankcase. It is possible also that the oil leaks from the pump shaft or crankshaft. There are packing glands to prevent oil leaks at these points and these should be tightened.

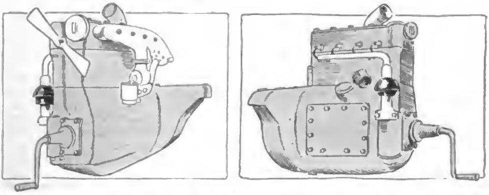


Fig. 1—Two views of block motor with combined intake and exhaust manifold and over head valves

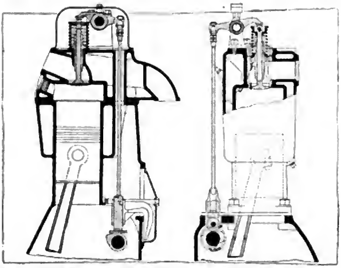


Fig. 2—Left—Section of Oldsmobile motor. Right—Section through Buick

3—There are several preparations on the market you might use, for filling these holes. Your supply dealer should be able to furnish you with a good one. You might also have these spots vulcanized.

Why Ford Motor Runs Fast

Editor THE AUTOMOBILE:—1—I am told that the Ford motor gets its power by speed or that it runs faster than other cars. Is this so?

2—Does it not get its power by having a low reduction gear. I would be much obliged for a good explanation on this matter.

3—I am told also that the Ford motor vibrates because it runs so fast?

4—Is it not because it is not machined as accurately as some of the higher-priced cars?

5—The argument was that it had to run faster than the Imperial or Case.

6—Does it run any faster to develop its power than any other of the same bore and stroke?

Page, N. Dak. JOHN SHANKS.

—1—The Ford motor does not run at a higher speed than other motors of this size, in fact many motors of this size operate at much higher speed. As you know, this motor has a bore and stroke of 3.75 by 4 inches and a motor with so small a bore naturally has reciprocating parts of less weight than a motor with a larger bore, therefore it is better adapted to higher speeds because the vibration depends, among other things, on the weight of the reciprocating parts, namely the pistons and connecting-rods. Also the length of the stroke has an effect on the maximum speed in that the piston speed with a short-stroke motor is not so high as it is on a long-stroke motor running the same number of revolutions per minute. The lower the piston speed, the less the wear on the pistons and cylinder surfaces, other things being equal.

The fact that the Ford motor does run faster than larger motors is not an evidence that it is overworked. It is simply good engineering practice based on well-founded theory and practical experience that a small motor should run faster than a large one, especially one with a large bore.

2—Since this motor is designed to run at a higher speed it must have a lower gear reduction. In one sense you might say that it gets its power by the use of the lower reduction, if by power you mean ability to climb hills, but this is true of all cars using motors of this size—the smaller the motor, the higher its speed and the lower the gear.

3—Other things being equal the greater the motor speed the greater the vibration and therefore it is natural that the Ford motor will vibrate more when driving the car at a certain speed than if it had a low-speed motor. The vibration however, is not excessive.

4—The question of accurate workmanship does not enter into the proposition to any great extent.

5—The revolutions per minute of these three motors at a car speed of 20 miles per hour are approximately: Case 25, 790; Ford, 813, and Imperial model 64, 840, since the wheel diameters and gear ratios are respectively: 34 inches and 4 to 1; 30 inches and 3.63 to 1; 32 inches and 4 to 1. According to the formula which was published recently in THE AUTOMOBILE, $M = \frac{S \times R \times 336}{D}$, where S = speed in miles per hour, R = gear ratio, D = diameter of wheel and M = speed of motor.

Therefore it is seen that the Ford is not an unusually high speed motor.

6—This question is partially answered by the preceding one. In Europe, the home of high-speed motors, a motor for a car of this size might run even 1,000 or 1,200 revolutions per minute at a car speed of 20 miles per hour.

Robe Attachment for Driver

Editor THE AUTOMOBILE:—Fig. 3 shows a sketch of a simple robe shield which enables me to tuck my auto robe closely down over my legs and feet and yet permits the free use of gear and brake pedals.

To make this robe shield, I took a piece of fairly stiff wire, bent an eye in each end, and then put two bends in the length of the wire so that the horizontal portion is about 8 inches from the floor of the car. With the eye-ends bent to lay flat on the floor boards, the shield can be easily screwed to the floor boards to suit the convenience of the user.

Bangor, Maine. FRED. H. CLIFFORD.

Construction of Olds and Buick Motors

Editor THE AUTOMOBILE:—Will you please illustrate the new Oldsmobile small four and Buick motors and describe their features of valve construction?

Birdgeport, Conn. S. E. D.

—Fig. 2 shows these two motors in section. The Oldsmobile is at the left. The valves are in the head which is detachable. The valves seat directly in the head and not in cages. The valve mechanism is fully inclosed. A mushroom type of cam follower is used.

The Buick also has overhead valves but the details are quite different from the Oldsmobile. The valves are carried in cages and the valve mechanism is not inclosed. The cam follower is a roller.

Questions on 1911 Lozier

Editor THE AUTOMOBILE:—1—I have a 1911-1912 Lozier, four-cylinder. It has a 5.375 by 6, bore and stroke. Can I use a Schebler 1 1-4 Model S carbureter with success?

2—I have been thinking of drilling into the exhaust pipe and connecting hot air to this carbureter or shall I connect hot water from the water jackets?

3—It has a multiple disk clutch with a hole drilled in the flywheel. Is this an oil hole? Does this clutch, which is all-metal, run in oil?

4—How do you tighten the clutch?

5—Describe the oiling system.

6—How fast can this car go, cut down? I have a racing sheet metal body weighing less than 100 pounds, tank and all. With the wind resistance cut down by putting on a wind cutter, similar to the one used by Burman in the Blitzen Benz, what speed can be made? One connecting rod has four holes drilled in it.

7—How many miles should I get on a gallon of gasoline?

Brockton, Mass. JAS. B. CURLEY.

—1—You will require a 1.75-inch carbureter on a motor of this size. The 1.25-inch carbureter you have will not do.

2—Either hot air or hot water are good and both are better. Do not drill a hole in the exhaust pipe, but fit an exhaust stove around the pipe. The hot air connections can be purchased from your supply dealer or from almost any carbureter company.

3—Your description is not very clear, but there is an oil plug in the clutch case which must be removed when the clutch is to be filled with oil. Ordinary cylinder oil should be used. All metal-to-metal clutches run in oil.

4—The clutch is adjusted by the collar just back of the clutch case. By turning it one way or the other the adjustment is tightened or loosened.

5—The oiling system used on the 1911 Lozier consisted of a mechanical oiler driven from the crankshaft which drew its oil from a large tank at the side of the car. Oil was delivered from the oiler to sight feeds on the dash, from whence it ran to the motor. At high speeds the band pump is also used, this pump drawing oil direct from the large oil tank and injecting it into the motor.

6—Eighty miles an hour is a fair estimate although under very favorable conditions you might get more. In order to reach this speed you will probably require a higher gear ratio.

The fact that only one connecting-rod is drilled will throw the motor out of balance at high speeds. Either all should be drilled, or none. The connecting-rods should be brought to exactly the same weight and so should the pistons.

7—The mileage you will obtain will vary roughly from 6 to 11 miles depending on the condition of your car, the adjustment of the carbureter, topography of the country, the speed and frequency of stops, etc.

Why Motor Starts Hard

Editor The Automobile:—I have a friend who has a 1913 Ford model T who finds it impossible to start the motor or cause the vibrator to buzz by switching on the ignition with switch lever turned to the battery side of coil and moving the spark lever from one end of its arc to the other which does not close the contact at commutator to any cylinder to be fired, as the engine seems to stop with no cylinder under compression, but by giving the crank a quarter of a turn it will hit all right. The car is fitted with a master vibrator and four-unit coil. The timing is geared correctly in mesh by prickpunch marks as assembled at factory. The commutator is set according to Ford instruction book. Otherwise the motor runs very well. Can you give me the reason why we cannot close the contact at timer with spark lever, when the motor is at rest?

Piermont, N. H. Burton M. Flint.

—You should be able to obtain a spark in some cylinder no matter what the position in which the motor stops, providing you move the spark lever from one end of the quadrant to the other. The fact that you do not would indicate that the advancing mechanism was binding at some point. This seems to be the only explanation and we believe that if you examine the linkage carefully you will find that there is something that prevents the spark lever from rotating the timer through the full arc.

Short-Circuit Makes Miss

Editor The Automobile:—1—A Ford car cranked up to firing position on number 1 cylinder, fires on number 1 nicely and also leaks electricity on to numbers 2 and 3, so it will jump a gap of from 1-64 to 1-32-inch. The coil box and commutator wires were changed, but did not do it any good. What was the cause?

2—What is the best moderate priced gasoline tank pump obtainable, and what do they cost?

Lyndonville, Vt. H. O. Allen.

—1—Possibly the insulation in the commutator is defective. Examine it carefully. You state that the coil box and commutator wires were changed, but it is not clear whether you mean that new wires with good insulation were substituted or the old wires were simply connected differently so that it could be determined whether the trouble was in the wiring or not.

Run the motor in the dark and see if you cannot discover a spark at some point. Also examine all insulation carefully, as some of it may be defective. Are the high-tension wires close together so that the spark might jump from one to the other if the insulation were poor? Possibly there is a short-circuit at the terminals in the dash.

2—It is against our policy to answer questions of this kind. We cannot give information of this character and be fair to all concerned. We would need extensive practical experience with all gasoline pumps if we did. We cannot take others' opinions.

To Determine Lamp Consumption

Editor The Automobile:—1—What is the formula for finding the amperes consumed in a lighting system where candle power and voltage are given?

2—Why do electric light bulbs for automobiles go by candle power instead of watts?

3—Is the following alternating or direct: Storage battery current; low-tension magneto current before reaching coil, high-tension magneto current before reaching coil.

Brooklyn, N. Y. Leo Schornstein.

—1—A simple rule to use when the watt-hour consumption of the lamp bulb is known is to use the following: Headlights require 1 watt per candle power and side and tail lamps 1.4 watts per candlepower. The ordinary 6-volt, 16-candlepower tungsten-filament head lamp consumes 240 watts which result is arrived at by multiplying the candlepower 16 by the voltage 6 by the amperage 2.5. In the same way the watt-hour consumption of a 6-volt, 6 candlepower side lamp is 744, since it consumes 1.4 amperes (6 x 1.4 x 1.4 x 6).

2—Apparently there is no good reason for rating automobile lamp bulbs according to the candlepower instead of the watt-hour consumption except that the automobile owner is more interested in the former than the latter, although with a given lamp efficiency one term is just as descriptive as the other, there being a definite relation between the two.

3—Storage battery current is direct and magneto current alternating, whether the magneto be a so-called high-tension or low-tension type. There is no difference in principle between these two, the difference is in the placing of the component parts. In the high-tension magneto the coil is situated on the armature and the armature winding and the low-tension winding of the coil are one and the same, but there is no difference in the character of the current such as you suggest by your question.

The high-tension current which goes to the spark plugs is also an alternating current although the current to a given spark plug is always in the same direction. If the firing order is 1, 2, 4, 3, then, the current flows in one direction to cylinders 1 and 4, and reverses itself when going to cylinders 2 and 3.

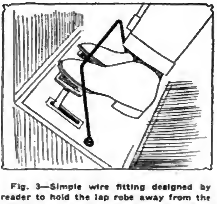


Fig. 3—Simple wire fitting designed by reader to hold the lap robe away from the feet, leaving them free to operate the pedals

The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XXXII Thursday, January 21, 1915 No. 3

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
231-241 West 39th Street, New York City

BRANCH OFFICES
Chicago—910 South Michigan Avenue Detroit—505 Free Press Building
Boston—1035 Old South Building Cleveland—516-517 Swetland Building

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

ADVERTISING
T. B. Van Alstyne, Advertising Manager
W. I. Ralph B. Mathewson Louis R. Smith
Howard L. Spohn H. H. Gill James P. Hunting
F. B. Barnett, Cleveland C. H. Gurnett, Chicago Chas. Anthony, Detroit
Guy W. Motz, Cleveland F. J. Robinson, Chicago

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Initiative

FROM time immemorial it has been a habit of the world to distrust innovation, for its own sake; to refuse to see the good in anything new until the minority of progressive men forced the inert majority's attention. But sometimes, when once started upon an appreciation of this kind, when once accustomed to accepting new ideas, the very doing so becomes a habit. A man who has several times in quick succession had his natural inertness overcome, seems actually to call out for a continuance of the process and to distrust absence of novelty.

In the automobile world the public has had prejudice after prejudice broken down till the car has become a part of almost every man's daily life. Meanwhile engineers have seen cherished notions destroyed and hitherto impossible mechanisms performing constant marvels. To a point this is good, if progress of any kind is desirable, but it has a certain danger, for the lust for new worlds to conquer by the engineer, and the ready acceptance of anything new by the public, combine to make easy the development of really new ideas at such a rate as defies any proper consideration of them. To strike a proper balance between desirable initiative and discontent with things we know and trust is always difficult, but initiative is only valuable when it is genuine and discontent is only excusable when it is reasonable. Automobile users and makers are, like other people, apt sometimes to fail in a proper gauging of this balance, which idea is suggested at the moment by a tendency to neglect some points which are really worthy of initiative attention, and to let their progressive ambition loose upon other points which might well wait.

Thermal Efficiency

CHEAP gasoline has caused one of the fundamental shortcomings of the automobile to be neglected by users and manufacturers alike, for even in the commercial field where the matter is far more important the amount of work that we get from each gallon of fuel consumed is lamentably small. It is small all through, too, small in the motor, lessened in the transmission and lessened far more in getting from the axle to the road. In preparing a racing car for the track or for the road a great deal of time is spent in overhauling the running gear of the chassis, in freeing the shafts in gearbox and axle, in seeing that the ball races in the front and rear road wheels turn with the minimum of effort, and so forth. Often this process alone, without any tuning of the motor will result in quite considerable increase of speed; showing clearly the amount of power that ordinarily is thrown away in the bearings. And all this power has to be paid for in dollars and cents; it easily may amount to quite a sum when figured over a year's mileage. Things have improved slowly, the case is no longer as bad as it was once upon a time, but there has never been any concerted concentration of effort towards obtaining higher overall efficiency in the every-day automobile, nor has the user demanded better results. It is a boon of the future, is the really low-cost-of-running car, and initiative given to this end is given worthily with good promise of satisfactory results.

Cheaper Fuels

IT has become a habit to look forward to the day when cheaper fuels will be available, and their coming is often regarded as a certainty, but is it? The tendency is surely the other way, and though we may hope for, and may even make great efforts to produce some new liquid that will replace gasoline, the possibility of so doing remains no more than possibility. On the other hand, there is certainty that, if we would take the trouble, we could get vastly more work out of the gasoline we have and shall continue to have for many years to come. Steam engineers have never, in a century of development, been satisfied with the thermal efficiency of their boilers and engines. There is no more reason for automobile men to be content with the uneconomical nature which their product assumes when viewed from the first principles of mechanics.

All through the chassis there is work to be done, from the carbureter that makes the gas to the tire that conveys the effort to the road and the body lines that facilitate the passage of the car through the atmosphere.

Government Buys Up Australian Trucks

Industrial Firms Replacing Lost Equipment with Anything to Meet Requirements—Many Light Delivery Cars in Use—Passenger Car Market Is Improved

SYDNEY, AUSTRALIA, Dec. 10—Every truck suitable for war conditions in Australia has been bought up by the government under compulsory orders. In New South Wales and Victoria 160 have been secured and it is expected that 100 will be obtained from the other states, making a total of 260. There is not a 3-ton truck available in Australia today, and industrial firms that have lost their trucks are purchasing anything to meet their requirements.

The motor truck industry in Australia is growing as rapidly as the pleasure vehicle. A large number of light delivery vehicles mounted on Ford, Overland, Buick and Studebaker chassis are being used for city and suburban delivery. They have a load capacity of 500 pounds. Business interests are rapidly discovering the utility of such vehicles. In Melbourne a number of three-wheel German vehicles are in use. Many Australian agents are today seriously considering the advisability of light delivery trucks of American make to meet these various requirements.

The passenger car industry in Australia is meeting with a decidedly improved market at present. When war broke out sales completely slumped but today the industry is recovering and conditions are fairly good with the exception of South Australia. The whole of this country, at the present time, is thriving on a credit system, in other words, everybody is trading on credit, and it is difficult to say how long people can endure this strain. The commonwealth government, which controls the affairs of the country, is short $65,000,000, and has started a revival of the import tariff. The tariff on motor cars from Great Britain remains unaltered but there is a 5 per cent. advance on chassis imported from foreign countries, including the United States. Hoods, wheels, etc., have risen to 45 per cent., an increase of 5 per cent. against the foreigner. The duty on tires from Great Britain has risen from 29 cents per pound weight to 37; and that on foreign made tires from 37 cents per pound to 50. There is an increase in duty on gasoline of 1-2 cent per gallon, the duty now being 2 cents per gallon against the foreigner.

The whole of the motor trade in this country is glad that the tariff on automobile bodies remains unaltered because otherwise any increase on the body would mean that the chassis would be imported and the bodies manufactured locally. At present there is not a firm in Australia that could start body building.

René Thomas to Race at Indianapolis

INDIANAPOLIS, IND., Jan. 20—*Special Telegram*—René Thomas, winner of the 500-mile race in 1914, has cabled the management of the Indianapolis Speedway that he will again take part in the classic this year. Thomas did not specify what car he will drive.

Reo Truck Assets $1,028,312.26

LANSING, MICH., Jan. 18—The balance sheet of the Reo Motor Truck Co., for the fiscal year ending Aug. 31, 1914, shows assets totaling $1,028,312.26.

The current assets total $742,669.04, in which is included cash on hand and in the banks, plus interest, the total being $202,006.79; notes receivable and accrued interest thereon $10,542.65; accounts receivable from the Reo Motor Car Co., $62,637.20; inventories, $339,364.13; and unexpired insurance, $1,876.24.

The capital assets aggregate $185,072.41, which includes land and building valued at $88,520.38; office furniture and factory equipment is recorded at $77,443; patterns, dies, jigs and tools, $18,431.60; patents and goodwill are valued at $250,000.

The current liabilities total $149,429.19. The capital assets total $1,028,312.26 which includes capital stock issued, $937,250, and surplus of $91,462.26.

N. Y. Automobile Fines Go to State

ALBANY, N. Y., Jan. 18—Secretary of State Hugo states that all fines collected for violations of local ordinances regulating the speed of motor vehicles in cities of the first-class must be turned over to the State treasurer.

SYRACUSE, N. Y., Jan. 15—For the 6 months ending December 31, the sales by the Franklin Automobile Co., Syracuse, increased 54 per cent. over the previous 6 months, while sales for the 12 months ending December 31 increased 60 per cent. over the sales the previous 12 months.

The total sales in 1914 exceeded the sales of any 12 months in the company's history, and December was the largest month the company ever had. The Franklin factory has been on full time continuously and beginning with January the output was increased 30 per cent. over 1914.

NEW YORK CITY, Jan. 15—The price of gasoline was reduced 1 cent today by the Standard Oil Co. Garages in the city are now receiving gasoline in sealed steel tanks at 12 cents a gallon. The new consumers' price is 14 cents.

For a Motor Transportation Army Reserve

WASHINGTON, D. C., Jan. 13—Lindley M. Garrison, Secretary of War, has made his report to the President on the operations of that department during the past year. Reporting on the motor transportation facilities of the U. S. army, he states: "The universal utilization of motor transportation in the present war has vastly increased the mobility of armies. It is necessary that we keep abreast of the times in utilizing motor vehicles for army transportation. It might be well worth while to devise ways and means of organizing into a volunteer motor transportation reserve the motor vehicles adaptable to military use now in the hands of private citizens."

WASHINGTON, D. C., Jan. 16—During a recent hearing before the senate committee on military affairs on a bill submitted by the war department contemplating the acquisition of motor cars and other motor transportation facilities by the army in time of war, some surprise was manifested by some members of the committee that there was already no general statute in existence that gives the military authorities power to take over property of this kind in case of emergency, and it seemed to be regarded as necessary to have such a law.

The war department is engaged in working out the details of a scheme, as contemplated in the proposed bill, which includes the preparation of a list of owners of motor vehicles to the end that there may be expeditious negotiations for their use in time of war. However, some familiar with conditions in this country are inclined to a belief that an effort in this direction amounts to time wasted.

It is likely the matter will receive much attention when Congress takes up the subject.

Metropolitan S. A. E. to Discuss War

NEW YORK CITY, Jan. 20—The Metropolitan section of the Society of Automobile Engineers will be addressed Thursday, January 28, on the foreign motor car situation, by A. Ludlow Clayden, who has recently arived from Great Britain. The meeting will take place at the Automobile Club of America at 8 p. m.

NEW YORK CITY, Jan. 18—Roland R. Conklin, Stanley L. Conklin and Harold B. Weaver, all of 1 Wall street, this city, have formed the Gas-Electric Motorbus Corp., in Eddyville, N. Y. with a capital of $10,000. They will manufacture motorbuses.

Trucks Lead in November Exports

842 Commercial Vehicles and 776 Passenger Cars—France Is Largest Buyer

WASHINGTON, D. C., Jan. 15—Automobile and truck exports for November, 1914, amounted to $2,879,177, as compared with $1,782,227 in the same month in 1913. During the 11 months ended November the number of motor vehicles exported decreased from 24,500, valued at $24,877,037, in 1913, to 23,189, valued at $24,121,037, in 1914. A total of 1,618 motor vehicles was exported in November, 1914, 842 of them being commercial vehicles and 776 being passenger cars. Last year for the same period, 1,771 motor vehicles were exported, 1,707 of them being passenger cars and only sixty-four being commercial vehicles.

Our biggest buyer was France with 695 cars. The United Kingdom was next with 404 cars. Both of these were increases over last year's purchases, France then having only bought eighty-seven and the United Kingdom, 321. These are the only two countries showing a gain in purchases from the United States.

One interesting point is brought out in the tire exports. Germany did not buy any tires, according to the tables, while England bought $100,970 worth, as compared with $32,375 in November, 1913. For the 11 months ending November, England purchased $1,275,925 worth of tires from the United States, showing another increase, the November, 1913 exports being $1,230,794. Tire exports dropped from $3,615,214 to $3,014,220 for the 11 months ending November. November, 1914, tire exports were $210,308 as compared with $134,083.

Rubber Shipments on the Way

NEW YORK CITY, Jan. 15—Permits have been granted by the English government to the United States Rubber Co. to resume the shipments of plantation grades of crude rubber from London to this city at an early date, the necessary bond having been filed, and other requirements in connection with the terms for lifting the embargo having been complied with.

Receivers of crude rubber in Para and Manaos have arranged with the Federal government for a loan, with rubber as collateral. An original deposit of $915,000 had been made with the Bank of Brazil. The plan calls for further deposits, but the cables state that, as the terms are indefinite, the holders of rubber are already becoming nervous, and are inviting bids for their supplies.

This action, it is explained, was taken with a view to sustaining the price of the Brazilian product, against the time that the embargo on plantation grades would be lifted by the English government. Recently a steamer from Brazil discharged a cargo of 1,300 tons of crude rubber here. Another is due January 16, which has 1,100 tons on board, and still another left Para January 13 with 531 tons, which amount it is expected will be increased to at least 1,000 tons at Manaos.

The Goodyear Tire & Rubber Co., Akron, O., which was not inconvenienced by the embargo, having anticipated possible disturbances owing to the war by carrying larger stocks than usual, states that the factory production for November was 20 per cent. greater than last November, and the factory production for December was 33 per cent. greater than last December. During the embargo the rubber has been coming into Canada and stored in Toronto. The company states it has more than 1,000 tons of crude plantation rubber in storage there.

A cable has been received by the B. F. Goodrich Co. stating that the first shipment of East India plantation rubber from England since the embargo went into effect would leave Liverpool on the Lusitania January 16.

To Reorganize Sphinx Motor Car Co.

YORK, PA., Jan. 15—The Sphinx Motor Car Co., York, Pa., which started operations during the latter part of September last, will be reorganized, which will bring into the concern considerable New York City capital. This action will be taken at a meeting of the directors to be held within the next week. The stock of three Lancaster men, who have been identified with the company since its organization, will be acquired by representatives of several New York banks. The reorganization will mean a big increase in the output of the York factory and the putting on of additional employes.

The capitalization of the company, which is $100,000, will

Exports and Imports of Cars, Parts and Tires for November and 11 Previous Months

	November				11 months ending November			
	1913		1914		1913		1914	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles:								
Commercial	64	$105,501	842	$2,244,518	921	$1,586,147	2,151	$5,598,027
Passenger	1,707	1,676,726	776	634,659	23,579	23,291,160	21,038	18,523,014
Total	1,771	$1,782,227	1,618	$2,879,177	24,500	$24,877,307	23,189	$24,121,037
Parts of (not including engines and tires)	.....	$552,812	......	$352,567	......	$5,730,074	......	$5,208,090
Total automobiles and parts of	.....	$2,335,039	......	$3,231,744	......	$30,607,381	......	$29,329,127
BY COUNTRIES								
Automobiles:								
France	87	$63,641	695	$1,714,145	801	$609,731	1,847	$2,510,830
Germany	69	35,827	......	....	959	811,293	1,063	799,552
Italy	25	17,899	2	8,360	302	259,079	235	160,058
United Kingdom	321	297,771	404	683,496	4,504	3,482,301	5,949	5,794,504
Other Europe	121	80,246	22	24,256	1,686	1,435,495	2,758	3,381,664
Canada	266	396,753	105	133,103	5,824	7,870,086	4,086	5,158,081
Mexico	14	24,161	8	14,300	213	386,894	81	101,684
West Indies and Bermuda	50	48,058	84	63,004	455	445,596	550	457,346
South America	203	218,930	100	47,380	2,474	2,773,140	1,063	822,884
British Oceania	295	269,941	115	113,638	3,069	2,855,330	3,190	2,732,850
Asia and other Oceania	229	244,120	67	69,428	2,230	2,218,897	1,362	1,309,764
Other countries	91	84,880	16	8,067	1,983	1,729,465	1,005	891,820
Total	1,771	$1,782,227	1,618	$2,879,177	24,500	$24,877,307	23,189	$24,121,037
Tires for automobiles:								
Belgium	.....	$112	......	....	......	$99,061	......	$301
Germany	.....	....	......	....	......	425,773	......	81,917
England	.....	32,375	......	$100,970	......	1,230,794	......	1,275,925
Canada	.....	32,772	......	19,408	......	1,090,057	......	852,473
Mexico	.....	9,659	......	10,283	......	143,322	......	70,240
Philippine Islands	.....	17,750	......	15,559	......	129,007	......	139,869
Other countries	.....	41,415	......	64,088	......	497,200	......	593,495
Total	.....	$134,083	......	$210,308	.....	$3,615,214	......	$3,014,220
IMPORTS								
Automobiles:								
France	16	$40,708	4	$16,289	174	$410,980	64	$134,493
Germany	2	5,200	1	1,571	80	211,131	12	21,979
Italy	6	6,426	39	38,812	80	143,799	106	115,718
United Kingdom	6	15,684	9	18,837	48	144,677	55	137,306
Other countries	7	9,755	9	6,138	72	150,631	43	45,237
Total	37	$77,773	62	$81,647	454	$1,061,218	280	$454,733

Automobile Securities Quotations

NEW YORK CITY, Jan. 19—Automobile and allied stocks, following their good showing of a week ago revealed even greater strength during the past 7 days. As a matter of fact the whole market showed a much stronger tone. The gains of the automobile stocks are the logical results of the increased business of the manufacturers due to the European war and the largely increased buying by farmers who have profited by war conditions. Among the large gains to be noted during the week are: Firestone common, 17; General Motors common, 3, and preferred 2; Goodrich common, 5 and preferred 3 1-2; Goodyear common, 6; Kelly-Springfield common, 3 and second preferred, 5; Maxwell common, 1-2, first preferred 5 1-2 and second preferred, 3, a consistent gain; Miller Rubber, 8; Studebaker common, 5 and preferred 2 1-2; U. S. Rubber common, 5 1-2; Vacuum Oil, 4; Willys-Overland common, 1 and preferred 3.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	195	..	250	.	..
Ajax-Grieb Rubber Co. pfd	98	100	100	..	..
Aluminum Castings pfd	97	100	95	100	..
J. I. Case pfd	..	..	..	85	..
Chalmers Motor Company com	..	92	..	96½	..
Chalmers Motor Company pfd	93	95	..	93½	..
Electric Storage Battery Co	..	..	..	..	..
Firestone Tire & Rubber Co. com	246	..	365	370	+17
Firestone Tire & Rubber Co. pfd	104	..	109	111	— ½
Garford Company pfd	80	90	..	..	..
General Motors Company com	46	46½	87	88	+ 3
General Motors Company pfd	84½	86	94	95	+ 2
B. F. Goodrich Company com	21	21½	31	32	+ 5
B. F. Goodrich Company pfd	80½	82½	95½	96½	+ 3½
Goodyear Tire & Rubber Co. com	235	242	194	196	+ 6
Goodyear Tire & Rubber Co pfd	98	..	101	102	— ½
Gray & Davis, Inc., pfd	90	100	..	..	..
International Motor Co. com	..	5	..	1	..
International Motor Co. pfd	..	15	4	10	..
Kelly-Springfield Tire Co. com	..	..	78	79	+ 3
Kelly-Springfield Tire Co. 1st pfd	..	..	79	80	..
Kelly-Springfield Tire Co. 2nd pfd	..	.	100	102	+ 5
Lozier Motor Company com	..	15	..	..	..
Lozier Motor Company pfd	..	80	..	..	..
Maxwell Motor Company com	4	4½	18	19	+ ½
Maxwell Motor Company 1st pfd	26	27	53½	54½	+ 5½
Maxwell Motor Company 2nd pfd	7	7½	21	22	+ 3
Miller Rubber Company com	124	130	158	165	+ 8
Miller Rubber Company pfd	..	..	101	103	..
New Departure Mfg. Co. com	120	125	..	120	..
New Departure Mfg. Co. pfd	100	103	101	..	— 1
Packard Motor Car Co. com	..	..	..	100	..
Packard Motor Car Co. pfd	95	100	93	..	.
Peerless Motor Car Co. com	15	25	15	20	.
Peerless Motor Car Co. pfd	75	80	..	55	.
Pope Manufacturing Co. com	..	2	..	..	..
Pope Manufacturing Co. pfd	..	12	..	..	..
Portage Rubber Co. com	..	40	30	36	..
Portage Rubber Co. pfd	..	90	80	85	..
*Reo Motor Truck Company	6½	7½	11½	12½	— ½
*Reo Motor Car Company	14½	15½	25	26	+ ½
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	51½	52½	52½	53½	..
Stewart-Warner Speed. Corp. pfd	94	96	100	102	..
Studebaker Corporation com	23	25½	41	42	+ 5
Studebaker Corporation pfd	73½	76	94	95	+ 2½
Swinehart Tire & Rubber Co	69	71	69	71	..
Texas Company	..	..	133	134	..
U. S. Rubber Co. com	59½	59½	58	59	+ 5½
U. S. Rubber Co. pfd	102½	103	102	103	..
Vacuum Oil Company	199	202	200	202	+ 4
White Company pfd	105	110	108	110	..
Willys-Overland Co. com	61	63	87	89	+ 1
Willys-Overland Co pfd	88	91	93	95	+ 3

*Par value $10, all others $100 par value.

be materially increased with the change. The capacity of the plant now is about ten cars a week. As soon as the reorganization is effected this will be increased to eight cars a day. Orders are now on the book for 2,500 cars and dealers are being booked daily to handle the cars throughout the different parts of the country.

The retiring directors are: Howard Rohrer, J. B. Rohrer and Harry H. Bard, of Lancaster. The officers are: Theodore C. Aumen, Reading, president; J. B. Rohrer, secretary and treasurer; H. R. Averill, York, manager and director of sales; Farnet T. Gilliard, superintendent and engineer.

Willys Sells Gramm and Garford Interests

LIMA, O., Jan. 18—According to an announcement made January 17, John N. Willys has withdrawn from the Gramm Motor Truck Co. of Lima, which he gained control of several years ago by purchasing more than $500,000 of the $750,000 common stock of the corporation. The capital of the company is $1,250,000. Willys interests have also been disposed of in the Garford motor truck company, Elyria, O., and the Gramm and Garford agencies in Boston, New York and Philadelphia.

The Geiger-Jones Co. of Canton, widely known as industrial bankers, will be the dominant factor in the reorganization of the company. The banking company has acquired from Mr. Willys all of his interests and a meeting was held with the Lima stockholders consisting of D. C. Dunn, Henry Deisel, Sr., E. A. Macbeth, Henry Freuh, B. A. Gramm, J. E. Morris, D. W. Morris, D. F. O'Connor, F. X. Selber, C. L. Wall, C. W. Werst, Jonas Wohlgemuth and P. A. Kahle.

E. A. Williams, Jr., formerly in charge of the Lima plant for the Willys-Overland Co., will be president and general manager. The Gramm company will make and sell Gramm and Garford trucks at Lima.

Market Reports for the Week

NEW YORK CITY, Jan. 20—A number of important changes in oil and lubricants occurred in this week's market reports. Fish oil, Menhaden, closed at $0.41 at a gain of $0.03. Linseed oil experienced a gradual rise during the week, closing at $0.60, a gain of $0.06. The linseed oil market at Duluth continued easy with quiet trading. The Standard Oil Co., on Friday dropped the price of gasoline to $0.12 a gallon to the garage men and to $0.14 a gallon to the consumers. Cottonseed oil closed with a steadier tone, at a gain of $0.55 a barrel. The metal markets were fairly steady this week, tin being the only one with fluctuating prices. This metal went down to $33.00 and then up to $33.75, and closing at $33.65, a gain of $0.05. It is stated that shipments of tin from the Settlements this month will be close to 6,000 tons. Copper prices were steady during the week with prices holding strong around $0.13 3-4 a pound. The impression here in regard to the European question on copper, is that the recent sales of 25,000,000 pounds each reported to Russia and Japan, indicate the disposal of the contraband copper which has been captured by Great Britain since the war began; the balance of the captured supplies being divided between Great Britain and France. Domestic consumers have bought little or no copper in the last few days, and at no time have home purchases been heavy. Lake copper is still quite freely offered.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.14½	.14½	.14½	.14½	.16	.15	+.00½
Beams & Channels, 100 lbs.	1.21	1.21	1.21	1.21	1.21	1.21	......
Bessemer Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Copper, Elec., lb.	.13 9/20	.13½	.13½	.13½	.13¾	.13 7/10	+.06¼
Copper, Lake, lb.	.13½	.13½	.13½	.13½	.13¾	.13¾	+.00¼
Cottonseed Oil, bbl.	6.20	6.19	6.38	6.60	6.70	6.75	+.55
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.38	.38	.38	.38	.41	.41	+.03
Gasoline, Auto, bbl.	.13	.13	.12	.12	.12	.12	—.01
Lard Oil, prime	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	3.70	3.70	3.70	3.70	3.70	3.70	......
Linseed Oil	.54	.57	.60	.60	.60	.60	+06
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.55	.55	.55	.55	.55	.55	......
Petroleum, bbl., Pa., crude	1.50	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.71	.71	.71	.71	.71	.71	......
Rubber, Fine Up-River, Para	.64½	.63	.63	.62	.63	.62	—.02½
Silk, raw, Ital.	..	3.90	..	..	3.90	3.90	......
Silk, raw, Japan	..	3.52½	..	..	3.52½	3.55	+.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	33.60	33.25	33.00	33.25	33.75	33.65	+.05
Tire Scrap	.05	.05	.05	.05	.05	.05	......

Stewart-Warner Stock Is Listed

NEW YORK CITY, Jan. 15—The listing committee of the New York Curb Market Assn. has admitted to quotation the 100,000 shares of common stock of the Stewart-Warner Speedometer Corp. of the par value of $100. The Columbia Trust Co. is the transfer agent and the Brooklyn Trust Co. is the registrar for the stock.

The quarterly directors' meeting of the Stewart-Warner Speedometer Corp. will be held in Chicago shortly for action on the dividend due February 1.

Ten Broeck Tire to Resume Feb. 1

LOUISVILLE, KY., Jan. 18—The plant of the Ten Broeck Tire Co., this city, will resume operations February 1 with a full force of employees. According to President Lewman the plant has been closed since December 14 on account of the rubber embargo and the recent lifting of this will enable the company to ship a large supply which has been bought in London.

The stockholders of the company met this week at the factory and re-elected all the directors, as follows: Fred Haupt, Dr. F. L. Koontz, Dr. Henry E. Tuley, R. T. Durrett, W. N. Cox and H. L. Lewman.

To Urge Complete Reciprocity

Abolish Non-Resident Car Registration Under Federal Law, Says Adamson Bill

WASHINGTON, D. C., Jan. 15—Complete reciprocity under the Federal automobile law, and the abolishment of non-resident registration, is embodied in the Adamson measure, which will be brought before Congress at its next session. W. C. Adamson of Georgia, chairman of the Committee on Interstate and Foreign Commerce, is the author of the measure.

For some time the Adamson measure has rested in committee awaiting a decision by the United States Supreme Court on what has been known as the "Maryland Case," wherein a resident of the District of Columbia contended that he had the same right as any other vehicle owner to the use of Maryland roads so long as he had provided himself with an identification number from his home district.

The inference in Justice McReynolds' decision that there should be a national law covering the subject prompted the A. A. A. to take the matter up with Mr. Adamson and to back the measure up in every respect.

A few of the states, however, have shown opposition to the measure. State Road Commissioner Stevens, of New Jersey, has written to the New Jersey Congressman in Washington attacking the bill. He claims the passage of the bill would provide unusual privileges for touring motorists who have complied with the registration laws of their own states. Colonel Stevens claims that that state would be deprived of a large revenue from summer residents, besides being detrimental to the roads, as no income would be forthcoming from those tourists to make repairs.

Draft New Automobile Laws for Seven States

INDIANAPOLIS, IND., Jan. 18—A bill amending the Indiana state motor license law has been introduced in the Indiana legislature. It provides that the annual licenses shall be collected by county treasurers, instead of by the secretary of state, and the money turned over to the townships directly for road improvements. The amendment also would provide a uniform license of $5 a year with a provision an owner may hold the same license plates so long as he pays the annual fee. At present the license fees are graduated according to horsepower, except that electric vehicles are licensed uniformly at $5 a year.

JEFFERSON CITY, MO., Jan. 16—Senator Casey, of Kansas City, this week introduced in the Upper House of the Missouri General Assembly several amendments to the present automobile laws.

Among the provisions of the amendments are requirements for the muzzling of exhausts, regulating the sounding of signals in villages, towns and cities; prohibiting the erasure of numbers and manufacturers' brands from automobiles, tires and all other accessories. The bill also would regulate the licenses charged by municipalities, fixing the maximum that may be charged at not exceeding 50 per cent. of the state registration tax.

The bill further seeks the requirement of the opening of branch registration offices in St. Louis and Kansas City.

WILMINGTON, DEL., Jan. 18—Several bills have been introduced in the Delaware Legislature, now in session, the purpose of which is to amend the automobile law. Briefly, their provisions are as follows:

One requires the secretary of state to immediately revoke the license of an operator convicted for the third time in 6 months of operating a car while under the influence of liquor, magistrates being required to report all such convictions to the secretary of state. Under the present law there is no provision for a record of such convictions so as to know when the third occurs.

Requiring cars of non-resident owners of business cars regularly using the roads of the state to carry Delaware license tags. The court has held that under the present law this is not necessary, except where the cars are engaged in business within the state.

Authorizing the governor to appoint an automobile inspector for each county, during certain seasons, at $50 a month, to see that the law is complied with, the inspectors to have authority to make arrests.

OLYMPIA, WASH., Jan. 15—Increased fees for automobiles ranging from $5 to $17.50, depending upon the horsepower and weight of the car and the use to which it is put, are provided in a new automobile license law drafted by I. M. Howell, secretary of the State of Washington, and will be introduced at the legislature now in session.

A novel provision of the new law proposed transfers of all money gained to the permanent highway fund, to be used in maintenance of good roads, this amount to be distributed among the counties in proportion to the amount contributed in fees by the counties.

The bill also provides that number plates which are to be furnished by the state are to bear prominently the number of the year in which they expire.

Chauffeur's licenses are $2 a year, with the restriction that no person under the age of 21 is to be so licensed.

Aside from this measure, it is expected that an attempt may be made to limit the activities of passenger carrying motor buses. One proposal has been to place their operations under control of the public service commission.

PHOENIX, ARIZ., Jan. 15—That automobiles be taxed by weight or horsepower, as in California, is one of the recommendations included in the annual report of the Arizona Tax Commission. Under the present law, Arizona machines are assessed upon their sale value, and in addition an annual license tax is collected—$5 for machines under 25 horsepower, A. L. A. M. rating, and $10 on larger cars. The total general tax paid by automobile owners last year was $27,600, and the total license fees $33,860. This is 7 per cent. of the taxes collected on all classes of property. It is alleged by the commission that 75 per cent. of the wear and tear on roads and bridges is due to motor traffic.

ALBANY, N. Y., Jan. 18—Four million dollars is needed for maintenance work of the Department of Highways this year, according to the report submitted to the Legislature today by Commissioner J. N. Carlisle. He recommends that the motor license fees be readjusted on an equitable basis to produce the necessary funds, there being only $1,530,000 available for this work.

He also asks that the Legislature impose a mileage charge for each mile of road covered by motor buses, as they are run in competition with railroads and street car lines and pay only the same fees as pleasure vehicles.

The commissioner suggests that the Legislature study a system to impose a tax on foreign cars touring in the state, and recommends that it be collected by an additional charge on each gallon of gasoline purchased by foreign cars in the state.

A State Registration Bill for Texas

AUSTIN, TEX., Jan. 15—A bill providing for the state registration of automobiles and motorcycles and the payment of a license fee varying with the horsepower of the motor vehicle which would bring the state a revenue of fully $500,000 a year has been introduced in this Legislature by Representative McKnight of Ellis. With the exception of one section in regard to the disposition of the fees, the McKnight measure is almost identical with the New Mexico law, which is said to have proved entirely successful in that state.

The proposed law includes all motor vehicles except traction engines, road rollers, fire wagons and engines, police patrol wagons, ambulances and vehicles run only on rails. Every owner of a motor vehicle must register his machine annually with the secretary of state, accompanied by a fee assessed as follows: For less than 12 horsepower, $2; 12 horsepower and less than 20 horsepower, $4; 20 horsepower and less than 30 horsepower, $6; 30 horsepower and less than 40 horsepower, $8; 40 horsepower and less than 50 horsepower, $10; 50 horsepower or more, $12. Upon payment of the fee the owner is given free of cost a number plate. A different color will be adopted each year for this plate. The law also provides for a dealer's license fee of $12 per annum. The Texas law will not apply to non-residents until their machines remain in the state 60 days.

The enactment of this law would abolish the county automobile tax, but would permit cities and towns to require owners of automobiles to register their state numbers, and to charge them a fee of 50 cents per annum. Upon the transfer or sale of a motor vehicle, the vendor shall notify the secretary of state, giving the name and address of the purchaser, who shall pay a fee of

$1, which permits him to use the same license and number until expiration.

The law would prohibit the owner of a car from allowing a person under 14 years of age from operating the machine, providing a fine of from $25 to $1,000, or imprisonment from 30 to 90 days, or both, for violation of this clause, and also of the provision prohibiting a person driving a car while intoxicated. The same penalties are provided for operating without a number or license, or violating any of the traffic rules set forth, including regulations regarding head and tail lights, adequate brakes, and passing other motor vehicles and animals. All licenses issued under the provisions of laws heretofore enacted are extended, without further application or payment of additional fees, to Dec. 31, 1916. The McKnight measure also exempts motor vehicles used exclusively on mail lines, from securing a license, but subjects the owners and operators to all of the other provisions of the act.

Non-Fluid Oil Prices Reduced

NEW YORK CITY, Jan. 17—The New York and New Jersey Lubricant Co., this city, has reduced the prices on Non-Fluid oil. The reductions, which affect the consumers' list, are as follows:

	New prices	Former prices	
3-lb. cans	$0.60 each	$0.75	$0.20 per lb.
5-lb. "	1.00 "	1.25	.20 per lb.
10-lb. "	1.75 "	2.00	.17½ per lb.
20-lb. "	3.00 "	3.50	.15 per lb.
50-lb. "	7.00 "	7.50	.14 per lb.

Krit Sale Set for Feb. 5

DETROIT, MICH., Jan. 19—At the first meeting of the creditors of the Krit Motor Car Co. and the Krit Sales Co., which was held yesterday, January 18, Frank W. Blair of the Union Trust Co. was appointed trustee for the former company and Harry Lansdale for the latter. February 5 has been set as the date for the sale of both companies.

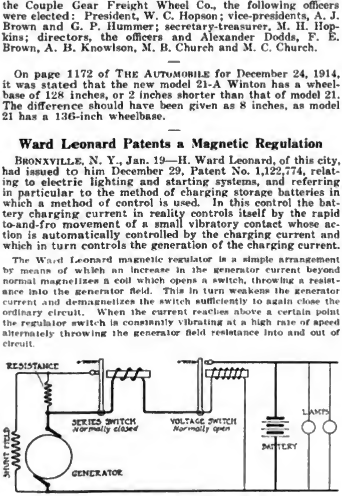
GRAND RAPIDS, MICH., Jan. 15—At the annual meeting of the Couple Gear Freight Wheel Co., the following officers were elected: President, W. C. Hopson; vice-presidents, A. J. Brown and G. P. Hummer; secretary-treasurer, M. H. Hopkins; directors, the officers and Alexander Dodds, F. E. Brown, A. B. Knowlson, M. B. Church and M. C. Church.

On page 1172 of THE AUTOMOBILE for December 24, 1914, it was stated that the new model 21-A Winton has a wheelbase of 128 inches, or 2 inches shorter than that of model 21. The difference should have been given as 8 inches, as model 21 has a 136-inch wheelbase.

Ward Leonard Patents a Magnetic Regulation

BRONXVILLE, N. Y., Jan. 19—H. Ward Leonard, of this city, had issued to him December 29, Patent No. 1,122,774, relating to electric lighting and starting systems, and referring in particular to the method of charging storage batteries in which a method of control is used. In this control the battery charging current in reality controls itself by the rapid to-and-fro movement of a small vibratory contact whose action is automatically controlled by the charging current and which in turn controls the generation of the charging current.

The Ward Leonard magnetic regulator is a simple arrangement by means of which an increase in the generator current beyond normal magnetizes a coil which opens a switch, throwing a resistance into the generator field. This in turn weakens the generator current and demagnetizes the switch sufficiently to again close the ordinary circuit. When the current reaches above a certain point the regulator switch is constantly vibrating at a high rate of speed alternately throwing the generator field resistance into and out of circuit.



Ward Leonard patent automatic control system for storage battery current for electric starting and lighting

Chicago Show Space All Sold

Over 100 Applicants Fail to Secure Quarters—11 More Car Makes Than at New York

CHICAGO, ILL., Jan. 18—The fifteenth Chicago national automobile show will open on Saturday, Jan. 23, and will close January 29. As in previous years the show will be held in the three largest exhibition buildings in this city, namely the Coliseum, the Coliseum Annex and the First Regiment Armory. The Chicago show promises to eclipse the fourteen exhibitions of a similar nature held in this city.

The exhibits have been assigned to the following spaces: Gasoline passenger cars on the main floors of the Coliseum, the Annex and the Armory, and in the basement of the Coliseum; accessories in the Coliseum balcony and basement, Armory gallery and second floor of the Annex; and electric passenger cars along the center aisle of the main floor of the Armory. There will be no truck display. Every inch of floor-space has been sold and the disappointed applicants for space total more than 100.

In the gasoline vehicle section the following cars, not seen at the New York show, will be on display here: Abbott, Austin, Bartholomew, Buckeye, Crow, Elkhart, Paterson and Vixen. Chicago also will have an augmented cast of electrics, the American, Milburn and Woods having been added to the six makes exhibited in the east.

Nine makers of gasoline-driven cars, who had space at New York, will not be represented here. Their products bear the following trade names: Crawford, Cunningham, Malcolm, Fischer, Grant, Kline, Owen, Pilot and Reo. However, the new additions total eleven, so that this deflection will not spoil the record of the show.

Manager Miles has ordered a new set of scenery for the Chicago production. The Coliseum will be transformed this week by the decorators into an English garden.

More than 18,000 invitations have been mailed to the agents and garage men of the middle west and if the acceptance anywhere near approaches that of previous years, dealers will be prominent in the crowds that will throng the three buildings afternoon and night

Westinghouse Ford Electric Outfit at Chicago

NEW YORK CITY, Jan. 20—The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., will show a motor-generator and ignition outfit mounted on a Ford motor at the Chicago show. The unit is placed to the left of the motor and is driven by silent chain at 2.25 times engine speed.

The outfit includes storage battery, battery box, fan pulley extension, starter switch, lighting switch, double-lamp headlights, tail light, vertical ignition unit for replacing the Ford timer, and all the necessary wiring.

Cleveland Show Opens with 72 Exhibits

CLEVELAND, O., Jan. 16—Automobiles to the value of $2,000,000, and occupying every foot of an acre and a half of floorspace, and set in magnificent decorations, characterizes the Cleveland Automobile Show, which opened Saturday at Wigmore Coliseum, and will continue through the week. Without exception, the show exceeds all previous exhibits held in Cleveland. There are seventy-two exhibitors, forty showing accessories.

42,000 See Milwaukee Show

MILWAUKEE, WIS., Jan. 15—When Milwaukee's seventh annual show closed last night, officials of the Milwaukee Automobile Dealers' Association declared that it is the greatest financial success the promoters have ever experienced. An attendance of 42,000, compared with 36,000 at the 1914 show, resulted in bigger gate receipts than ever before, while the number of exhibitors showed an increase, resulting in larger receipts for show space.

On page 78 of THE AUTOMOBILE for December 31, the S. A. E. rating of the Hudson 54 is incorrectly given as 27.20. The correct rating is 40.8.

DETROIT, MICH., Jan. 14—The Hupp Motor Car Co. has established a factory school, where the employees will be taught to be more efficient. R. G. Blaine, son of Professor Blaine, of Belfast, Ireland, is in charge of the school. Two meetings will be held per week at which factory and outside experts will do the talking and demonstrating. Speaking about the school, manufacturing manager S. H. Humphrey said: "This mechanical school will be a big benefit to every man who attends. We teach them the principles of motor car construction, how to read blue prints, the functions of the different parts of the engine, their relation to each other, why it is necessary that each man sticks to his job and that we have no shirkers, and the result of shoddy work after the car is on the road"

Show New Trucks at Detroit

One New Passenger Car

DETROIT, MICH., Jan. 16—The fourteenth annual automobile show promoted by the Detroit Automobile Dealers' Assn. opened tonight. Two buildings are used, one for the commercial vehicles and the other devoted to the passenger cars, which occupy two floors. There are 203 cars and chassis on the three floors, divided up into 178 gasoline and twenty-five electrics. In the first of these two classes there are 119 passenger cars and fifteen passenger chassis; thirty commercial cars and thirteen chassis; one specially built gasoline war vehicle. Of the twenty-five electrics, nineteen were passenger cars and one a passenger car chassis; three were electric commercial vehicles and one a chassis and one an electric taxicab.

The J. C. Wilson Co., which only recently started to make trucks has added a worm driven model. It is a 1 1-2-ton vehicle identical otherwise in general construction with the double-chain driven model. The torque is taken by springs and the propulsion is also by springs while the total gear ratio is 7.7-1. The size of the front tires is 37 by 3 1-2 inches and the rear tires are 37 by 5 inches. The price is $1,800.

The Dominion truck which is shown for the first time at any show is made by the New Dominion Motors, Ltd., of Walkerville, Ont., and by the Dominion Motor Truck Co., which has just been organized in Detroit. It is in reality a combination truck and trailer having a Continental motor 4 1-2 by 5 1-2, Schebler carbureter and Atwater Kent ignition. The truck is $3,300.

The Denby Motor Truck Co., which has been making a 1,500-pound and a 2,000-pound truck, has added two models, one a 3,000-pound truck and the other a 4,000-pound model. Both use Continental 3 3-4 by 5 block, L-head cast motors, Stromberg carbureter, Eiseman ignition, Westinghouse starter and Kemco lighting. The wheelbase is 144 or 160 inches, this being optional. The 3,000-pound truck has front tires 34 by 3 1-2 and rear tires 36 by 6, while the 4,000-pound truck is equipped with tires 34 by 4 on the front wheels and 36 by 7 on the rear wheels, or 36 by 3½ dual. Russell axles are used on both models which also have left steering and center control. The price of model D or the 3,000-pound truck is $1,900 and model E, or the 4,000-pound model is listed at $2,100.

The International 1,000-pound truck made by the International Harvester Co. is new and lists at $1,150. It has two opposed L-head cylinders 4 1-2 by 5 and giving 20 horsepower. The wheelbase is 102 inches and 38 by 2 1-2 front tires along with 38 by 3 rear are used. Other specifications include a cone clutch, Heinze magneto and Holley carbureter.

In the passenger car list practically the only vehicle seen here which was not in New York or is not to be shown at Chicago is the little two passenger car built by the States Cycle Car Co., Detroit, which concern has been getting under way for some time and now is entering the selling field. The States car has a 2 3-8 by 4 four-cylinder motor with cylinder cast in a block and rated at 10-15 horsepower. The tread is 36 inches, wheelbase 90 inches and the wheels are wood, carrying 28 by 3 tires. Seats are side by side, drive on the left and control in the center. Gasoline tank is under the cowl. The price of the States equipped is $365.

A noticeable reduction in price is found in the R-C-H which though practically the same in general construction as it was is reduced from $900 to $775. Electric starting and lighting by the Ward Leonard system add $75 extra, making it $850.

The Storms electric passenger cars made by the Storms Electric Car Co., Detroit, are shown for the first time at any show. The roadster lists at $750 and the coupé at $950.

Another car which is shown for the first time at a show is the two-passenger Princess, made by the Princess Motor Car Co., of this city. With electric lighting and starting system it sells at $495, fully equipped. The motor is a four cylinder block 2 3-4 by 4, L-head. The carbureter is a Holley, the ignition Bosch. The transmission is a Warner selective sliding with three speeds forward. The wheelbase is 92 inches and the tread 44. The body is of the Renault type.

Two New Worm-Drive Mack Trucks

NEW YORK CITY, Jan. 20—The International Motor Co., this city, has brought out two overhead worm-drive Mack trucks of 1- and 2-ton capacity. Most prominent among the characteristics of the new Mack is its cab design. The hood, fenders and cab are all designed as a unit, of pressed steel, and have sweeping curves. The top is detachable.

The chassis itself is founded on a straight pressed steel frame, with integral spring horns and a substantial channel bumper in front.

The 4 by 5-inch cylinders are cast in pairs with valves on right; the pump and magneto are driven by a crossshaft in front of the motor; spark is fixed, although hand advance is obtainable; the motor has a sealed governor, set at 16 miles an hour; the wheels are wood with square spokes; tires are 36 by 4 single in front on the 2-tonner and 36 by 3½ on the 1-tonner, the rear tires being dual. Wheelbases are 144 or 162 inches.

The three-speed selective gearset and dry-disk clutch with twelve disks, are unit with the motor.

The rear axle is a Timken-David Brown, propulsion being through the springs. Three universals are used in the two-part driveshaft, an intermediate bearing being hung approximately halfway between the gearset and the axle to reduce the length of the shaft, thus eliminating any tendency to whip.

New International 1,500-Pound Truck

CHICAGO, ILL., Jan. 19—The International Harvester Co. of America has augmented its line of motor trucks by the addition of model E, a two-cylinder water-cooled type of 1,500 pounds capacity and 102-inch wheelbase. This model does not replace model M, the 1,000-pound truck from which it differs, among other things, in that it has a steel frame instead of wood and uses semi-elliptic springs in front instead of elliptic. An I-beam front axle is used as compared with buggy-type on model M. The body space is also larger as the driver's compartment has been brought forward.

Factory Miscellany

CLEVELAND 1914 Additions Cost $3,000,000—During 1914 more than $3,000,000 was spent in the erection of manufacturing buildings alone in Cleveland, O., and among the thirty-four concerns which have spent $20,000 or more there are five among them connected with the automobile industry: the Ford Motor Car Co. spent $350,000 on its plant at 11610 Euclid avenue, the Parish & Bingham Co. has a new building at 10601 Madison avenue which cost $120,000, the new plant of the Cleveland Metal Products Co. on Ivanhoe road cost $40,000, the Willard Storage Battery Co. plant at 280 East One Hundred and Thirty-first street is recorded at $30,000, and a second factory plant on Ivanhoe road for the Cleveland Metal Products Co. cost $20,000.

To Market Disc-Friction Clutch—The Lausen-Lawton Co., manufacturer of gasoline engines, DePere, Wis., is preparing to market a disc-friction clutch designed by C. A. Lawton.

Case Increases Force—Because of the increase in orders in the automobile department, the J. I. Case Threshing Machine Co., Racine, Wis., has added several hundred men to its payroll, which now stands at 2,100, compared with 2,400 in normal times. By the end of January the Case company expects to be able to return all of its former employes to work and have a payroll of at least 2,500.

U. S. Wheel Purchases Site—The U. S. Wheel & Tire Co. has purchased a site for a factory building at Rockton, Ill. The company was recently organized under the laws of South Dakota and will manufacture automobile wheels.

Davis Plant Being Rushed—The Davis Mfg. Co., Fifteenth avenue and Park street, Milwaukee, Wis., gasoline engines and light cars, has awarded all contracts for the erection and equipment of its new manufacturing plant at Fifty-seventh avenue and Mitchell street, in West Allis, Milwaukee county. Foundations were laid some time ago, and the work has now been resumed and is to be rushed so that occupancy may be taken in the spring.

A Million Fords by Aug. 1—With the completion of the 200,000-car schedule August 1, 1915, there will be one million Ford cars in operation. There are nearly 6,000 Ford dealers. The ratio of Ford owners as compared to owners of all motor cars is shown, for example, by California, Iowa and Florida, three extreme points in the Union. More than 50 per cent. of all the automobiles owned in these three states are Fords. There is a Ford dealer every ten miles in Iowa.

Hartford Pump Adds Equipment—The Hartford Tire Pump Co., Hartford, Wis., manufacturer of automobile tire pumps, is installing additional equipment, including an oxyacetylene welding and cutting unit.

Oakes Horn Plant Busy—The Beartone Mfg. Co., Berlin, Ont., is a Canadian branch factory of the Oakes Co., Indianapolis, Ind., manufacturing the Beartone horn. The Indianapolis concern recently received an order from a firm in England for 1,000 Beartone horns. It is the plan of the company to extend its operations into India, Spain and South America. According to Mr. Oakes, the export business can be obtained with little more effort than is required for local business. Payment for goods can be obtained just as quickly as in the local fields. Because of the export business, the Oakes plant at Division street and the Vandalia Railroad, Indianapolis, is working day and night. Adtional machinery has been installed.

The Automobile Calendar

Jan. 16-23	Cleveland, O., Show., Cleveland Automobile Show Co., F. H. Caley, Mgr.
Jan. 18-23	Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.
Jan. 20-28	Lancaster, Pa., Hiemenz Auditorium
Jan. 21-23	Santa Ana, Cal., Show.
Jan. 23-30	Montreal, Que., Show, Allen Line Liverpool Bldgs., Montreal Automobile Trade Assn., T. C. Kirby, Mgr.
Jan. 23-30	Portland, Ore., Show.
Jan. 23-30	Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 25-30	Fall River, Mass., Show.
Jan. 25-30	Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 28	New York City, S. A. E. Met. Section Meeting; Report Research Com. on Greases. Supplementary subject; Asphalt vs. Paraffin base lubricants.
Jan. 30-Feb. 6	Columbus, O., Show, Memorial Hall, Columbus Auto Club and Columbus Auto Trades Assn.
Jan. 30-Feb. 6	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Automobile Trade Assn.
Feb.	Portland, Ore., Show; Portland Auto Trade Assn.
Feb.	Tòledo, O., Show, Toledo Auto Show Co.
Feb. 1-6	Louisville, Ky., Show, Louisville Auto Dealers' Assn., First Regiment Armory.
Feb. 2-7	Kalamazoo, Mich., Show, Armory.
Feb. 4-6	Marinette, Mich., Show, Dealers Assns. of Marinette and Menominee.
Feb. 8-13	Toledo, O., Show, Terminal Bldg., Toledo Auto. Shows Co., H. W. Blevins.
Feb. 8-14	Kansas City, Mo., Show.
Feb. 8-14	Troy, N. Y., Show, Troy Auto. Dealers' Assn.
Feb. 9-12	Eau Claire, Wis., Eau Claire Auto Dealers' Assn.
Feb. 9-13	Peoria, Ill., Show, Peoria Auto & Motor Cycle Dealers.
Feb. 15	Fort Wayne, Ind., Show, Fort Wayne Auto Trade Assn.
Feb. 15-20	Grand Rapids, Mich., Show, Klingman Furniture Exposition Bldg., Grand Rapids *Herald;* C. L. Merriman.
Feb. 15-20	Omaha, Neb., Show, Auditorium, C. G. Powell.
Feb. 15-20	Bridgeport, Conn., Show, State Armory; B. B. Sterber.
Feb. 22	Newark, N. J., Light Car Club of N. J., Hillclimb at Teaneck.
Feb. 22	San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Feb. 22-27	New Haven, Conn., Show, Second Regiment Armory; W. N. Lindsay.
Feb. 22-28	South Bethlehem, Pa., Show, Coliseum; J. L. Elliott.
Feb. 23-27	Syracuse, N. Y., Show, Arena, Syracuse Motor Vehicle Trade Assn.
Feb. 23-27	Syracuse, N. Y., Show, Armory, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27	Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 25	New York City, S. A. E., Metropolitan Sec. Meeting; Report of Research Committee on Kerosene Carbureters Research Com. Report on Non-Electric Continuous-Torque Transmission.
Feb. 27	San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 3	Albany, N. Y., Associated Garages of America, General Convention.
Mar. 4-6	Springfield, Mass., Show; J. H. Graham.
Mar. 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13	New York City, Made In the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13	Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13	Canton, O., Show, Auditorium, Stark Co. Auto Show and Electrical Exposition.
Mar. 8-13	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., Two-mile Track Meet.
June 16	Chicago, Ill., Speedway, 500-Mile Race, Speedway Park Assn.
June 25	Sioux City, Ia., Track Meet.
July 4	Tacoma, Wash., Road Race.
Aug. 20-21	Elgin, Ill., Road Race.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

MANSFIELD Takes Over Wells Business—The entire business and factory of the R. C. Wells Mfg. Co., Fond du Lac, Wis., producing lighting, starting and ignition systems, has been purchased by R. H. Mansfield, for 14 years secretary of the Cutler-Hammer Mfg. Co., Milwaukee, Wis., maker of the Vulcan gearshift. Mr. Mansfield retires from the Cutler-Hammer Co. and has taken charge of the Fond du Lac plant. He has been identified with the electrical manufacturing business for 23 years. The Wells company was organized in 1911 and manufactures a large line of coils, generators, cranking devices and switches.

Miles Resigns from Stevens-Duryea—Duff Miles has resigned as purchasing agent of the Stevens-Duryea Co., Chicopee Falls, Mass.

Hobes Montreal Ford Manager—C. S. Hobes has been appointed manager of the Montreal branch of the Ford Motor Car Co. of Canada, Ltd.

Pope Joins Hupp Engineering Dept.—C. S. Pope has become a member of the engineering department of the Hupp Motor Car Co., Detroit, Mich.

Marshall Heads Dayton Inter-State—W. L. Marshall has been appointed general manager of the Twyman Motor Car Co., Dayton, O., agent for the Inter-State car.

Attleboro Club's Officers—The Attleboro, Mass., Automobile Assn. elected the following officers: H. Smart, president; W. K. Rounseville, vice-president, and Walter Kendall, secretary-treasurer.

New Manager for Electric—W. S. Jameson has been appointed manager of the Rauch & Lang electric branch in Boston, Mass., succeeding Mr. Boulden, who has joined the Chase Motor Truck Co.

Scott Heads Kansas City Association—Estel Scott, manager of the Kansas City, Mo., branch of the General Motors Truck Co., has been elected president of the Kansas City Motor Car Dealers' Association.

Shepler Overland Vice-President—At a recent board of directors meeting, H. L. Shepler was elected a vice-president of the Willys-Overland Co., Toledo, O. He will continue in charge of the production as in the past.

West, Portland King Manager—F. W. West, for the past 3 years manager for J. W. Leavitt & Co., Portland, Ore., has been made manager of the E. E. Gerlinger Motor Car Co., Portland, distributor of King cars.

Fitchburg Club's Election—At the annual meeting of the Fitchburg, Mass., Automobile Club the officers elected were as follows: Dr. D. S. Woodworth, president; F. H. Brown, vice-president; F. S. Suthergreson, secretary-treasurer.

Move's Headquarters in Detroit—John V. Move, who has been appointed assistant general sales manager of the Kelly-Springfield Tire Co., will have his headquarters in Detroit. Mr. Move was formerly with the Goodyear Tire & Rubber Co.

Switzer Joins Kelly-Springfield—Maurice L. Switzer has been selected as advertising manager of the Kelly-Springfield Tire Co., New York City. He will be located at the company's headquarters in that city, 229 West 57th street.

Drumpelmann Olds District Manager—W. J. Drumpelmann has been appointed district manager of the Olds Motor Works, with headquarters at the Lansing factory. E. A. Hart, D. E. Ford and F. A. Gross, formerly factory representatives, have been promoted to the positions of Central, Southwestern and Southern district managers, respectively.

Bay State Rejuvenation—The fate of the Bay State A. A. of Boston, Mass., one of the pioneer automobile clubs in the country, was settled at the annual meeting when it was voted to drop the membership fee to $3 from $10 and run the club more on a social basis. G. W. McNear was chosen president; J. J. McNamara, vice-president, and F. W. Swett, secretary-treasurer.

Brown Heads Mt. Pleasant Co.—The Mt. Pleasant Motor Co., Mt. Pleasant, Mich., has been organized to build the M. P. M. automobiles. N. J. Brown is president of the company, H. A. Sanford, vice-president; W. A. Kees, secretary, and Mayor Doud of Mt. Pleasant, treasurer. The designer of the car is L. J. Lampke. For the present a touring car only will be made, but later a runabout will also be placed on the market.

Bailey Heads Gearless Differential—The offices of the Gearless Differential Co., Detroit, Mich., have been moved to 864 Woodward avenue. The capital stock of the company has been increased from $50,000 to $75,000. At the annual meeting the following officers were elected: George D. Bailey, president; C. F. Ferguson, vice-president; R. O. Knight, secretary-treasurer. H. H. Bailey, George Stroh, A. MacLaren and John Schrag are the directors.

Garage and Dealers' Field

Auto Surplus Moves—The Auto Surplus Stock Syndicate has removed from 875 Seventh avenue, New York City, to 1657 Broadway.

Montreal's New Service Stations—The White Motor Car Co. will shortly construct a show room service station and garage in a prominent location on Phillips square in Montreal, Que. The McLaughlin Buick Co. will open a new service station with over 25,000 square feet at their disposal.

Remy Service for St. Louis—The Remy Electric Co. of Anderson, Ind., has opened a service station in St. Louis, Mo., which will be conducted by the Vehicle Top and Supply Co., 3414 Lindell avenue. This service station will carry a full line of Remy repair parts and will have a Remy factory mechanic in charge of all repair work.

Garages Combine in Hartford—The J. N. Macdonald Co. of Wethersfield and the Hartford Garage Co. of Hartford, Conn., have combined, and the business will hereafter be conducted from the old location of the latter concern at the corner of Allyn and High streets. The Macdonald company retains the presentation of the Velie and Allen cars and the Hartford Garage Co. the Monarch six.

Ajax-Grieb Moves in N. Y.—The Ajax-Grieb Rubber Co. has acquired quarters in the Ehret Bldg., Broadway, from Fifty-eighth street to Columbus Circle, New York City. The change in location of the Baker Motor Vehicle Co., which is moving to Central Park West and Sixty-first street, has made it possible for the Ajax-Grieb Co. to take on the store at 1796 Broadway, next to its present location.

Universal Oxygen Adds—The Universal Oxygen Co., Sheboygan, Wis., a producer of welding and cutting apparatus and tanked gas for such plants, has purchased the business and shop of the Wisconsin Welding & Cutting Co., 167 Barclay street, Milwaukee. The shop is to be enlarged at once. The Wisconsin company featured motor car repair work, and the policy will be unchanged under the new regime.

Recent Columbus Changes—The Little Garage and Machine Works is the name of a new garage and repair shop opened at 972 North High street, Columbus, O. The Westcott Motor Sales Co., managed by Foster & Fischer, Columbus agents for the Westcott, have moved from 560 East Mound street to the Spring Street Garage, 58 East Spring street. The Rogers Motor Car Co., agent for the Haynes, has moved from 115 North Wall street to 248 North Fourth street.

Two Milwaukee Companies Consolidate—The Milwaukee Motor Sales Co., Milwaukee, Wis., has been organized by J. C. Coxe, F. S. Durham and F. E. Bassett to take over the business of the Stanley Steamer Co. and the Burgett Auto Co., Milwaukee. The agency lines consolidated by the organization are Stanley steam car, Lewis VI and Detroiter, which the concern will represent in Wisconsin and upper Michigan. F. E. Bassett, manager of the company, was for two years manager of the Milwaukee branch of the J. I. Case T. M. Co., Racine, Wis.

Milwaukee Co. Opens New Dept.—The Geuder, Paeschke & Frey Co., Milwaukee, Wis., one of the oldest and largest enameling and stamping companies in the middle west, has opened a department specializing in motor car parts and stampings in sheet aluminum, metal, brass, sheet steel, copper and tin-plate. Special equipment is being installed for quantity production and a large output of fenders, hoods, housings, and pans, gas tanks, mufflers, clutch cases, drums, shells and other stamped parts is planned. The factory was established 33 years ago and covers 15 acres.

Without a Peer

V-Ray

SPARK PLUGS

V-Ray spark-plugs eliminate spark-plug overhead,— Absolutely.

Do yourself, and your motor — a favor. Say "V-Ray" next time

Always Everywhere $1

The Good Work You Do Today Increases Your Possibilities Tomorrow

¶ Your product is as good, and no better, than your ability to merchandise it intelligently.

¶ Any commodity "good enough" to sell in competition is "good enough" to be a leader.

¶ Today the Automobile Industry is tuned for action. Are you "marking time" with the trailers or "speeding up" with the leaders?

¶ Next week (Jan. 28th) is the last big show issue of The Automobile. Its 21,000 readers constitute a mighty purchasing (as well as purchase directing) power.

¶ Let us grasp this "made to order" opportunity together. Send your special message direct to those that want to hear it, have paid in advance to get it—via The Automobile.

¶ We specialize in the creation of "result bringing" copy. Let us co-operate with you for quick action.

THE AUTOMOBILE
239 West 39th Street, New York
Member of the A. B. C.

AL. Automotive Industries

The AUTOMOBILE

JANUARY 28, 1915

10¢ A COPY

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

A Wide Variety *and* Range *of* Colors - Fabrics *and* Weights to select from-Both *in* Top *and* Seat cover Materials -

To the man who takes pride in his car and is particular about its appearance, it makes a lot of difference whether or not he can match the car color with top and seat cover fabrics.

"NUMOTOR" Bull Dog Fabrics are not only made of the staunchest, most pliable and durable materials, but in line with their policy to produce the greatest fabrics of their kind, they offer "NUMOTOR" in so wide a range of colors and in textures for both top and seats that any desired color scheme may be carried out.

"NUMOTOR" Fabrics are noted for their invulnerability. They are the double woven kind with the interlining of pure Para rubber, which makes them able to withstand sun, rain, folding, dampness, heat, cold and all the other changing elements to which tops and seat covers are subjected.

The exceptional character of the weaving, the long-strand cotton, the fadeless color, the indestructible rubber interlining produce the famous Bull Dog Fabrics, which alone withstand wear and folding almost indefinitely.

If you want the finest that can be put in a top or seat cover, insist on "NUMOTOR."

L. J. MUTTY COMPANY

BOSTON **MASS.**

Vol. XXXII New York—Thursday, January 28, 1915—Chicago No. 4

The Automobile

Main aisle, looking from the south in the Coliseum, one of the buildings in which the Chicago automobile show is being held

Closing the National Show Circuit

Six New Eights at Chicago, Four Being on Chassis—11 Car Firms Not at New York

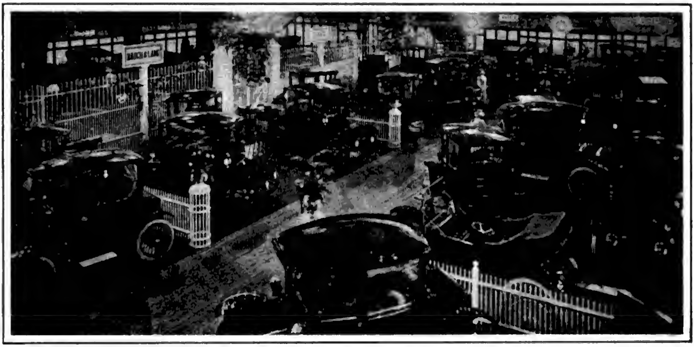
CHICAGO, ILL., Jan. 23—Opening time at 2 p. m. today found the 302 exhibitors at the Fifteenth Annual Automobile Show in the Coliseum, First Regiment Armory, Coliseum Annex and Greer building, ready to receive the influx of visitors which seemed the largest on any opening day in the annual exhibition's 15-year history.

Developments are always seen at the Chicago show which have not made their appearance at New York or other previous exhibitions on the national show circuit. This year proved to be no exception to the rule, eleven car manufacturers, eight of which are gasoline and three electrics, are exhibiting in the metropolis of the central west who did not show at New York. In addition to these there are forty-nine accessory makers whose wares have not previously appeared in the exhibitions. Besides these new makers among the names of those exhibiting there are several others who waited for the Chicago show to make announcements which are of prime importance.

CENSUS OF THE SHOW

Total Makes of Cars	88
Gasoline Car Makes	80
Electric Car Makes	8
CHASSIS	
Four-Cylinder	19
Four-Cylinder Sleeve	4
Six-Cylinder	18
Eight-Cylinder	3
BODY TYPES	
Touring Cars	122
Roadsters	42
Limousines	11
Coupés	6
Raceabouts	4
Sedans	7
Cabriolets	5
Broughams	3
GASOLINE CARS	
Four-Cylinder	120
Four-Cylinder Sleeve	15
Six-Cylinder	109
Six-Cylinder Sleeve	1
Eight-Cylinder	11
ELECTRIC CARS	
Coupés	20
Roadsters	2
Coupelets	2
Chassis	1

Four new eights make their first appearance here. These are the Cole, Ross, Regal and Abbott. In addition there are two new eight-cylinder motors exhibited by engine builders. These are Buda and Davis. The Massnick-Phipps Mfg. Co. is also showing the Perkins eight exhibited at New York. Three new sixes are also on view for the first time; these are the Imperial, the Ogren and the Halladay shown on motor row. Altogether, there are nine new car models, the products of eight makers, which are either at the Coliseum or in private exhibitions. These are the Franklin, Ross eight, Regal eight, Regal small four, Imperial six, Cole eight, Shaw taxicab, Halladay six and Ogren six. In addition to these the Moline company is showing a new four-cylinder motor which is the smallest Knight that has ever



Partial view of the electric car exhibits in the First Regiment Armory, which is one of the buildings housing the Chicago show

been announced in this country and which will form the power plant of a new car to sell for $1,475. In one instance, the Chandler, an important price reduction has been announced. This is a cut of $300, from $1,595 to $1,295.

The general arrangement of the show buildings is the same as in former years, the car exhibits being on the main floor of the Coliseum and Annex. The main floor of the Greer building, which is connected directly by a doorway to the floor of the Coliseum, is also utilized. From the Greer building there is an exit which leads to an alley through which the visitor must pass to enter the First Regiment Armory. The alley is covered with canvas, bringing the entire exhibit under a common roof in that it is not necessary to pass through an unsheltered area to get from one building to another. In order to have all the parts of the show equally attended it is necessary to pass through the Greer building in going from the Armory to the Coliseum.

Accessories on Balcony

The accessory exhibitors are disposed about the balcony of the Coliseum, in the upper floor of the Annex, the balcony of the Armory and the Annex basement. There are 215 accessory exhibitors housed in these spaces. This takes up all the available space in these buildings and, in fact, many were unable to secure room in which to exhibit their wares.

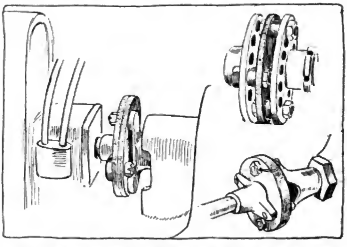
In a decorative way the show is one of the most successful ever held in Chicago. The scheme is that of an English garden with white picket fences separating the exhibitors spaces and a touch of color is given by the use of twining roses. Overhead the decorative scheme is carried out by having the ceiling painted like the beams of a vast pergola with the blue sky showing between. On the whole the exhibits are tasteful in that they are sufficiently subdued to form a suitable background for the color scheme of the cars. The show committee consists of Sam Miles, Col. George Pope, H. O. Smith and Wilfred Leland.

Comparing the Chicago show with that of New York, there are seven more car exhibitors, or a total of eighty-eight. In addition to this difference of figures some of the exhibitors have more space and hence more cars on view, than they did in New York. For example: In four-cylinder models there are 122 here as against ninety-six in New York. The sixes are nearly even, the figures being Chicago 109, New York 105. As regards eights there is a difference of four in favor of Chicago, New York having seven. As at New York, the four still holds its supremacy as shown by the figures.

122 Touring Cars

In body work the touring car naturally leads. There are 122 of these, with roadsters second, to the number of forty-two. The remainder is made up by limousines, sedans, coupés, cabriolets and other special types. Those cars which are at Chicago, but which were not exhibited at New York are Abbott, Austin, Glide, Buckeye, Crow, Elkhart, Paterson and Vixen for the gasoline cars, and the American, Milburn and Woods electric. The American is the product of the consolidation of the Broc, Borland and Argo and the Milburn is a new make put out by a prominent body and carriage maker who has recently entered this field.

The eights at the show are Cadillac, Cole, King, Regal, Detroiter, Remington and Abbott; at the LaSalle Hotel there is the Ross eight and besides these there are the three eights of the motor makers, Buda, Davis and Massnick-Phipps. Of these the Cole, Regal, Abbott and Ross are seen for the first time mounted in the chassis of the companies mentioned. The Buda and Davis are shown as unmounted motors also for the first time. The Cole is a V-eight selling at $1,785 and was



The use of leather disks in magneto couplings as found in several cars at the Chicago show. Left—Overland. Upper right—Jeffery. Lower right—Chandler described in THE AUTOMOBILE for January 21. The Regal eight is a 2.875 by 4.5 V design mounted on a 112-inch wheelbase selling at $1,250 and has the novel feature of a removable horizontal plate connecting the two sets of cylinder heads, which are detachable. It is fitted with a Bosch-Rushmore flywheel installation.

The Abbott eight makes use of the Perkins motor in a chassis which is a standard Abbott design. The new Ross eight which is making its début in Chicago is the product of the Ross & Young Machine Co., parts makers of Detroit. It sells for $1,350 and has a 3 by 4.5 V motor with silent-chain driven camshaft and thermo-syphon cooling. It is fitted with a starting and lighting outfit operating at 12 volts manufactured by the Ross & Young Co. Other specifications include a multiple-disk clutch, Hotchkiss rear system, 115-inch wheelbase and 34 by 4 tires.

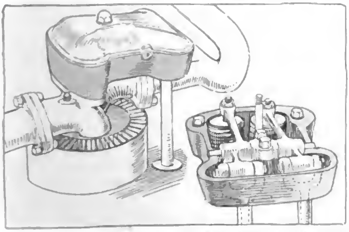
Three New Sixes

The new sixes are the Imperial, Ogren and Halladay, while in addition to these Franklin has announced a new series in which the only changes have been the inclosure of the overhead valves and a roomier body. The Imperial, known as the model 66, has a Continental block 3 by 5 motor, is mounted on a 122-inch wheelbase with 33 by 4 tires and sells in five-passenger touring form for $1,285.

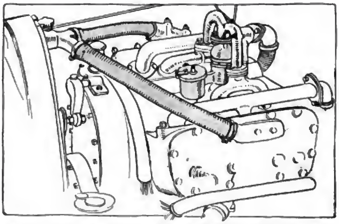
The new Halladay six, which is the product of the Barley Mfg. Co., incorporates a Rutenber power plant which is an L-head block, a disk clutch and a three-speed gearset in a unit, with three-point suspension. It has a floating rear axle and is equipped with a Westinghouse combined ignition, starting and lighting outfit. Gasoline feed is by Stewart vacuum.

The new Moline motor is of more than passing interest as it is the forerunner of the new Moline car which is shortly to be announced and at the same time is the smallest Knight motor so far in America. The new car to be known as the 40 will sell for $1,475 and, while complete details are not as yet available, it is known that the wheelbase will be 118 inches, the clutch a leather-faced cone, the rear axle floating and the tires 34 by 4 inches. The Ogren six is not quite new, having been produced by the Ogren Motor Car Co., of Chicago, during the past year, but it is not familiar to many show visitors. It is a 3.75 by 5.5 L-head job with standard parts throughout and sells for $2,500 in seven-passenger form.

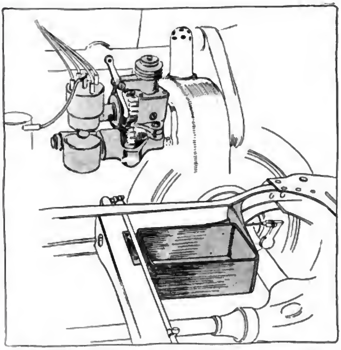
Regal is showing a new four-cylinder car that has a smaller power plant than its previous four which is continued, bringing the Regal line to three models, an eight and two fours. The new four has a 3.375 by 4.75 power plant cast in a block, with the clutch and gearset as a unit. It has cantilever rear springs, a 106-inch wheelbase and 30 by 3.5 tires. It sells at $650 with complete electric equipment, one-man top and a streamline touring body.



Left—New Franklin valve cover. Right—Showing top of box removed. The box is integral with the manifold, the center part of the cover being secured to it by a holding-down bolt



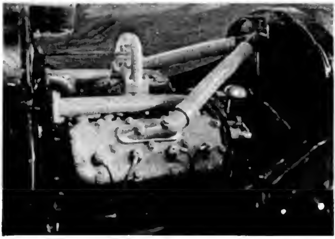
Regal eight-cylinder motor, showing diagonal return water connections between cylinder blocks and radiator. Note accessible carbureter and detachable flexible exhaust lines



Upper—Mitchell ignition distributer and tire pump mounting. Lower—A good example of battery support using a metal box as found on Mitchell cars

The use of polished chassis is showing an increase at Chicago as at New York, nineteen fours, eighteen sixes, three eights and four Knights being shown in this manner, and attracting considerable attention. Others are showing cutaway motors or distinguishing parts of the chassis. The Woods electric has a worm drive running in a glass case. The Hudson six is on a scale as at New York, and accessories firms are employing moving exhibits such as jumping dolls for shock absorbers, etc.

In body work the tendency is to show the stock hues, but Locomobile, Packard, White, Paige, Apperson, Cadillac, Moon, Oakland, Buick, Saxon, Chalmers and Pierce have cars which are painted in striking colors. The inclosed bodies are in all forms and, in connection with these may be mentioned the hinged steering wheel on the Pierce coupé. This differs from the forms used by Cadillac and King in that the wood rim itself hinges on either side rather than whole rim swinging out of the way.



Right side of the new Regal eight-cylinder V motor.

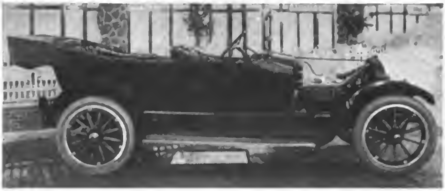
View of Cole eight-cylinder motor, which is one of the surprises of the Chicago show

Nine New Cars on Display at Chicago

Cole, Regal, Ross and Abbott Have Eights—Imperial, Halliday and Ogren Sixes—Small Regal and Shaw Taxicab Are Fours—New Motors Shown

EIGHT-cylinder cars constitute the feature of the exhibit at Chicago. There are four new eight-cylinder cars on exhibition in addition to those which were shown at the Grand Central Palace. These are the Cole, the Regal, the Ross, and the Abbott. In addition, three new eight-cylinder motors were shown by engine makers, one of these Davis, another Buda and the third, Perkins. Two new small sixes were on view, the Imperial at the Coliseum, and the Halladay on motor row. New fours in every case are smaller than those the concerns exhibiting them had used previously. The new Moline-Knight is the smallest Knight engine which has appeared in America and the Regal four has a smaller four-cylinder engine.

In all there are nine new cars or new models not previously shown, to be seen either at the Coliseum or in private exhibitions. The Franklin company has announced a new series whose only change in design is the inclosing of the overhead valve. In the electric field the only change within the past 2 weeks has been in the announcement of wire wheels as stock or optional equipment on practically every electric.



The new Cole eight-cylinder touring car announced at the Chicago show

Price reductions are announced in one instance, the Chandler price being dropped $300.

The Ross Eight

A new car makes its début in eight-cylinder form at the LaSalle Hotel. This is the Ross eight, which is given the name of model A. It is the product of the Ross & Young Machine Co., Detroit, Mich., a concern which long has been making parts for Detroit car manufacturers. Aside from the eight cylinders, the feature of the car is its price, which is $1,350 for the five-passenger touring model, the only body offered at this time. The motor is made by the Ross & Young company.

The cylinders are arranged in a V and are 3 by 4 1-2 inches. The cylinders are cast in L-head blocks of four with the valves on the inner side. The camshaft is driven by a silent chain and thermo-syphon cooling is used. Lubrication is by oil forced to cylinders, crank and camshaft by means of a plunger pump. Ignition is by an Atwater Kent Unisparker having automatic advance with both dry cells and storage batteries as a current source. Fuel is fed to the carbureter from a rear tank by the Stewart vacuum system.

Starting and lighting is by an electric system of Ross & Youngs' own manufacture. It operates on 12 volts. A multiple disk clutch with cork inserts is used and in unit with the rest of the power plant is a three-speed selective gearset with center control. The unit power plant thus supplied is suspended at three points.

The drive from the propeller shaft and Timken axles is taken through the springs on the Hotchkiss principle. Brakes are 14 by 2 1-4 inches in size, the service brakes being internal, and the emergency brakes external on the rear wheel drum. The wheelbase is 115 inches, and tires 34 by 4 on Detroit Q.D. rims. Springs are three-quarter elliptic in the rear, and the conventional semi-elliptic in front. The equipment includes the one-man top aside from the regular outfitting. A very clean streamline boat-shaped body is provided.

The Regal Eight

The Regal Motor Car Co., Detroit, is showing two new cars at the Coliseum, the complete Regal line for the coming season being three models, a new eight, a new small four and the larger four. The eight-cylinder car sells in the five-passenger touring form at $1,250. It has a V-type motor, 2 7-8 by 4 1-2 inches and 112-inch wheelbase. Equipment includes, aside from the regular fitment, a one-man top with Jiffy curtains and tire carrier at the rear with an extra rim.

The eight cylinders are cast in two separate blocks of four, being L-head with the valves on the inside. The outside view of the motor is made particularly clean by means of a removable horizontal plate connecting the two sets of cylinder heads which are separately detachable on each block. The electric equipment includes a Bosch-Rushmore generator on the forward left side of the engine with the cranking motor connecting to the flywheel. Ignition is by battery and distributor. Above the plate, connecting the two sides of the V, is the Stewart carbureter which communicates with each block of cylinders through a ram's horn intake to the integral manifolds. The engine is cooled by thermo-syphon, there being a single outlet at the top of the radiator which branches to each block of cylinders in the form of a Y. The timing gears are chain driven.

Except for the motor, the car is exactly the same as the other Regal, and it is significant that the use of the eight-cylinder engine has added only 44 pounds to the total weight of the car, while the horsepower has been greatly increased.

Regal Small Four

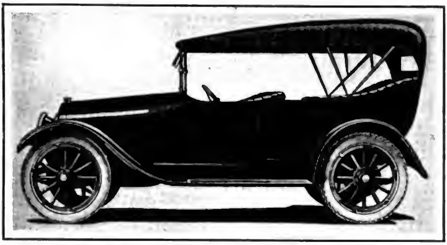
The other new Regal model is a little four having a 3 3-8 by 4 3-4-inch engine of nominal 20 horsepower, 30 by 3 1-2 inch tires, 106 inch wheelbase, and selling at $650 with complete electric equipment and one-man top, as well as the usual set of tools, etc.

The four cylinders are in block and the clutch and gearset are carried as a unit with the engine. The electric equipment includes a Splitdorf Aplco motor generator with battery ignition. The gearset is a three-speed selective with center control. Rear axle is floating on roller bearings, and the rear springs are of the cantilever type. The wheels have demountable rims. A streamline body is used and, like the rest of the Regal models, the radiator filler is under the hood so that the smooth line from windshield to radiator is not broken. The fuel is carried in the cowl and the filler is inside the forward compartment. A spare tire carrier is supplied at the rear.

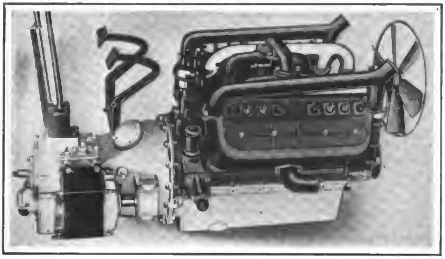
Another of the new cars to make its début at the Coliseum is the eight-cylinder Cole at $1,785 which was described in detail in THE AUTOMOBILE for January 21.

Imperial Six

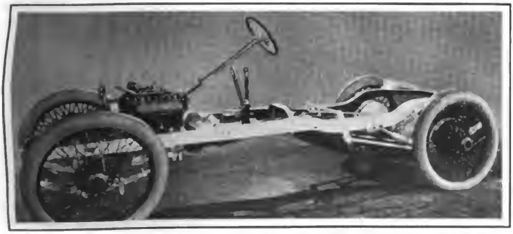
The new Imperial six-cylinder model 66 lists at $1,285



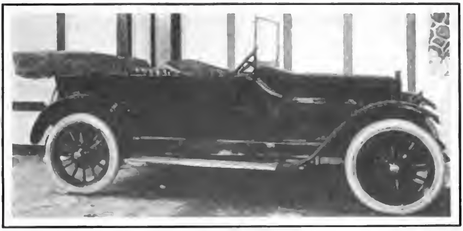
New Ross eight-cylinder touring model announced at the Chicago show



View of the new Ross eight-cylinder 90-degree V motor



View of the eight-cylinder Abbott chassis, showing mounting of new motor and double-drop frame



The Imperial six touring car which was announced at the Chicago show

with electric equipment, one-man mohair top, demountable rims and regular equipment. The motor is a Continental block casting with L-head cylinders 3 by 5 inches in size. Cooling is by centrifugal pump and lubrication is by splash system with a circulating pump. A disk-clutch faced with Raybestos and a three-speed selective transmission complete the unit power plant, which is suspended at three points. Fuel is fed by pressure from a gasoline tank at the rear. The rear axle is a floating type on Hyatt high duty roller bearings with a 4 to 1 reduction on high and 12-inch brakes, internal and external, are supplied on the rear hubs. Left steering and center control are standard. The wheelbase is 122 inches, and tires are 33 by 4. The storage battery for the electric lighting and cranking system is carried under the front seat. The rear springs are three-quarter elliptic, and the body upholstering is made a special point, being designed to give maximum comfort without sagging.

The car is marketed as a five-passenger tourist with streamline body, the doors being unusually wide, with concealed hinges and latches.

Franklin Series Seven

A new Franklin chassis makes its appearance under a new model name, Series Seven. The feature of the new series is the inclosure of the overhead valves. Aside from this the only alteration from the car as described previously is the slight lengthening of the tonneau to give increased roominess and a general lightening of the chassis which amounts to a reduction of probably 24 pounds in the weight of the car as a whole.

The inclosure of the valves has been accomplished by placing a metal cover over the valve-operating mechanism on each of the separate cylinder heads. These covers bolt to flat bosses milled on top of the cylinder heads, and cover the valve springs and rocker arms completely, thus giving the increase in efficiency of the overhead valve without the noisy valve operation which sometimes is characteristic of this type.

New Halladay Six

Halladay cars, after a period of inactivity, are again to make their appearance on the market, this time as the product of the Barley Mfg. Co., Streator, Ill. The re-appearance of the Halladay is signalized by a new six-cylinder called the 6-40, which is to sell at $1,385. It embraces in design a Rutenber motor of 40-horsepower with L-head block cylinders. Oiling is by a combination force feed and circulating splash and cooling by centrifugal pump circulation combined with a belt-driven fan.

The carbureter is a Stromberg with the control lever for the air adjustment mounted on the steering control. Ignition and all the electric equipment is Westinghouse. A combined magneto and generator supplying the current for ignition and lighting, and in connection with the 6-volt, 100 ampere hour battery, supplies the Westinghouse flywheel starting motor, which is equipped with a Bendix gearshift.

The three-speed gearset and disk clutch are in unit with the motor, the whole power plant having three-point suspension. Gasoline is carried in a rear tank, and supplied to the carbureter by the Stewart vacuum system. Left steer and center control are stock features. A floating rear axle which runs on ball bearings is supplied and the rear springs are three-quarter elliptic. Tires are 34 by 4 inches on Firestone or Stanweld demountable rims, and a spare tire carrier is hung at the rear.

The body is of modified boat type. Individual front seats are fitted and there is an aisle between them. With the regular equipment are included, among other features, a one-man top, and an 8-day clock.

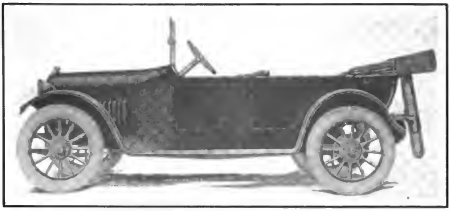
Smaller Moline-Knight

The Moline Automobile Co., Moline, Ill., is showing the motor of a smaller Moline-Knight car which is to be announced later. The motor itself is almost identical with the larger Moline-Knight, except for its smaller dimensions. It is understood that the motor is to be a part of the lighter and lower-priced Moline car. Its bore is 3 1-2 inches and its stroke 5 inches, and it is a block casting of clean exterior appearance. The only distinguishing feature between this engine and the larger Knight is in the novel way in which the ignition wires are carried up through the cylinder head between the two middle cylinders, so that the only exposed wiring or ignition connections are the short leads to the spark plugs. Ignition is supplied by means of a Connecticut igniter, current for which is produced by a generator driven by a layshaft on the timing gears. A separate cranking motor connects with gears cut on the flywheel. Another external change is the alteration of the exhaust manifold to give a more direct flow of the gas.

Shaw Taxicab

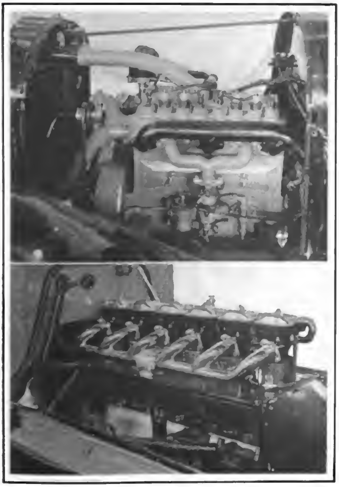
Although not at the show, a new car is on display on motor row as the product of a concern which heretofore has not built cars for the general market. This is the taxicab of

Regal light four, which embodies a smaller motor than the other four-cylinder car



New Moline-Knight 40 touring car, which has the smallest Knight motor yet announced

the Walden W. Shaw Livery Co., Chicago. This concern has been building its own cars for local taxicab work for several years, but the demands from other cities for cars especially designed for this service has led it to announce that it will manufacture these cars for other livery companies. Orders from several other cities have been received and the concern states that it is in the position to produce about 500 cars a year. The cars are designed for quick and easy repairs and replacement as well as for wearing qualities for the special service for which they are intended. They have one or two outstanding features which distinguish cars for this service, as designed by the Walden Shaw company. One of these is the transmission brake, another the spiral bevel drive, and another the elimination of brake equalizers, it being found that in livery service, where for safety's sake the brakes had to be looked to every day in any of them, equalizers were a detriment. Easy gear shifting is made possible by a clutch brake. There is no spark advance, and a triple oiling system is provided, there being a constant level splash and force feed in addition to two plunger pumps operated by the camshaft. The pumps can be worked independently of each other, and in case both fail, sufficient lubrication for a 60-mile drive is provided in the splash reservoir.



Upper—Regal light four-cylinder motor, which is shown at Chicago. Lower—The new Franklin six motor, which has the overhead valve construction inclosed

To show in what way the special design of a vehicle when used to this service has been effective in keeping down operating costs, the Shaw company reports on the maintenance of its entire equipment for a period of 6 months show that the labor and maintenance per cab per day is 57 cents. The material cost is 35 cents and the painting 17 cents, making a daily bill on each cab of $1.09.

The Ogren Six

A six-cylinder car new to the field in general is the Ogren six, which has been on the market in a small way for about a year. This is the product of the Ogren Motor Car Co., Chicago, which expects to turn out about 250 cars within the next year. The car is built from standard parts as a seven-passenger touring car, a roadster and a limousine, the seven-passenger listing at $2,500.

The engine is a six-cylinder 3 3-4 by 5 1-2, L-head with Bosch magneto, Bosch-Rushmore cranking and lighting, Rayfield carbureter, Stewart vacuum fuel feed, Brown-Lipe three-speed gearset, left steering, center control, Timken axle and Kellogg power tire pump. The body is made by Obresch. In the seven-passenger touring body the extra seats are arranged to fold in the back of the front seat when five passengers are carried.

Marion Brings Out New Eight, Six and Four

CHICAGO, ILL., Jan. 26—*Special Telegram*—In the midst of all the rapid fire announcements of eight-cylinder cars during the show, the Marion Motor Car Co., Indianapolis, Ind., has gone the other manufacturers one better by announcing not only a new eight, but a new six and a new four. This makes the Marion line the only complete one so far as the number of cylinders is concerned.

All three of the models are built of standard units, the eight having a V-type, 3 1-8 by 4 1-2 motor of the conventional type, and wheelbase of 115 inches. It sells at $1,500 either as a roadster or five-passenger touring car.

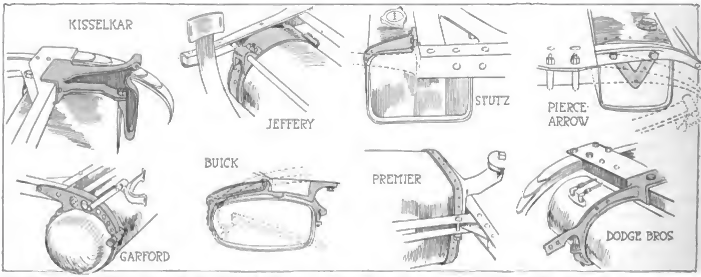
The four has a Continental block L-head engine, 3 3-4 by 5. and the same wheelbase as the eight. It sells for $1,250. The six has a 3 by 5 block L-head engine, a 122-inch wheelbase and sells for $1,350. The equipment in each case includes such fittings as one-man top, demountable rims, with one extra, rain vision, built-in windshield and graphite lubricated springs.

In every respect of general design, except engine and chassis length, the three cars are identical. The design includes a dry disk clutch and three-speed gearset in unit with the engine and spiral-bevel drive.

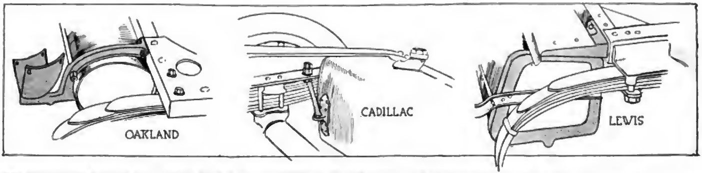
Motor equipment includes Bosch magneto, Gray & Davis lighting and starting, Stewart vacuum fuel feed from a tank at the rear and Fedders honeycomb radiator. The lighting system includes double bulb headlights, for city or country driving. Tires are 34 by 4.

The Mutual Motors Corp., which has the manufacturing of Marion cars, expects to be delivering within a very few weeks.

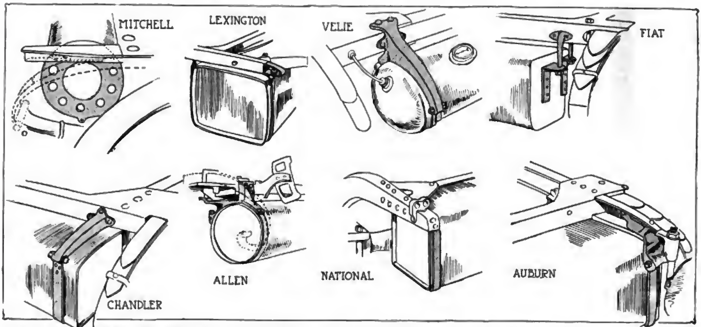
Some Tank Mountings Seen at Chicago



Rigidity of suspension is shown in the characteristic tank mountings illustrated herewith. This phase has become important since the widespread adoption of vacuum feed. Some makers are combining the tank bracket with the tire carrier, giving a rigid support for both with a minimum number of parts



The tanks themselves are in a variety of shapes, necessitating wide differences in the shape of the tank bracket. It is practically universal practice, however, to rivet to the rear cross member

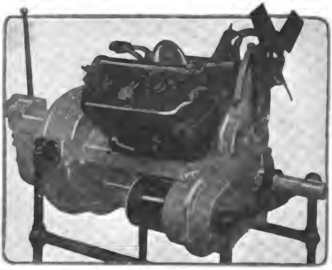


In many of the tank brackets depicted herewith it will be noted that efforts have been made to arrange the suspension so that the tank can be readily removed. This is generally accomplished by a hinged portion of the bracket which can be swung out of the way when it is desired to take off the tank

Davis Eight Uses Two Camshafts

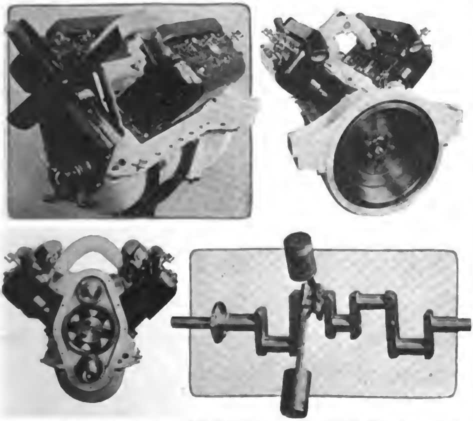
ONE more eight-cylinder motor has made its appearance. This time the Davis Mfg. Co., Milwaukee, Wis., is the newcomer with a V-type with 90 degree cylinders. It is a conventional eight with 3 by 4-inch cylinders, giving a piston displacement of 226.2 cubic inches, and an S. A. E. rating of 28.8 horsepower. It is a high-speed design, showing its greatest efficiency between 2,200 and 2,600 r.p.m. and is intended for a gear ratio of approximately of 5.5 to 1.

Two of the unconventional features of this Davis eight are, first the use of two camshafts located side by side in the top of the crankcase, immediately below the apex of the V. One camshaft serves for actuating the valves in one cylinder block and the other for the opposite block, the object of using two shafts being that any desired timing can be had, and the use of rocker arms between the cams and the tappets is eliminated, consequently reducing the noise possibility. The valve timing employed is as follows: Intake opens 10 degrees late, closing 30 degrees late, and exhaust opens 45 degrees early, closing 5 degrees late. The tappets with mushroom ends bear direct on the cams and carry on their upper ends nut and lock nut for correcting the timing.


The compact Davis eight-cylinder motor

The other unconventional feature is the employment of thermo-syphon cooling for the two cylinder blocks. Water from the base of the radiator enters each block at its lowest point and well to the rear of the jacket, and the return pipes leave the highest point of the jacket at the forward end, there being individual hose connections between each cylinder block and the radiator. All valve seatings are entirely water-jacketed.

Spur gear trains are used for driving the two camshafts as well as the ignition system, a silent chain being employed to connect the crankshaft with the Allis-Chalmers motor-generator unit which is mounted under the right front motor arm. It is geared 3 to 1 to the crankshaft and no clutches are interposed, the silent chain connection being positive. In order to have chain adjustment the motor generator is mounted in an eccentric bushing surrounding the entire cylindrical unit, and this bushing in turn is clamped into the housing in the crankcase arm.


Views of the Bude eight described last week. It has thermo-syphon circulation, each block of cylinders having separate water leads. The intake pipe is jacketed and forms a connecting link between the cylinders. Being at the top of the water system it should be well warmed. The side-by-side connecting-rods are shown above, and also the accessible valve covers. Ignition apparatus is located between the cylinders, and the starter can be under either motor arm, the dynamo being combined with ignition

The motor is designed for battery coil ignition system with the timer-distributer element mounted on a short vertical shaft in the forward part of the V where it leaves all valve springs quite accessible. Lubrication is by a splash constant-level system and to guard against a surplus of oil in one cylinder block baffle plates are inserted in the open ends of the cylinders in this block, the other block being without baffles. The carbureter is located high in the V and attaches to a upwardly arched semi-circular type of intake manifold.

The rotating and reciprocating internal parts of the motor are generally conventional. Use is made of the yoke type connecting-rod in preference to the side-by side style, these are I-beam types, 8 inches center to center, the crankshaft, a two-bearing type, has main and journal bearings 1 3-4-inch in diameter, the front bearing is 3 inches long, the rear 4, and all crankpins are 2 1-4 inches long. Valves are 1 5-16 inches in

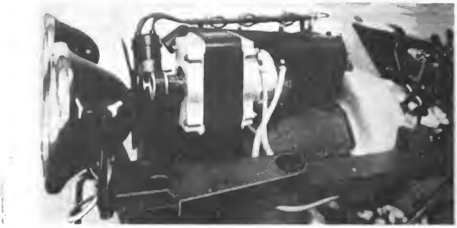
diameter in the clear and 7-32-inch lift. Each camshaft is supported on three bearings. Pistons measure 3 3-4 inches in length and carry three rings close to the piston head and one oil ring immediately below the wristpin.

The motor is regularly designed to take a unit gearbox, the flywheel being completely housed for this purpose, and with the two supporting arms in the flywheel plane. A single forward support is used, giving three-point suspension.

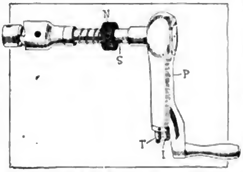
New Accessories at the Show

CHICAGO, ILL., Jan. 23.—The accessory exhibit at the Chicago show can boast of not more than two dozen new devices brought out since the New York show and among these there are perhaps only eight which are of real interest to the car owner, the others being garage necessities or manufacturers' propositions. One of the most attractive displays offered in the accessory layout is the new Westinghouse-Ford cranking, lighting and ignition system which was kept rather quiet until show time. The new Kellogg Ford tire pump, while it was announced a week ago by the company, is being displayed for the first time.

Chicago can be always relied upon to show spring wheels, safety fenders and other accessories of unusual construction, among them, being shown such devices as a combination pump and crankhandle, a heater which uses no coal, exhaust gas or water, but employs chemicals, a new shock absorber with three springs and a seating arrangement which allows of a two-passenger roadster being converted into a three-passenger design. In all, there are forty-nine exhibitors of accessories at Chicago who did not appear at New York.


New Westinghouse starting, lighting and ignition system for Ford cars as it appears mounted on motor

New Westinghouse-Ford System—The Westinghouse exhibit is featured with a new cranking, lighting and ignition system for Ford cars, which sells for $90, and which consists of a 12-volt motor-generator, battery and ignition distributer which contains also the interrupter and step-up coil. The motor-generator externally differs little from the regular Westinghouse unit. It is driven by silent chain from the crankshaft and in order to allow of a means of driving the fan the belt is fastened to a pulley on the motor-generator shaft. The cutout which is used is a separate unit. In the mounting of the motor-generator two brackets are used, one of them being attached to the cylinder head by means of special bolts, and the other being attached to the lower portion of the cylinder casting.

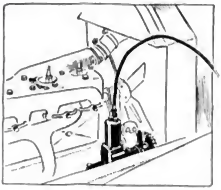


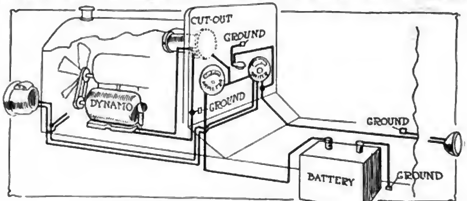
DeLaunty combination tire pump and crank

The ignition distributer is an entirely new affair, being a combination timer, distributer and coil. It is located on the opposite side of the motor-generator, the right side, and is driven by two bevel gears from the timing case. This allows of a vertical unit. The price is $75 for the motor-generator, battery, switch, wiring—in fact, everything except the lamps—and at $90 the ignition distributer also is furnished.

Kellogg Pump—Another new single-cylinder pump, Model 111, just brought out by the Kellogg Mfg. Co., is being shown at its booth for the first time. This new pump is for Fords, and in general construction is like the one-cylinder Model 101. It is an all-metal design with a poppet valve for inlet and exhaust, uses wick oiling and sells for $9.50 complete, ready for attachment. The drive is directly by gears from the front end, as shown in the illustration herewith, a hand lever being used to throw the gears into mesh. It is stated the pump may be installed in 20 minutes without moving any of the essential parts of the car.

DeLaunty Tire Pump and Crank—A most unusual combination accessory is being shown by the Chicago Automatic Machine Co., the device being in the form of a unit single-cylinder tire pump and crank handle. This unit replaces the present crank on the car. The pump is contained in the portion P in the illustration herewith, and is driven by a floating shaft within the one marked S. When the pump is to be used the nut N is pushed inward, this causing


Kellogg one-cylinder tire pump for Fords



Bright-Ray lighting system for Ford cars the floating shaft to be connected with the crankshaft. The air inlet for the pump is shown at I, and the hose connection at T. The price is $12.50, and for the Ford type $10.

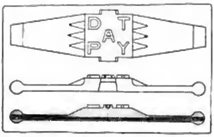
Bright-Ray Ford Outfit—A new Ford lighting system is being shown by the Paul G. Nirhoff Co., Chicago, the outfit consisting of a generator driven by belt from the fan shaft, a battery, cutout, ammeter, wiring, etc. The generator produces 8 amperes at 6 volts, and is driven, as shown herewith, by a belt which is looped around a special pulley fastened to the fanshaft. The cutout is a separate unit mounted on the dash together with an ammeter and switch. The outfit complete, including the parts mentioned, together with two headlights and tail light, 6-volt 30-ampere-hour battery, wiring, bolts, etc., is $45, and without the lamps is $38.50.

Two other new products shown for the first time, but marketed for about 1 year, are the Red Devil electrolytic rectifier and the Red Devil non-spillable battery, which type often is referred to as a dry storage battery.

Day Sectional Tread—This is a puncture and blowout preventing device shown by the Day Sectional Casing Co., Chicago. It consists of a rubber and fabric tread made in a number of sections fastened together so as to be slipped in place as a unit. There are spaces between each section, and this, together with the rough surface of the sections, is said to prevent skidding. Prices range from $18.75 for the 30 by 3½ to $25.50 for the 37 by 4.

So-Sha-Belle—The So-Sha-Belle Co., Los Angeles, Cal., is exhibiting for the first time a seating arrangement which allows of three persons sitting in the tonneau or front compartment, where the present plan allows of only two being seated comfortably. It is an arrangement which places the seats in staggered fashion, the center one either ahead or behind the two outer cushions. This seating arrangement may be used on either old or new cars and requires changes in the upholstery and seat frame and does not interfere with the body lines. By the use of this arrangement the passengers have individual seats and arm rests. It is a particularly desirable feature in two-passenger roadsters.

Catpaw Shock Absorber—This is an entirely new type of auxiliary spring shock absorber, and is shown by the Frazer Lubricator Co., New York. As shown in the illustration herewith, the Catpaw consists of two cylinders, each containing three springs, one set upright and two smaller ones placed at an angle above it. Each spring has an individual cylinder for operation. Aside from the three springs there is an air cushion cylinder below the large spring shown in the illustration herewith. It will be noted that the bar B is wedge-shaped at its upper end and that the sides can touch the shoes S under the two smaller springs. It is clear that any upward movement of the bar B will carry with it the large spring, leaving the two smaller ones free, and in order to make the large spring return to normal slowly, the air chamber shown comes into play. Also, the downward movement of the bar causes the wedge to exert pressure against the two shoes and hence the smaller springs are compressed. The combination of the two smaller springs with the air chamber is said to produce excellent results in checking rebound. The price of the absorber is $40 for cars up to 2,200 pounds.



Upper—Day sectional tread mounted on wheel
Lower—Section, elevation and plan of individual section of Day tread

A Ford type is shown, but it employs only one large spring, which is fitted into a cylinder open at the bottom, as shown in the illustration herewith.

Chicago Spring Wheel—A new type of spring wheel is being shown by Gray Bros., Chicago, this wheel employing a flexible hub with special side flanges. These flanges have slots into which fit the lower portion of special wedge-shaped steel spokes. The upper end of the spokes are in contact with rollers, so that when the wheel strikes a bump the spokes slide over the rollers, the movement being taken up in the hub slots.

Dixon's Grease—The Dixon Crucible Co., Jersey City, N. J., is showing a new form of grease for differential housings which it claims will not make its way to the brake-bands. It is No. 680 and sells for 30 cents per pound in 5-pound tins.

New Solar Searchlight—A new type of searchlight is being shown by the Badger Brass Mfg. Co., Kenosha, Wis., which may be moved vertically or laterally with a lever and locked in any desired position. The lamp used is a new parabola design with the reflector in the body with a washer between it and the glass. The casing is water-proof and dust-proof and has an outside adjustment for bulb focusing. The searchlight complete sells for $14.75 in black and nickel.

Grau Shock Absorber—This is a new Ford absorber on exhibition for the first time. It is being shown by the Grau Shock Absorber Co., Chicago. It is a single, coil-spring type with the mesh exposed. It replaces the regular Ford shackles and sells for $5 per set of four.

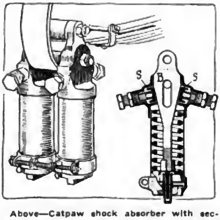
Telescope Fender—A new type of safety fender is being exhibited by the Telescope Fender Co., Cleveland, O., this device automatically stopping the engine and dropping a curtain to the ground so as to prevent the person from being caught under the wheels. When a person strikes the fender the ignition is cut out, the curtain drops and the car stops.

Vesta Batteries—The Vesta Accumulator Co., Chicago, is displaying an entirely new line of batteries for starting and lighting service, and a new type of headlight for Ford cars. The new batteries are made in all standard sizes and in 6, 12, 16, 18 and 24 volt form. All capacities are offered. A fair idea of the prices will be had from these: 6-volt, 80-ampere-hour, $35; 12-volt, 80-ampere-hour, $69.25, and 24-volt, 53-ampere-hour, $108.

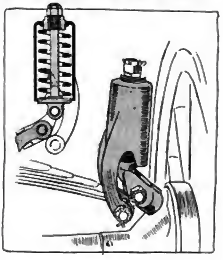
The new Ford headlight is designed to take the place of the gas lamps furnished, and for this purpose a special bracket is furnished. The price is $12.

Doehler Bearing Co.—For the first time the Doehler Die Casting Co., Toledo, O., shows die-casting finished in brass, enamel, copper, etc., the concern having extended its line to include finishing also. A complete line of aluminum die-castings are shown, the concern having gone into such production to a greater extent than heretofore.

Pierce Quadrant—The Pierce Speed Controller Co., Anderson, Ind., has something novel in the way of a Ford accessory—the Pierce auxiliary quadrant. This is a throttle quadrant which is fastened to the one already on the Ford car. It allows of the throttle lever being adjusted more accurately, the regular sector requiring that the lever be set into cuts in the quadrant. These cuts, the Pierce company claims, change the speed one-third of a mile per hour, which often is not accurate enough for the driver. With the Pierce device the lever may be moved any fraction of an inch. The price is $1, and it is easy to install.



Above—Catpaw shock absorber with sectional view through one member, showing wedge principle



Right—Special Catpaw Ford shock absorber

Compensated Cantilever Eliminates Roll

A New Springing System Adopted by Large European Manufacturer—Appears an Important Advance

WHEN a wheel on one side of an automobile drops into a hole in the road and the wheel on the other side remains on a smooth surface there is a natural tendency for the body to follow the axle, and tilt over in the direction that the axle has to incline. On a rough road this often produces a heavy roll that is very uncomfortable for the passengers, besides racking the frame. A device which has just been adopted by the Wolseley Co., the largest producer in Great Britain, and one of the largest in Europe, is described in *The Autocar* of January 16. The existence of this new system has been known to a few friends of the company's chief engineering men, for over a year, but the experiments have only recently been completed and the new system got ready for manufacturing.

Broadly, its basic idea is to force both rear springs to work together whether the shock is on one or on both sides of the axle, to play off the strength of one spring against the other so as to reduce rolling tendencies. The following description is extracted from our contemporary's account.

Effect of Periodicity

It is obvious that the stiffer the spring the quicker the periodicity, the more rapid its vibration. On the other hand, the more flexible the spring the slower the periodicity, and consequently the greater the movement. The more flexible the spring the greater the movement caused by a road shock, and the easier the motion. The leaf springs used in most cars, whether they be of the semi-elliptic, three-quarter-elliptic, or cantilever type, all conform generally to this law.

If we go to a car and regard it from the back, and consider that one wheel may have dropped into a hole, it is apparent that the body will make a corresponding movement. One side of the body will fall slightly, and this movement will introduce to the body as a whole a heeling-over or roll. The amount which the body drops to a large extent is controlled by the one spring upon the side on which the hole has occurred. The roll is caused by the fact that the sprung portion of the car has been given a tendency to turn about its center of gravity. This rolling tendency is aided by the spring upon the side of the car opposite to the hole endeavoring to escape from its normal state of compression, with the result that the roll is augmented. The *two* springs together then control a rolling movement of the car body and provide for it a rolling periodicity which is quite distinct from the vertical periodicity of one spring or the other separately. It is essential to the comfort of the car, and also to its stability, that the rolling periodicity should be a quick one, in other words a return to the upright position, and a maintenance of it, should take place as soon as possible. The vertical periodicity of the springs, however, should be as slow as it can be made, because the slower the vertical periodicity the slower is the vertical movement transmitted to the passengers of the car. Unfortunately, however, as has already been shown, the combined vertical periodicities of the springs also control the rolling periodicity of the body, and should the vertical periodicity be slow the rolling periodicity is even more slow, which is just what is not wanted. In ordinary springing systems, therefore, a happy mean has to be struck.

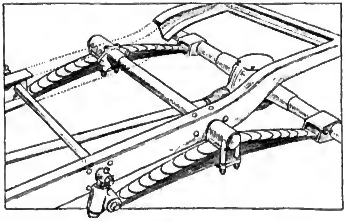


Fig. 1—Compensated cantilever springs

The Wolseley solution of the difficulty, which, by the way, is the invention of A. A. Remington, consists in so connecting the rear springs on each side of the car that a quicker periodicity when rolling is ensured than when a vertical movement of the body in relation to the axle is taking place. This means that a far greater latitude of compromise becomes possible. The principle of the invention lies in the cross connection of the centers of the two springs and in the present evolution of it a cantilever form of springing is employed because it lends itself admirably without adding complication. As shown in Fig. 1, the system consists of a single cantilever spring on each side of the chassis. Each spring is hinged to the chassis in the center, attached to the rear axle at the rear end, and shackled to the chassis frame at the front end. The great point of the device, however, is that the central hinged pin of the spring on one side is carried across the frame in the form of a stout tubular cross member, to become the hinge pin of the spring upon the other side. In other words, the center of each spring is firmly attached to an extremity of this tubular cross member, and the tubular cross member is free to rock in the frame. So long as the rear axle of the car receives road shocks, which cause vertical oscillations only, the transverse connecting member turns somewhat in the frame under the influence of the two spring movements, and the full elastic capacity of the whole length of each spring is brought into play, thus giving a comparatively slow vertical periodicity. If, however, the body of the car tries to roll over on to one side, the effect is that the spring upon one side tends to turn the transverse member in one direction, whilst the spring upon the other side is tending to turn the transverse member in the opposite direction, and this ultimately results in the transverse member remaining stationary.

The front portions of the spring, that is, the portions between the rocking cross member and the front shackles, become inoperative, with the result that only about half or less of each spring, *i.e.*, the portion between the rocking cross member and the rear axle itself comes into action. Half a spring being stiffer than a whole spring, speaking loosely, the resulting rolling periodicity is speeded up and is considerably faster than would be the case if the whole length of each spring were in action. By arranging the rear portion of each cantilever spring so that its rate of deflection under a given load is greater than that of the front portion of the same spring, it is possible still further to reduce the tendency to roll.

It would possibly be of assistance in grasping the principle of the device if attention were directed to the diagram in Fig. 2. This shows an alternative design of the spring, in which the rocking cross tube appears as usual, and extending back from each end of it is one half of a cantilever spring. To the center of the cross tube is attached two substantial half-cantilevers side by side, which are shackled to the frame at the forward end. It will be realized that a vertical movement, which affects both sides of the car more or less alike, deflects the springs A and B upwards, and also, as the tube is rocked, it endeavors to bend the end of the springs C downwards against the restraining influence of the shackle. If, on the other hand, the axle is twisted and the end A endeavors to rise simultaneously as end B endeavors to fall, it will be realized that the quarrel must be taken up between the springs A and B in endeavoring to flex in opposite directions, the stresses induced by each being taken up by the cross tube which has no tendency to movement and therefore no tendency to flex the springs C. A moment's reflection will show that the twisting of the axle in the manner shown is exactly the same really as keeping the axle still and twisting the frame of the car in relation to the axle, which, of course, is rolling pure and simple.

Trying Out the System

We turn now to the practical side of the question. It must not be supposed that the Wolseley Co., having evolved this springing system, were content with theoretical results. For a long time past they have been experimenting and carrying on research work with scale models. In order, however, to obtain direct tests of actual mechanism they laid down in their works a special plant for the purpose. A large pit having been prepared in the floor of one of the shops, a massive shaft carried on suitable bearings was installed and provided with two drums some 5 feet or more in diameter and from 2 feet to 3 feet wide, which were spaced apart a distance suitable to correspond with an ample margin, with the wheel tracks of their various types of cars. A detachable flooring was then built to cover in the pit in such a way that it was possible to drive a car into position so that each of its rear wheels rested upon a drum.

The front wheels of the car having been suitably scotched so as to prevent movement forward or backward, it was only necessary to provide upon the surface of one of the drums a hollow comparable in depth and size with a known hole, in order to reproduce fairly closely actual road conditions. The road wheels of the car to be tested were driven by the engine in the ordinary way, and the wheels in turn drive the drum which turns idly, that is, without any load other than friction upon it.

Running a car upon the drum makes it possible to observe and to measure accurately the actual movements made by the axle in relation to the ground, the car body in relation to the ground, and the car body in relation to the axle, all at different speeds. A recording apparatus, consisting of a revolving drum to which a paper could be attached, is arranged in a suitable position opposite the hub cap of the wheel resting on the drum having the hole in it. A fitting was provided on the hub cap to take a spring loaded pencil capable of tracing a line upon the drum, and thus indicating the actual path of the wheel. A similar pencil attached to the light framework was connected to the frame of the car itself. It should be mentioned that the revolving recording drum was driven by suitable gearing and a belt from the main drums upon which the wheels revolved.

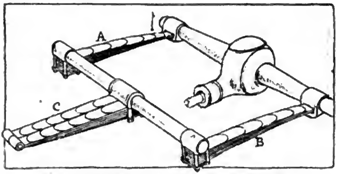


Fig. 2—Diagram to show action of compensation

Graphs Show Action

Fig. 3 shows the graphs taken by the apparatus with the wheels of the car traveling round at a rate equal to one mile per hour on the road. The top graph is that traced by the pencil and attached to the body of the car, and the lower one is that traced by the pencil attached to the axle of the wheel. The straight line running through the upper portion of the top graph represents a kind of datum line showing the position of the body of the car when stationary on the drum, and the other straight line of this same graph is again a kind of datum line showing the position of the body of the car with a wheel at the bottom of a hole. It should be mentioned that the relative positions of these two lines are not very regular, for the reason that, owing to the friction of the leaves of the springs, the car does not always set in exactly the same level when at rest under a given load. The straight line running through the top of the lower graph represents a datum line showing the position of the pencil in the center of the hub when the wheel is resting at the bottom of a hole in the drum. The first graph shows the car with the driver only on board, travelling at the rate of 1 mile per hour. Looking at the lower graph, it will be seen that the wheel drops right into the bottom of the hole as shown by the downwardly pointing peak actually touching the hole datum line. Instead, however, of this peak being of an inverted conical shape or

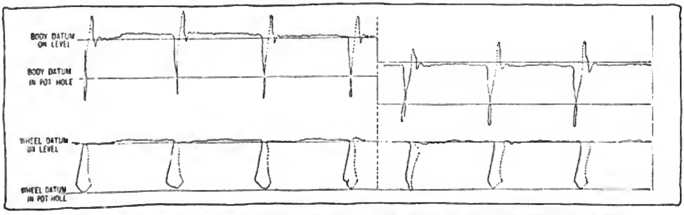


Fig 3—Graphs of car and axle movement at 1 mile per hour.- Left with driver only. Right with five passengers

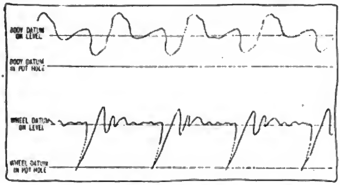


Fig. 4—Graph at 10 miles per hour with driver only

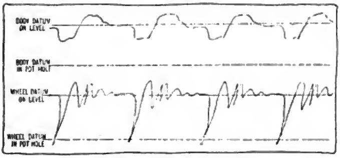


Fig. 5—Graph at 10 miles per hour with five passengers

even more or less parallel straight lines, it will be seen that it swells out in size towards the bottom. This is due to the drums, upon which the road wheels are revolving, running idly, with the result that, when the wheel drops into the hole, the drum is given a slight exhilaration, and when the wheel climbs out of the hole it is given a slight retardation, so that the bottom of the hole appears to be wider than the top. The first noticeable peculiarity regarding the movement of the body traced on the upper graph is that its amplitude is very considerably greater than the depth of the hole. This is due to the inertia of the body. It will be noticed that the amplitude of the movement of the body very quickly dies down. The graphs on right in Fig. 3 were taken with a car traveling at 1 mile an hour as before, but with a full complement of five passengers. It will be noticed that the body datum line and its attendant hole datum line have dropped a considerable degree lower. Figs. 4 and 5 show similar graphs at 10 miles an hour; Figs. 6 and 7 at 20 miles.

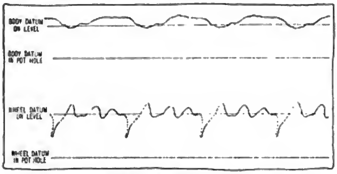


Fig. 6—Graph at 20 miles per hour with driver only

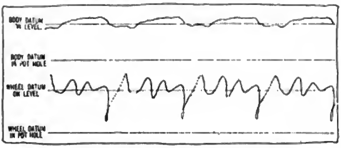


Fig. 7—Graph at 20 miles per hour with five passengers

Figs. 8 and 9 show the car traveling at 30 miles an hour with the driver only on board, and five passengers respectively. These last two graphs show that the body movement becomes very much less at the higher speed—in fact, so little as to produce almost a straight line. To sum up, these graphs prove indisputably that, with compensated cantilever springs, an increase of car speed results in a decrease of discomfort.

Tests on Different Springs

Knowing the movement given to one wheel of the car by the hole, it is interesting to ascertain the movement transmitted to the body on that side of the car, and also the movement of the body on the other side of the car. The apparatus used was a piece of steel bolted across the back of the body having at each end a pointer. Attached to the ground opposite each pointer end is a vertical pillar, to which are attached horizontal fingers capable of adjustment up and down. The car was arranged to drive the drum at the approximate speed of ten miles an hour with five passengers on board. While the car was running the horizontal fingers on each side were adjusted separately until the lower finger marked the lowest extreme of movement of the pointer attached to the car, while the upper finger marked the upper extreme of the movement. With five passengers on board the following results were obtained:

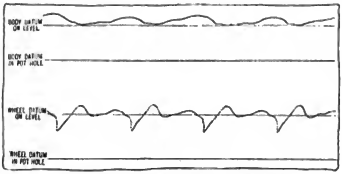


Fig. 8—Graph at 30 miles per hour with driver only

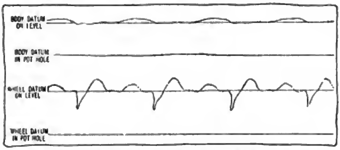


Fig. 9—Graph at 30 miles per hour with five passengers

At 10 miles an hour—	
On the smooth running side of the car	1⅜ in.
On the rough running side of the car	2¼ in.
At 20 miles an hour—	
On the smooth running side of the car	11/16 in.
On the rough running side of the car	⅝ in.
At 30 miles an hour—	
On the smooth running side of the car	⅜ in.
On the rough running side of the car	⅜ in.

For the purpose of obtaining some idea of the behavior of a car sprung in the usual manner on three-quarter elliptic springs, a vehicle of this kind was placed upon the drums and subjected to a similar test. The results were as follows with five passengers on board:

At 10 miles an hour—	
Smooth side	¾ in.
Rough side	1⅜ in.
At 20 miles an hour—	
Smooth side	⅝ in.
Rough side	1½ in.
At 30 miles an hour—	
Smooth side	¾ in.
Rough side	⅝ in.

Wheels for Commercial Vehicles

Different Types of Built-Up Steel Wheels in Use. Need for Standardization of Tires and of Axle Fittings.

By Thomas Clarkson

Member Institute of Automobile Engineers of Great Britain

EDITOR'S NOTE.—*Thomas Clarkson was one of the pioneers in the motor bus business, having satisfactory steam buses running years before the gasoline type had become reliable. He has thus gained a very wide experience of the subject treated in this paper since the C. M. wheel was made for the Clarkson bus after trial and failure of other kinds. He will be remembered by many in this country as one of the party of English automobile engineers who were the guests of the S. A. E. at their 1913 summer meeting.*

THE steel wheel hitherto most extensively employed is a casting, and up to the present the British steelfounders appear to have had only qualified success in the production of such castings. A casting is always liable to blowholes and to internal stresses owing to the warring forces of contraction and cohesion, and a good proportion of the ultimate strength of the material in a wheel may be neutralized by internal stresses, the existence of which is at present unknown.

Another difficulty in connection with the use of castings is the inequality of thickness in the material, which causes local variations in the strength, and also results in imperfect balance, which has a deleterious effect upon the life of the tires which are fitted to such wheels.

A few years ago, Mr. Morison and the author looked into the question with a view to producing a type of wheel which would be free from the drawbacks of cast material, and which should, as a natural consequence, be both lighter and stronger. The so-called C.-M. Wheels are the result. These are built up, see Figs. 1, 2, and are constructed entirely of forged steel. The spokes are tubular, and are welded electrically under pressure to the hub and also to the rim flanges. The hub, Fig. 2, is a drop forging having bosses corresponding to the spokes, and these are machined to a section which corresponds exactly to the section of the tubular spoke. Butt welding is employed, which has the advantage of preserving the uniformity of the section and avoiding sudden change of section, which is always liable to develop disturbing stresses, resulting in strain and fracture.

The rim is pressed up from a steel plate, and the two edges are flanged, one inwardly, and the other outwardly, so as to form a stop for the tire. The rims were formerly machined both inside and out, but this is now found to be unnecessary, as the pressing can be done with sufficient accuracy. The spoke flanges are united to the rim either by rivetting or by spot welding.

Permission was obtained from the Commissioner of Police to test the wheels on public service buses in London, than which the author believes there is no more severe test for a commercial motor wheel, owing to the exceptional character and conditions of the service. After the trial wheels had run over 20,000 miles, they were subjected to special tests by the engineer of the chief commissioner, these showing no permanent set was created by an axial load of 12,000 pounds.

As a result permission was accorded to extend the use of these wheels for public service buses, and up to the present the distance covered by these wheels has amounted to upwards of 22,000,000 miles.

The leading points of the C.-M. Wheel are that, being built up, it is free from internal stresses, and as a consequence the whole of the material in the wheel is available to resist useful stress, while there is, of course, no chance of a blowhole anywhere in the wheel. Next, the material of each part of the wheel and each weld can be tested before the wheel is completed, for which special machinery is provided; and lastly, the rim, being pressed out of a plate or rolled, is of practically uniform thickness, and the wheel is in consequence balanced very perfectly.

The chief drawback to the general adoption of this wheel has been the higher cost of production, due to the increased labor charges and the employment of a superior grade of material. The hubs are exceptionally large drop forgings, consequently the dies are costly, and very few British firms are equipped with hammers of sufficient power for this class of work. This difficulty is being overcome by a modified construction in which the hub is forged from a circular blank. The blank is first cupped, and on the cylindrical surface formed by the cupping, spoke bosses are pressed out from the center. This construction results in a material saving in the cost of manufacture. Other economies have been effected, and the author believes that these wheels will soon be produced at a cost which compares favorably with that of cast wheels.

Wants Standard Hub

One cause which has militated in the past, and which still militates, against the cheap production of wheels, is the

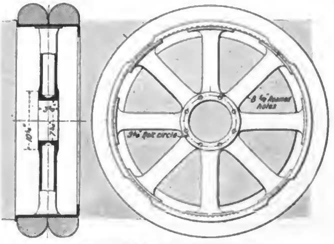


Fig. 1—Diagram of C.-M. twin wheel

WEIGHT OF TWIN WHEELS WITHOUT TIRES

Size of Tires Suitable for Rims in Mm.	Weight per Wheel
760 × 90	122 lb.
860 × 90	130 lb.
1020 × 90	145 lb.

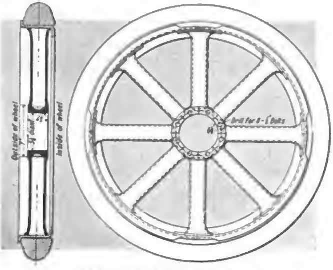


Fig. 2—Diagram of single C.-M. wheel

WEIGHT OF SINGLE WHEELS WITHOUT TIRES

Size of Tires Suitable for Rims in Mm.	Weight per Wheel
820 × 100	76 lb.
870 × 100	80 lb.
960 × 100	92 lb.
900 × 120	100 lb.
920 × 120	92 lb.

unfortunate variations in design which are so prevalent amongst makers of commercial motors, more particularly in connection with the details of the axle bearings in the wheel hub and the method of attaching the driving gear and the brake drums. During the past year most of the leading makers of commercial motors of from 30 cwt. to 5 tons capacity, and also representatives of the War Department, have been approached with a view to obtaining standardization. For the present, the difficulty has been to a large extent overcome by making the wheel hub interchangeable, and of a diameter sufficiently large to accommodate various designs of hub centers. This, to some extent, obviates the necessity for special construction of hubs, but more remains to be done before the advantages of standardization are realized fully.

In connection with this, the excellent work which is being done by the Engineering Standard Committee, the Society of Motor Manufacturers and Traders and this Institution must be recognized. They have recommended the adoption as British standards of the following six sizes of rim diameters for solid tires: 670 millimeters, 720 millimeters, 741 millimeters, 771 millimeters, 850 millimeters, 881 millimeters.

In regard to the question of tolerance in rim diameters, the society's committee has suggested nothing under, but one millimeter above, the standard diameter. The author regrets that he is unable to support this suggestion, in the light of his experience. It has not been found practicable to dispense entirely with the use of canvas packing between the tire band and the rim, and the internal diameter of the tire bands is frequently under the standard diameter. With a rim above standard diameter there is great danger of bursting the tire band while the tire is being pressed on, and the author is therefore of opinion that for the present it is preferable to make the rim tolerance nothing above, but one millimeter below the standard diameter.

Pressed Steel Wheels

The Sankey is another type of built-up wheel in which the two halves are pressed out of a sheet and subsequently united in the center plane of the wheel by acetylene welding. This makes a very nice-looking job, which appears to stand well when fitted with pneumatic tires, but the author has not found it satisfactory on solid tires for bus work, unless it was reinforced by a center plate. This addition makes a material increase in the weight of the wheel, and a further point against it is the higher cost of manufacture. Plated wheels, both plain and dished, are also used to some extent; these are, of course, well balanced, but are inclined to be heavy, and difficulty has been experienced in the junction of the plate with the hub, and also, in some cases, with the junction at the rim.

A very good type of plated wheel has been recently put upon the market by Ruston, Proctor & Co., Ltd., of Lincoln. In this design, Fig. 4, two circular plates are dished to a conical section, and the rim is formed by flanging the edge of the plate. The two dishes are united to each other by rivetting through distance pieces near the rim, and the plates are joined to the hub by long bolts. This wheel is superior to other forms of plated wheel in having the rim solid with the plate. The drawback, as with other plated wheels, is that it is about 50 per cent. heavier than is necessary.

Number of Tire Slots

The sub-committee of the Engineering Standards Committee expressed the opinion that to facilitate the removal of the tires, four equally spaced slots should be provided in the outer flange of the rim. The Society of Motor Manufacturers and Traders has subsequently recommended that for rims above 771 millimeters diameter six slots should be used. With this recommendation again, the author is unable to agree, experience having shown that four slots are sufficient for forcing off twin tires of 1050 millimeters.

As the cutting of the slots necessarily reduces the strength of the rim at these points, it is preferable to arrange them opposite to the spokes, so that the direct support obtained may neutralize the loss of strength due to the slotting. The number of rim slots is therefore related to the number of spokes in the wheel. Six spokes are insufficient except for light work, and experience has not shown that it is necessary to employ more than eight spokes even for loads up to five tons. Four rim notches suit an eight spoke wheel, but in order to have six rim notches each separated by a spoke, where more than six spokes are necessary, it is obvious that the wheel would need to be made with twelve spokes—which is more than is required and adds unnecessarily to the weight of the wheel and the cost of production. Four inches is a convenient width for the rim slots, and it is desirable that the ends of the slots should be raduised instead of having sharp corners.

In regard to the employment of retaining flanges or cleats, the author is convinced that if the tire is properly fitted to the rim and forced on with, say, not less than 50 tons pressure, there is no necessity for a retaining flange or for cleats. Neither the retaining flange nor the cleats will keep the tire on the wheel in the event of a fracture of the steel band forming the base of the tire. For town work the bolts for securing cleats or retaining flanges are frequently sheared

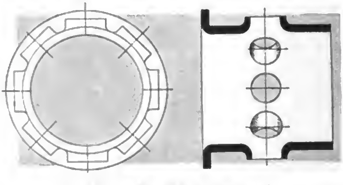


Fig. 3—Pressed steel hub of C.-M. wheel

by contact with the curb, and where there is much curb work the author thinks that it is preferable that no retaining flange or cleats should be used, and that the registering flange, against which the tire is pressed, should be put upon the inside; otherwise it is liable to serious injury by contact with the curb, and the notches in the flange are peculiarly liable to trouble of this kind, and are also liable to catch on the edge of the curb.

Plain versus Ball or Roller Bearings

There is considerable diversity of practice in the matter of the hub bearings—ball bearings, roller bearings, and plain bearings are all used. The ball or roller bearing requires less attention for lubrication, but the plain bearing is able to resist shocks with greater impunity. There does not appear to be much to choose in first cost between the ball or roller bearing and a properly constructed plain bearing. The plain bearing should be provided with hardened steel surfaces which are ground accurately to cylindrical shape after hardening. Between the hardened and ground surfaces is fitted a floating bush of bronze or gun metal, the said bush being drilled—usually spirally—to facilitate the flow of lubricant between the two surfaces.

The plan bearing needs to be regularly replenished with lubricant, or it will soon depreciate. The ball or roller bearing requires practically no additional lubrication after the first assembly, but it must be kept clean and dry or it will rapidly deteriorate.

The critical time for ball or roller bearings is when changing wheels, say, for tire renewals, as it is then that they are exposed, and if, as sometimes happens, part of the bearing slips out of the hub and on to a wet and dirty floor, and is replaced without first being thoroughly cleansed, depreciation is very rapid and serious injury to the bearing will result. The presence of water is particularly objectionable in either ball or roller bearings, owing to the corrosion which is set up destroying the surface of the races and the rollers or balls.

On the whole, the author is of opinion that the best results are obtained by the employment of roller bearings, one on each side of the hub, so constructed that the bearings are not exposed when the wheel is taken off, and that every part of the bearing is securely held together so that no part can fall out during the handling of the wheel. Standard designs of hubs are being developed on these lines.

Ball journal bearings are also able to bear considerable side thrust, but in the case of a roller bearing, side thrust must be provided for independently, either by the use of plain washers or preferably by the employment of properly designed ball thrust bearings.

The practice in the United States is generally in favor of the employment of cone roller bearings in wheel hubs, of the Timken or other somewhat similar patterns. They have the advantage of taking both journal and end pressure.

Tires on Soft Ground

A rubber tired wheel, being designed for use on a hard road surface, is at a disadvantage on soft ground or in snow. The surface of the tire has no tractive "bite," and the rotation of the driving wheels causes them to sink deeper into soft ground. This difficulty is constantly met with in handling the motor transport in France, and is due not merely to bad roads but also to the fact that the vehicles have frequently to be cleared off the roads into adjacent fields so as to facilitate the movement of troops. It is easy to imagine the condition of the fields in consequence of the heavy rains, and the author is informed that vehicles have in some cases been lost through sheer inability to get them back on to the road before the arrival of the enemy.

To overcome this serious difficulty, an attachment to driving wheels has been designed by one of the transport officers. This device consists of a series of steel rings which are secured to the periphery of the driving wheel by a central chain which is provided with turnbuckles. An anchor chain is also provided to prevent circumferential slipping. The device can be quickly attached and detached when required, and its reliability has been demonstrated in actual service; it is not suitable, and is not intended, for use upon a hard road surface. Fig. 4 shows a wheel fitted with this non-skid device, of which some thousands are now in use at the front.

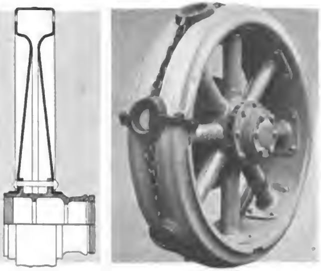


Fig. 4—Left—Ruston Proctor pressed disk wheel that has half rim in one piece with disk. Right—Non-slip device used by army trucks for getting out of soft places

Widen French Highways To Facilitate Army Motor Transportation

FRENCH national highways, leading from base depots to main points along the fighting line are being widened by the military authorities in order to facilitate the work of the army transports. Practically all French macadam roads are flanked by grass tracks, sometimes as wide as the road itself, on which trees have been planted at regular intervals. These tracks give pasturage to cattle when on the move and the trees act as a protector against sun and wind. Owing to the immense amount of traffic on the main roads, the grass tracks have been used by men and horses, leaving the center free for automobile convoys, until, instead of a smooth, trim grass surface, there is nothing more than a bed of mud.

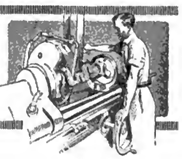
The military authorities, taking the work out of the hands of the department of roads and bridges, is now making the side tracks fit for traffic. Stakes are driven into the road and over these are placed wood beams or old railroad sleepers, laid longitudianlly. Logs are placed crosswise above the sleepers, at regular intervals of about 5 feet. A heavy layer of broken stone and sand is spread over this wood framework. The surface thus obtained is found entirely free for automobile traffic, comprising heavy convoys, fast touring cars, and troops being moved in buses and trucks.

The work of transforming the roads is being undertaken by the engineer corps in the army and by territorial troops who are officially considered to be resting; in other words, who are not in the actual firing line.

$787,083 in N. J. Automobile Fees

TRENTON, N. J., Jan. 23—New Jersey collected license fees from motorists totaling in 1914, $787,083, according to the annual report of Job H. Lippincott, commissioner of motor vehicles. Fines for violation of the law totaled $25,025. The commissioner reports the establishment of a rogues' gallery for automobilists.

The Rostrum



Installing the Center Ball Bearing

EDITOR THE AUTOMOBILE:—Please explain and show in a drawing in your next issue of THE AUTOMOBILE how to mount the center ball bearing in a three-ball-bearing crankshaft.

2—What would the piston displacement be for a motor 3 by 6?

3—Have the Mercedes, Benz and Delage companies American agencies?

4—What type of motor has Louis Disbrow in his racing car Simplex Zip.

St. Louis, Mo. F. SMITH.

—1—The installation of ball bearings on the main journals of a two-bearing crankshaft is not difficult, as they may be easily assembled in place and removed for examination when desired. The problem of supporting the center journal of a three-bearing, four-throw crankshaft is an interesting one that can be solved in a variety of ways. One which is used successfully by the New Departure company is shown in Figs. 1 and 2. The crankshaft is made in the usual manner except that the crank webs have rounded corners to make possible the installation of the ball bearing which must be passed over them. The bearing inner race is supported by a split or two-piece bushing which makes up the space between journal pin and bearing inner race. This is assembled after the bearing has been placed on the journal by pressing that member against one of the crank webs, thus leaving room enough at the other side to enable one to put the half bushings together around the shaft and then forcing them sidewise into the bearing bore. The bearing and bushing are then pushed to the center of the journal and the assembly is retained in place by clamping the two retaining and spacing rings (which are also in two pieces) around the shaft by suitable bolts. The bushing supporting the bearing inner race and the bearing as well are thus firmly held on the crankshaft. The outer race is a good pushfit in the crankcase housing supporting the center bearing.

Another method is that in which the diameter of the crankpin is increased at the point upon which the bearing is installed. The inner races are all securely clamped inwise, the outer races are all sucking fits and free endwise, with the exception of that at the center, which is held between shoulders with .01-inch clearance. This bearing rather than the one at the flywheel end is limited endwise because it is subject to the lesser radial load. The crankcase has the lip and groove end closure to prevent oil leakage in the common manner. Instead of clamping the inner races endwise by a nut, bolts lying in grooves in the wrist clamp the washers. These washers are horseshoe-shaped to facilitate placing.

Still another method is followed when the bore of the intermediate connecting-rod bearing is large enough to pass over the web. Halved bushes well fitted to the wrists are set on these; halved threaded bushes fill up the remaining wrist length, leaving a slight space. These halves are slipped on endwise over the web tops which do not project beyond the wrist diameter. Halved nuts with clamping lugs fit the threaded bushes. These nuts securely bind the inner races, tightening the clamping lugs and locking the nuts securely. Both the methods last described are used by the Hess-Bright Co., and with either successive bearings can have the same bore.

2—The piston displacement for a four-cylinder 3 by 6 motor would be 169.6 cubic inches; for a six-cylinder motor it would be 254.4 cubic inches. Displacement per cylinder, 42.4.

3—The Mercedes car is handled by Paul LaCroix, 3 East Fifty-second street, New York City. The Benz car is handled by the Benz Auto Sales Corp., 1696 Broadway. There is no American agent of the Delage car so far appointed of which THE AUTOMOBILE has any record.

4—The Simplex Zip has the regular 50-horsepower Simplex motor fitted up especially for racing. This is a 5.375 by 6.5 T-head job.

Thomas Receivership in 1912

Editor THE AUTOMOBILE:—Why did they discontinue making Thomas cars in 1912?

2—What was the general opinion as to the merits of the 1911 model 59.

3—What horsepower has it?

4—What is the market value today of this car?

5—What is the highest speed that can be obtained?

6—Can you tell me the functions of the torque tube?

7—What is consumption of gasoline per mile under normal conditions?

8—How can I take up the backlash in the shaft and differentials?

Lynn, Mass. JOHN R. COLEMAN.

—1—Thomas cars ceased to be manufactured in 1912 because the E. R. Thomas Motor Car Co., of Buffalo, N. Y., the maker, became involved in financial difficulties. The receivership of the Thomas plant resulted from action in equity brought by the creditors on the grounds that the company, while solvent, was temporarily unable to meet its obligations. The company was re-organized in 1911 and extension notes were given at that time. These fell due in August, 1912, and could not be met. The total amount was $250,000, out of which the holders of $210,000 agreed to grant a 3-months extension, but the holders of the remaining $40,000 declined and as a result Judge John R. Hazel in the United States District court appointed a receiver. In 1914 the reorganized Thomas company announced a new six which appears with refinements for 1915.

2—The Thomas has been regarded as a reliable car.

3—The rated horsepower of the 1911 Model M was 40 and that of the Model K 70.

4—According to the reports published by the Chicago Automobile Trade Assn. the value of the model M 1911 Thomas for a seven-passenger touring is now $430 and for the Model K $390.

5—The highest speed would depend on the condition of the car and its gear ratio.

6—The function of the torque tube is to take the strains that are imposed on the frame of the car in starting and in applying the brakes. Under these two conditions the axle housing tends to rotate and were the torque tube or some equivalent device not used the strain would be taken by the shaft. The torque tube generally incloses the driveshaft.

7—The consumption of gasoline per mile under normal conditions depends upon so many varying factors that no general average can be given. It may be stated, however, that, with the moderate weight cars now in use, a mileage of 14 or 15 to the gallon is very common. With lighter weight cars this mileage may run up as high as 30 and with heavier as low as 4 or 6. It is impossibile to give a general mileage.

8—The only method of taking up backlash in the differential gearing is to replace the parts which are worn and which caused it. If there were adjustments to bring the teeth of the gears into closer mesh a small amount of lost motion could be taken up by utlizing this adjustment feature.

Asks Value of Steel Alloys

Editor THE AUTOMOBILE:—In your recent article on vanadium there was frequently mentioned such combinations as nickel-chrome-vanadium steel. I never see mentioned nickel-chrome-tungsten steel, tungsten steel being spoken of as simply tungsten steel.

1—What properties would be imparted to tungsten steel by the addition of nickel to the alloy? By the addition of the element chromium? of silicon? of manganese?

2—I also read in your magazine sometime ago that the National cars use silico-manganese steel for springs instead of carbon steel. What peculiar advantages are claimed for silico-manganese steel springs as compared with carbon steel springs? As compared with vanadium steel springs? I also note that silico-manganese steel is used for making gears. It seems to me rather strange that the same properties in a material that make it especially adapted for springs should also make it especially suitable for gears. How is this?

3—Do you not think that it would be well for the A. A. A., the S. A. E., or some similar body to officially weigh each model of each make, fully equipped, but with tanks empty, and to see that the correct figures are readily available to the public? Not only is the public entitled to reliable information on this point, but the remedy suggested would be a great boon to the automobile industry and business; for there would not be such a premium on dishonesty as at present, and the manufacturers of a really light car would be suitably protected in whatever advantages are rightfully due him. It seems too bad that the automobile industry and business, which in the main is highly legitimate and honorable, should be so sadly tainted with dishonesty in this one matter; and some such plan as I suggested would do a great deal of good in more ways than one.

Chicago, Ill. J. B. McQUEENY.

—1—Nickel is added to steel to increase its elastic limit, its hardness and its ductility. It is generally used to the extent of 3.5 per cent. for forgings. The reason it is not generally used with tungsten in alloying steel is that the tungsten itself is a hardener. Tungsten is of value in combination with chromium and carbon in that it raises the temperature to which the steel can be brought without losing hardness. For this reason tungsten steel is known as high-speed steel. That is, the heat generated in high speed cutting does not soften the metal sufficiently to dull the edge of the cutting tool with the rapidity that would be the case were ordinary steels used. High-speed steel is chrome-tungsten steel and a typical composition is carbon .68 per cent. manganese .07 to .11, chromium 5.95 to 5.47, tungsten 17.81 to 18.19. The manganese which is present is added to overcome the effects of the sulphur and oxygen impurities. Silicon is a steel hardener and is not present because the tungsten fulfills this purpose.

2—The advantage of silico-manganese and vanadium-steel springs as compared to carbon steels is generally due to the

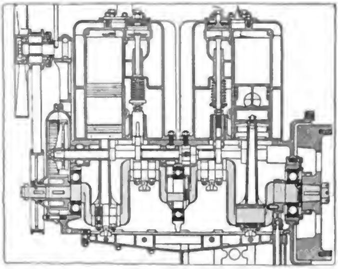


Fig. 1—Sectional view through motor showing a ball-bearing crankshaft installation

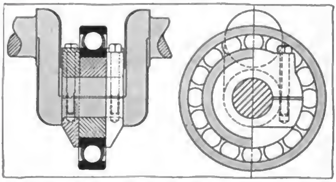


Fig. 2—Detail of center ball-bearing mounting for a three-bearing crankshaft

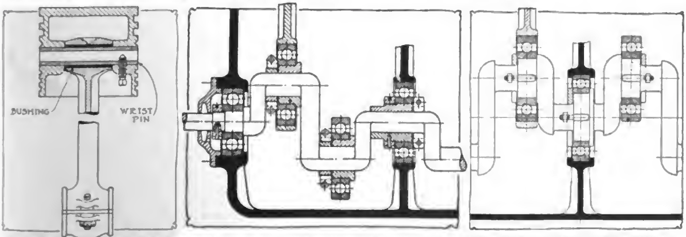


Fig. 3—Left—Overland piston pin arrangement. Center and right— Methods of fitting the ball-bearing on a four-cylinder crankshaft

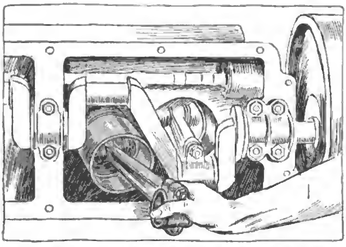


Fig. 4—Method of withdrawing piston and connecting-rod assembly after the bottom half of the crankcase has been removed

prolongation of life of the spring. Every spring or any piece of steel has just so many possible vibrations before its life is terminated. The purpose of using the silico-manganese and vanadium alloys is to raise the possible number of vibrations. The reason the alloys you speak of are used for making gears is that they tend to harden the gears and hence reduce the wear.

3—It cannot be doubted, but that a standard method of weighing cars and of securing reliable data on this subject would be an advantage.

Repairing Overland Piston Pin Bearing

Editor THE AUTOMOBILE:—What is the best way to get at the wristpin bearings in an Overland model 79 so that they can be tightened.

2—Is half kerosene and half wood alcohol a good carbon remover for Pope-Hartford cars?

3—Has the Paige-Detroit car direct drive?

4—The Pope-Hartford cars are very hard to start in summer and almost impossible to start in winter. Is there any way to start them easily?

Falls Village, Conn. F. S. S.

—1—The wristpin on the model 79 Overland is not adjustable. The pin itself is a hollow hardened steel piece which bears against a solid circular bronze bushing as shown at the left, Fig. 3. When wear has increased to such an extent that there is a knock at this bearing the method which you will have to follow will be to remove the piston, drive out the piston pin and remove the bushing. The worn bushing and piston pin are then replaced by new ones. This will cost 80 cents. The wristpin is 30 cents and the bushing 50 cents.

The method of removing an Overland piston is to take off the bottom half of the crankcase and then remove the connecting-rod bearing cap from the rod attached to the cylinder which it is desired to remove. The bearing cap is held by two bolts fastened by castellated nuts. When these are removed the rod can be swung to one side out of the way of the crankshaft and the entire assembly withdrawn from the cylinder in the manner illustrated on this page, Fig. 4. The pin can then be driven out with a punch after which the bushing can be readily removed. The new parts are replaced by simply reversing the above directions.

2—Half kerosene and half wood alcohol is a good carbon solvent and may be used to good advantage in the Pope-Hartford car. After taking the carbon from the cylinders the oil in the crankcase should be renewed in order that the lubricant will be in good condition.

3—The Paige-Detroit has a direct drive on top speed at which point the reduction is 4 to 1; this being the ratio in the rear axle. The car referred to is the touring model.

4—There may be any number of reasons why the car is hard to start. The only way to arrive at the cause is by process of elimination. There are three important factors in starting a car; namely, compression, ignition and carburetion. The first, compression, should be good. If it is not the possibilities are that the piston rings are leaky, that the valves need grinding; that the spark plugs and other cylinder connections are leaky, admitting air into the cylinder, or that the cylinders and pistons are gummed with carbon.

Ignition must be good for starting, since the spark is produced under the adverse condition of a slow rotative speed. To test the ignition, remove the plugs and lay them upon the cylinders. Crank the engine at approximately the same speed that you use in cranking to start, and observe the sparks. If they are all good and snappy, it is fairly certain that ignition trouble is not bothering you. If the sparks are poor, or do not occur at all, it will be a matter of tracing back trouble in the ignition system.

The proper carburetion for a start is that in which an exceedingly rich mixture is provided. With the later carbureters it is almost universal practice to provide an air shutter which will cause the suction of the motor to fall on the gasoline jet drawing practically raw gasoline into the cylinders. If your carbureter is so provided this phase of carburetion is taken care of but if it is not, the adjustment for low speed should be altered so as to provide a sufficiently rich mixture for starting. Proper starting carburetion is often interfered with by leaky manifold connections which permits air to enter the intake thus weakening the mixture. All gaskets and joint connections in the intake line should be kept tight. If your compression is good, the spark what it should be, and, a rich mixture introduced into the cylinders, you will have no trouble in starting even in cold weather.

Detroiter Motor Is L-Head Block

Editor THE AUTOMOBILE:—Will you please tell me what type of motor is used in the Detroiter car. Has it a two-bearing crankshaft fitted with ball bearings?

New York City. H. D.

—The motor used in the Detroiter car model C is an L-head block with the valves on the right. It has a bore of 3.5 inches and a stroke of 5. It is cooled by thermo-syphon and oiled by splash. The crankshaft is carried on two ball bearings.

Wants to Remove Nickel Plate

Editor THE AUTOMOBILE:—I would like to know what to use to take off different kinds of re-nickeling that I have used on the brass parts of my car. Something that will restore and not harm the original brass surface.

Albion, Nebraska. W. B. MARTIN.

—The coat of nickel which is deposited over the brass will have to be eaten off by acid or else scraped off mechanically. The acid will have a more even action and is recommended by large brass companies. The acids used are a mixture of nitric and sulphuric in even quantities. After the acid has eaten through the nickel it will leave the brass and then the acid is washed off and the brass repolished. To get a very good job it would be better to have the brass rebuffed.

Washing Soda for Radiator Cleaning

Editor THE AUTOMOBILE:—I have been having trouble getting the water to circulate through our 1910 Packard radiator. I have put pressure on it with a hose but the water went through only very slowly. I did this a number of times and there did not seem to be any loose sediment of any kind coming out of the radiator. I have heard that washing soda dissolved in boiling water will clean it, also boiler compound. Can you advise me regarding this?

Hyannis, Mass. C. A. MURRAY.

—Common washing soda dissolved in boiling water is an excellent remover of the scale that forms in the radiator. The radiator should be thoroughly flushed out with a solution consisting of about two heaping handfuls of soda to an ordinary pail of boiling water. The soda solution should be allowed to remain in the radiator for a short time and it should then be flushed out with clear warm water.

It is inadvisable to use boiler compounds in automobile radiators unless the constituents of the compound are well known. Some of the boiler compounds contain ingredients which corrode any metal surface with which they come in contact. The result is that instead of merely removing the scale the metal itself is decomposed and in a short time the radiator becomes leaky.

Oil Reaches Combustion Space

Editor THE AUTOMOBILE:—We would appreciate your telling us how to correct the oiling system in a new car which has given trouble since it left the factory. The car has been driven 3,000 miles so by this time should be thoroughly "worn in." The trouble is that oil works up into the first and fourth cylinders.

Somerset, N. Y. FROST BROTHERS.

—Faulty piston rings seem to be the only condition which would give the oiling trouble you mention. It may be that the joints of the rings which are of the ordinary eccentric type, have become aligned leaving a passageway for the oil to enter the combustion space. Another possibility is that you have too much oil in the crankcase which causes a greater supply than necessary to be thrown up. It would seem that the best step to take would be to remove the pistons and examine the rings on the cylinders that give the trouble. The pistons can be removed by taking off the lower half of the crankcase, removing the lower connecting-rod bearing cap and withdrawing piston and connecting-rod assembly. A replacement of the rings should eliminate the difficulty.

Building a Light Narrow-Tread Car

Editor THE AUTOMOBILE:—I am sending you a drawing, Fig. 5, of a light car that I am building. It is of the underslung type; is 105 inches long and has a tread of 48 inches. I am going to use 28 by 3 wheels and have a 20-30 horsepower motor. It will have a 10 3-4 inch road clearance and the transmission is a three-speed sliding gear and reverse. If I use a 48-inch tread, rear axle of the racing type that is used in the Tiger light car, 3 to 1 gear, would a 20-30 horsepower motor be too much for it?

Ft. Wayne, Ind. EDISON DALE.

—A motor producing 30-horsepower would not be too much, provided that the gearbox and transmission parts were designed to accord with this power. The question of tiring should be settled after the design had been layed out to a sufficient extent for you to be able to determine the exact load on each wheel.

Would Like Metric Measurements

Editor THE AUTOMOBILE:—The S. A. E. is to be warmly congratulated for its efforts towards the regenerating of the American standards. The results already obtained are very encouraging, yet the great work ahead for the S. A. E. calls for a large amount of foresight as well as energy in order that the final achievement be permanently useful. It is obvious that the entire work of establishing new standards should be started from a simple and reliable base, so that the system of standards (measures, weights, etc.) once laid out, should remain a solid and permanent monument to American engineering. An ideal system exists already and is, besides, very much in use throughout the world. It is the metric system.

We realize that our present system of standards and measures is antiquated and unreliable and that a change is very much needed. Why not adopt the metric system? It would be then a surprisingly easy matter to establish standards that would not only fit our own needs, but would tally automatically with the standards of the other nations that have already adopted the metric system. Sooner or later, the United States will have the metric system, and the sooner the better, so why not now? It is encouraging to note that we are favoring its introduction here.

We popularly give now the fractions of an inch in decimals, we are gradually getting used to hear about centimeters, millimeters, cubic centimeters, etc. For a multitude of reasons, it is now more timely than ever to seriously consider or discuss the possibility of adoption of the Metric system by the United States. That question is no small item since so stupendous a change would necessarily require a large amount of work and the co-operation of the entire American nation.

The history of the metric system, which is of French origin, is a remarkable one. Before its creation the French unit of length was the "toise," about equal to the English yard. At the time of the French Revolution, two engineers, Mechain and Delambre, were entrusted with the task of measuring one-fourth of the length of a terrestrial meridian. They found this meridian to measure so many thousand toises. They divided that number of toises into exactly 10,000 parts and called each a meter, the base of the whole metric system, as all other measures are derived from it. It is verily a simple scientific system, and it is derived from the very earth on which we all live. Therefore, it ought to be good enough for any nation. Its great simplicity won for it immediate favor and it is today adopted almost universally, the English speaking countries being a sorry exception.

Arcadia, California. CHAS. VINER.

—What would be a simple matter as far as actual measurements are concerned, would be far from simple when it came to replacing all our present dies, tools and fixtures by millimetric devices. It is hardly possible to conceive the enormous expense to which manufacturers in every phase of the industry would be put in replacing their present tools by those of metric dimensions.

This matter has been brought up and discussed from time to time and it has always resulted in the discovery that it would be impossible to secure concerted action by all our manufacturers because there would always be many who would feel that it is impossible to go to the expense of replacing their expensive machinery by that using the metric measurements.

Motor Speeds of Franklin Car

Editor THE AUTOMOBILE:—How many r.p.m. should the motor of the latest Franklin touring car make respectively at speeds of 20, 30, 40 and 50 miles per hour on high gears?

Oakland, California. A SUBSCRIBER.

—The wheel revolutions of the Franklin 6-30 touring car at speeds of 20, 30, 40 and 50 miles per hour on high are respectively, 197.8; 296.6; 395.5; and 494.4. Since the gear reduction on high gear is 3.7 to 1, the revolutions per minute of the motor are respectively 731.86; 1,097.42; 1,463.35; and 1,828.28.

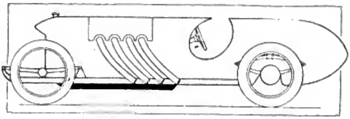


Fig. 5—Car body designed for light high-speed work

The Improvement of Spring Systems--V

Points worth noting in charts recording frame and axle movements in an automobile with spring and tire equipment—preliminary to figuring out corresponding action for springs and hard tires

By M. C. K.

(Continued from issue of January 7, 1915)

ATTEMPTING to bring to book, timed and measured, the movements and shocks which occur when vehicle springs are actuated through the wheel impact with a hump in the road, one feels the need of actual test records for checking the correctness of reasoning, as the subject is rich in elusive complications and one has to deal with very small time elements in deciding, for example, whether at a given moment after a shock has been received the vehicle frame and body will move in the same direction as the axle or against it—upon which, again, may depend the suitability of any proposed remedy for faulty action. But test records are not easily obtained. Instruments for recording graphically the jolting of a vehicle are not often used and have in most instances been arranged to show the relative movements of frame and axle and the highly effective quieting of these movements which results if some sort of spring regulator device is employed. But neither comfort nor safety depends upon making the axle and the frame move in unison; on the contrary, the axle must follow the uneven road surface, except in so far as tires or spring wheels or vehicle speed will permit deviations, and the frame should follow its own level in so far as possible. Such instruments also fail to indicate the severity of shocks which are not translated into movement—and thereby allayed—and are in fact based, it seems, upon the false theory that shock is indicated, in the case of a vehicle, by the extent and suddenness of vertical movement, or the stopping of such a large movement, or else upon the idea that shock is preferable to bouncing, which is contrary to the whole purpose of spring suspension. It may be said that the large movements indicate a sharp acceleration or retardation and that acceleration and retardation are commonly accepted as the only causes of shock; the instruments, by showing the movements in one case and their suppression in another, might on that theory be supposed to record the shocks and their avoidance indirectly, were it not that the ideas have become twisted, the movements really indicating the cushioning of shocks, though perhaps in a wrong direction, and the suppression of the movements indicating a condition under which the shocks may be simply endured though they may also have been dissipated by friction. The confusion arises perhaps from failing to distinguish between useful movements, necessary for cushioning an impact, and useless bouncing due either to reactions following the storing of a shock in spring tension or to misdirection of a cushioning movement. At all events, the records of the instruments are inconclusive.

No Direct Shock Records

It is, further, notable that the worst shocks to which vehicles are subject escape adequate and proportionate recording by means of a stylus, even if such a stylus floats between two sensitive springs, as they depend upon the horizontal movement of the vehicle being transformed by an obstruction into a very small vertical movement plus a severe shock, through the absence or momentary inaction of elastic elements. This sort of shocks are those which springless vehicles and the running-gears of vehicles with hard tires constantly receive, but they also occur when springs are too stiff and—this being the most practical instance—when a shock is received at a moment when springs of suitable flexibility are stiffened by strong compression resulting from a previous shock and ungoverned spring action.

As acceleration or retardation in these instances (which the instruments show only as a small movement in each case) is also scarcely recognizable, being veiled in a change of direction, nothing has probably been gained for a wide understanding of the subject by insisting that acceleration or retardation is indispensable for the production of shock, as it is only in a highly scientific sense that either measures proportionately the shocks which are most destructive or disagreeable.

Instruments Wanted

Briefly, the instruments so far used on the road for demonstrating the efficiency of spring devices, record only movements but not forces which are spent destructively, and the movements are not the important ones. The movements of prime interest are those of the axle and those of the frame or body in relation to the road, and those of the axle in relation to those of the frame are secondary. The latter may be constructed on paper if the former are known, but not *vice versa*, as the road level is not disclosed by a chart of the relative axle and frame movements. Fig. 10 shows on a smaller scale the exaggerated relative axle and frame movements corresponding to the more important movements relatively to the road level which are represented in Fig. 9.

As said in the beginning, test records showing the important movements would greatly assist in analyzing the requirements, and those wanted at the present stage of the examination should preferably refer to vehicles with hard and unelastic tires, normal springs and the shocks and movements caused by a road obstacle about 3 inches high at a vehicle speed of about 35 miles per hour, so as to furnish a direct comparison with the results figured out for these conditions. The best records available are, however, those produced by Dr. Bobeth for a car with pneumatic tires passing over an obstacle about 1 inch high and shaped as the shaded space in Figs. 9 and 11. The dimensions of the obstacle are not recorded explicitly but may be inferred from the tire action shown in the diagrams.

The Accompanying Charts

The speed for Fig. 9 is 22 kilometers (13.60 miles) per hour, which is found to result in more bouncing of the frame —when pneumatic tires are used—than either lower or higher speeds, and the speed for Fig. 11 is 75 kilometers (46.50 miles) per hour. The horizontal extension of the diagrams represents space, not time, so that the time scale is nearly 3 1-2 times smaller for Fig. 11 than for Fig. 9. In order to visualize the difference in the horizontal and vertical scales, the obstacle, which is indicated in true relations to the oscillations by dotted line *c* at the beginning of the curves, is represented in its true shape in the shaded space which has otherwise nothing to do with the charts. In the original records the curve *b* of the frame movements is drawn on the same base line as the curve *a* of the axle movements, and this is also done in Figs. 9 and 11, curve *b* being dotted, but in addition curve *b* is shown in full line at an arbitrary distance above curve *a*, so as to indicate the oscillations of axle and of frame more nearly in the relations to which the eye is accustomed in the direct observation of a vehicle.

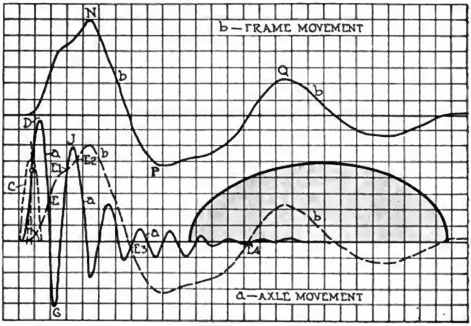


Fig. 9—Frame and axle movements, as measured from their levels at rest, for car equipped with springs and air tires when passing over a given obstacle at 13.6 miles per hour

Spring and Tire Interaction

By looking over these charts it is perhaps first observed that the axle movements are dominated by the influence of the pneumatic tire, and secondly that this influence seems much more favorable at the high speed, Fig. 11, than at the low speed of 13.60 miles per hour, Fig. 9, where the tire gets time to react against the wheel before this has reached the middle of the obstacle and throws the axle to the point D, which is at least high enough to take the load off the tire while it clears *c*. All the portions of the axle curve *a* lying below the original axle level represent of course solely tire compression, in excess of the tire compression due to the static load, and it can be seen that the cushioned blows against the ground which they indicate are caused largely by spring extension. The locations of E, E_1 and E_2, Fig. 9, which are the points where the axle curve intersects the frame curve before the latter reaches N, show this to be the case; for at these intersections the axle and the frame are in their initial relations, but as they are above their starting levels, the load is removed from the spring, and the latter is left free to extend, which it does with considerable force, since at E it is coming back from D, anyway, with the recoil of its first compression and the frame is going up at the same time. It is noticed that not only the first but also the second axle oscillation contributes to raising the frame to N, and that the second spring extension (from E_1 to the base line plus simultaneous rise of frame) is almost as marked as the first one (from E to the same line plus rise of frame). The descent of the frame from N does not begin till after the second spring extension is finished and then proceeds from N to P under the combined effect of spring recovery and gravity and gathering momentum toward P, thereby in turn compressing spring and tire after E_3 and causing their last oscillations. It is noticed that the spring compression after E_3 is very considerable, being indicated on the chart not by the height of the axle alone but also by the drop of the frame, in fact by the extent to which dotted curve *b* dips below curve *a* between E_3 and E_4. The oscillations of *a* are here evidently due to tire action after frame drop H to P.

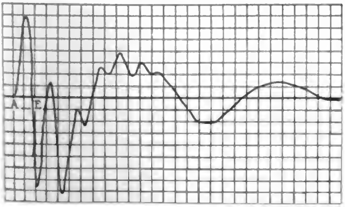


Fig. 10—Relative movements of frame and axle, under conditions of Fig. 9, showing successive spring compressions and extensions

Fig. 10, giving the chart of relative frame and axle movements, shows the succession of spring compressions and extensions directly by the vertical distance of any point in the curve from the line AE; compression above this line and extensions below it.

But while it is possible to some extent to separate, in these charts, the indicated movements into spring movements, which affect the frame, and tire movements which affect both the frame and the axle levels, it is scarcely possible to point out how the spring and the tire mutually affect the movements of one another. This must be done either by test records similar to Figs. 9 and 11 from a vehicle with hard tires, which would be preferable, or by figuring from assumed data. For lack of tests the latter method must be used.

Effects of Speed

Fig. 11, considered as a time schedule, corresponds only to the first portion of Fig. 9, as far as E_3 in that chart, but covers the same distance of vehicle travel, approximately 8 to 10 feet.

The points of greatest interest in Fig. 11, apart from those it has in common with Fig. 9—for example that two spring compressions, the last one at J very slight, and two tire compressions take place before the frame lift reaches maximum at N—are those due to the higher speed of the vehicle. It is seen that the speed makes the wheel clear the obstacle without raising the axle as much as the height of the obstacle amounts to, this meaning, of course, that the obstacle becomes deeply imbedded in the tire by reason of the force of the shock, and the vehicle is past before tire rebound takes effect. The frame does not begin to rise until the first spring and tire compression is finished at D, and the spring compression is evidently much smaller than the tire compression—and smaller than in Fig. 9 at lower speed and lighter impact. The location of G in comparison with D shows that the tire action predominates. Finally, in harmony with the small spring action, the frame movement at its maximum at N is only about one-half that of the axle movement and much smaller than in Fig. 9, but the maximum at N is reached, as before, at a moment closely coinciding with the maximum of the second spring and tire extensions; and these nearly coincide with one another.

Plainly, a much larger portion of the shock is absorbed in the pneumatic tire (with standard inflation) at 46.5 miles per hour than at 13.6 miles, though the two shocks are in the proportion of 46.5^2 to 13.6^2, or about 10 to 1, so far as the horizontal components are concerned and perhaps more than 4 to 1 for the vertical components. And by virtue of the rotation of the wheel a very large portion of the elastic reaction from the tire shock is released in heat and in stresses converging toward the center of the wheel from all sides, so that the springs are greatly relieved from work. This effect discloses the truly magic value of pneumatic tires as shock absorbers under the conditions of speed, inflation and shape and size of obstacle which obviate tire reaction against the springs, and it stands to reason that similar effects in lesser degree are produced by elastic tires under less favorable conditions.

The Unceasing Tire Work

They are paid for in the very considerable demands upon the propulsive power which such tires—and all other rotary springs—make on smooth ground by the continuous flexing and unflexing of their fabric caused by the load and the rotation; a drawback which does not apply to vehicle springs and which suggests the desirability of developing the spring system so highly that air tires may be used at a high inflation, to reduce this loss of power occurring when the tires are least needed, as well as the wear which the tire flexions involve.

Equipment for Desirable Tests

So far, no means have been found for calculating the amount of shock force which the elastic tire, especially the air-filled tire, can actually store and release harmlessly to save the springs, and all figuring of shock stresses and movements must therefore cease when there is question of vehicles equipped with such tires. A great work remains to be done in tabulating these effects for different sets of conditions by experiment. A sheave capable of rotation at predetermined speeds, obstacles of different shapes and dimensions attachable to the sheave, provision for a lateral displacement of the sheave to take the obstacle out of the wheel plane after the wheel has passed over it, a wheel which can be equipped with different tires, springs of different flexibility and differently loaded to hold the wheel against the sheave, and a simple registering device to record the spring compression with the load fixed as well as with the load subject to the spring action—these would comprise all the essentials of a testing equipment by which the data might be produced.

Comparison of Fig. 9 and 11 shows, however, that the maximum benefits of the air tire are very closely associated with both high speed and small size of the obstacle, and uses of motor vehicles for which these factors are unimportant are so numerous that the problem of designing spring systems which shall act acceptably without the assistance of air tires becomes a greater one, at least economically, than that of devising the most suitable system for making air tires and the spring system support one another, and it remains probable that the spring system best suited to work alone will also be best suited to co-operate with air tires for the highest degrees of speed, comfort and security. The factors coming into play for such spring systems must be subject to at least approximate calculation, not only with regard to the movements of springs and vehicle parts, but also with regard to those shocks that remain despite the easing by the springs; and these are not ordinarily plotted when the effectiveness of a spring arrangement is under discussion.

That an obstacle so broad (such as the ordinary wave in a road) that tire reaction will take place before its summit is reached, or one so high (such as 3 inches) that only the smaller portion of it can become imbedded in the tire, would make the curves of Fig. 11 look a good deal like those of Fig. 9, and especially would greatly increase the frame lift at N, seems clear without argument. On the other hand, it has been demonstrated by tests that reduced air pressure in the tires would make the curves of Fig. 9 more acceptable but would involve much increased loss of power from tire flexions on smooth ground as well as stresses and wear of the tire fabric which the latter is not adapted for withstanding properly.

Braking the Wrong Movements

Finally, it has been shown by test records that the great superfluity of movements evidenced in Fig. 9 as occurring after those which are directly useful and necessary for surmounting the obstacle can be considerably reduced by the use of spring regulators—dampers and rebound checks—so that the charts do not represent the best that can be done with means at disposal. But these test records still leave it in doubt whether the suppression of movements accomplished by the auxiliary devices is not bought at the cost of shocks taking their place, if not in all cases at least under certain combinations of road and speed conditions, and the shortest way to insight in the methods which will serve acceptably for any given practical purpose—comprising all the work of any given vehicle type—remains a systematic examination of the movements and shocks, or alleviations of shocks, caused by each element of a spring system. Among these elements the ordinary vehicle leaf springs come first, and Figs. 9, 11 and 10, though they include tire action, give a good preliminary idea of the many different ways in which vehicles may react under road shocks and of the factors to be considered before means for effecting a desirable uniformity in these reactions can be evolved—the greatest of all devices for this purpose, the air tire, being after all only an admirable makeshift working very differently under different conditions.

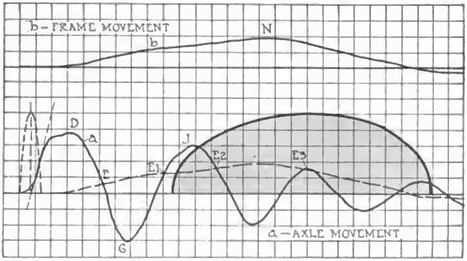


Fig. 11—Frame and axle movements, as measured from their levels at rest, for car equipped with springs and air tires, when passing over a given obstacle at 46.5 miles per hour

That the spring system of 1925 may become as far superior to that of 1915 as the motor of 1915 is superior to that of 1900, if a similar amount of work is expended upon the improvement of the spring suspension as has been spent on the design of motors, is taken for granted by many. And the number of spring suspension workers is steadily increasing. Systematic test records would speed their efforts.

(To be continued)

Duplex Carbureter for Eights

Zenith Introduces New Model for Independent Supply of Gas to Each Cylinder Block—Single Float Mechanism and Only One Throttle Connection

THAT the Zenith Carbureter Co., Detroit, is keeping abreast of the times is evidenced by its announcement of a special carbureter for eight-cylinder V-type motors, which maintains all the Zenith features and is similar in construction to the horizontal type brought out by the concern about a year ago. In the new model there are two outlets to the intake manifolds, one for supplying each set of four cylinders, and two throttles. The latter are interconnected, so that the usual throttle lever and accelerator will act to open or close both simultaneously.

Two Mixing Chambers

Referring to the illustrations, Fig. 1 is an external view of the device, while sections are shown in Fig. 2. It will be seen that there are two entirely separate and distinct mixing chambers with their jets and throttles, these both being supplied from a float chamber, which, with the float mechanism, is common to both. It might be considered that each is a complete carbureter for four cylinders except that only one float chamber is used, and there is also only one air intake, this supplying both mixing tubes. The mixing chambers are horizontal, with the jets entering the venturi section at right angles, so each outlet attaches to the intake connection without bends.

Two Concentric Nozzles

The main feature of the Zenith carbureter is the combining of an ordinary nozzle with another from which the flow is independent of the suction of the engine. These two nozzles are concentric, the ordinary nozzle, or main jet M, obtaining its gasoline from the float chamber through the passage C. It is surrounded by the jet J, which is supplied through the passage N from the well. This well is open to the atmosphere and gets a measured flow of gasoline through the compensating hole D which is not subjected to the suction and, has, therefore, a steady flow. The main jet, if used alone, would give a mixture of which the richness would be in proportion to the speed, and therefore the suction. At low speeds the suction is low, and therefore the mixture would be lean and at high speeds when the suction is greater, too rich a mixture would result. To compensate for this the outer jet lends its strong support to the main nozzle at low suction, when it is most needed, and withdraws it gradually as the main nozzle gathers in strength with the increasing suction.

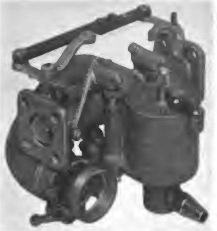


Fig. 1—New Zenith carbureter for eight-cylinder V motors

Slow-Speed Arrangement

The slow-speed arrangement is also a feature of the Zenith construction. It is composed of the idling tube X, of which the lower end is so sloped as to receive the coned upper end of the idling tube Y. This tube Y can be screwed up into the end of X, more or less, by means of the knurled tube Z. This provides for adjustment of the mixture going through the tube, since air can enter at the base of tube X through holes drilled in adjusting tube Z.

The tube T connects the idling tube X with the carbureter mixing chamber near the throttle, by means of the intervening passage T_1. At starting, the suction at the throttle is very powerful, and fuel is drawn up from the well through the nozzle of Y and idling tube X, at the bottom of which it mixes with air entering through the holes in the lower part of Z. The mixture is thereupon atomized, and sprays into the carbureter just behind the throttle and near the end of the mixing chamber. This gives a good starting mixture, and, as the throttle is opened wider, the compound nozzle comes into use and the starting jet goes out of action.

Interchangeable Nozzles

The standard Zenith features of interchangeable nozzles to fit any type of motor, metallic float with overhead float action and removable venturis is retained for the new design. The common air intake is shown at A and the mixing chambers open off it on opposite sides.

The interconnection of the two throttle levers is shown at B, while the hole B_1 provides the means of attachment to the control rods. As the illustrations show, there are two complete sets of compound nozzles, two slow speed nozzles, and everything which has to do with the vaporization and mixing of the fuel is in duplicate, so that the generation of gas will be in accord with the demands of both sets of cylinders, in the V between which the carbureter is intended to be placed. The horizontal design should prove very convenient in this position.

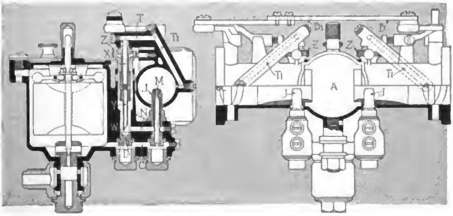


Fig. 2—Left—Cross-section of new Zenith. Right—Section, showing duplex mixing chambers and the pair of jets

Starting and Lighting for 1915

Part II

DELCO equipment for 1915 is slightly more simplified and lighter. This is a single unit system consisting of starting motor, generator, and timer and distributer. Each installation is a special design and therefore there are no stock models. The 6-volt, single-wire system is standard.

The generating characteristics have been changed so that the maximum output is reached between 15 and 18 miles per hour. In general, current regulation is obtained by the use of a field rheostat. A special resistance wire is wound on a spool of non-inflammable material and mounted in the distributer housing back of the condenser. The regulation is effected by an arm which is operated by the distributer shaft. This arm is caused to move by the centrifugal force of the weight to which it is connected and when the arm is in the raised position the resistance is in series with the shunt field, thus decreasing the current and consequently cutting down the charging rate at high speeds.—Dayton Engineering Laboratories Co., Dayton, O.

National Combines Ignition

A combination ignition and lighting generator, and a starting motor are made by the National Coil Co., Lansing, Mich. The former appears in two models, one for four- and one for six-cylinder motors. The starter is made in two sizes also. Six or 12-volt systems are made as required.

The generator, shaped like a magneto, has the breaker box and distributer at one end and produces a 6-volt current and will carry the average lamp load when the car is running at 8 to 10 miles per hour.

A feature of this machine is the provision for increasing the output in cold weather when the efficiency of the battery is reduced, which is done by changing a screw plug on the front plate of the generator. The field windings are protected from excessive current by a fuse located on the front of the machine. The four-cylinder lighting generator runs at crankshaft speed and the six at one and one-half.

Few changes are noted in the generators except that the regulation on the six is now a constant-current system in which a vibrator is used. This instrument has also been reduced in height about 1 inch. In the four, current regulation is by means of a third brush.

The starting motor is a series-wound type, cylindrical in shape and at the brush end there is a removable, waterproof cover which gives access to the brushes.

Additional torque is a feature of the new starters and a reduction in diameter of .25 inches has been made. A cut of 7 pounds in the weight is the result of substituting aluminum castings for iron. Various types of drive are used, the worm being the commonest.

On a four-cylinder motor 4.12 by 4.5 inches, the starter will crank the motor at a speed varying from 120 to 130 r.p.m., depending on the tightness of the different parts of the engine. The current consumed while cranking this motor will be approximately 125 amperes at 6 volts.

In conection with the lighting system the company makes a unit switch which contains the ammeter, relay, and switches for lights and ignition.

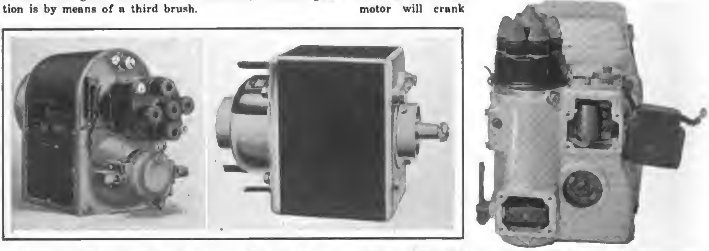
Auto-Lite a Two-Unit

Auto-Lite cranking and lighting systems, which are of the two-unit type, admit of much variation in the methods of application and may be accommodated to almost any amount of space. In order to make this possible, the motor unit is made in two sizes, one longer and of less width than the other. There are two sizes of generators, so that it should be possible to get one of dimensions to fit in the space available.

The Auto-Lite system operates on 6 volts, and besides the two main units consists essentially of a circuit breaker, foot switch, lighting switch, ammeter and storage battery. The Auto-Lite company also makes a form of its apparatus in which an ignition distributer is a part of the generator, the system then caring for all electrical functions.

Auto-Lite Completely Enclosed

The model M cranking motor is a series-wound type of high torque, it is said. It is compact, the length being 8 3-4 inches, width 5 1-2 inches, and the weight 36 1-2 pounds. The entire machine is compactly inclosed in cast iron, which protects all parts from dust and water. By removal of the nameplate band the brushes and commutator are readily accessible. This motor will crank



Left—National generator and ignition outfit. Center—Apico motor-generator. Right—Delco combined starting motor, lighting generator and timer distributor for ignition. The voltage regulator is shown in the upper opening a six-cylinder engine having 60 pounds per square inch compression pressure at 100 revolutions per minute, using under 95 amperes, it is stated. It is so constructed that it can be applied to the car in either a vertical or horizontal position, and can be connected either to the crankshaft through a train of gears or a chain, or to the flywheel direct by having its pinion mesh with the teeth of the periphery. It can also have a transmission application.

Though designed for exactly the same work as Model M, the other Auto-Lite motor, Model MC, differs in construction and shape. It is 7 1-2 inches long by 6 3-4 inches wide, and weighs 30 pounds. A cast-iron frame and field are used, and the series winding is also present. Removal of the nameplates on the end gives access to the four brushes. This motor can also be adapted to any desired position. It is said to be capable of driving a 4 1-8 by 5, four-cylinder engine of 60 pounds per square inch compression pressure at 185 revolutions per minute. The usual gear reduction is about 25 to 1. In the Auto-Lite application, an over-running clutch is interposed in the drive which disconnects the electric motor when the gasoline motor starts under its own power.

The three Auto-Lite generators are designated as Model G, Type SR4; Model G, Type VR4; Model GC, and Model GB. The first two are identical except that VR4 has the ignition distributer as a part of it. Model GC is adaptable to the same work as the SR4, but is of a different shape. Model GB has been brought out to meet the needs of the small types of cars.

Reversed Winding Regulation

Type SR4 generator is of the excited field type, in which the current output is regulated by reversed windings on the field, which serves to cut down the current produced by weakening the field. The generator begins to charge at an engine speed of 200 revolutions per minute, which corresponds to a car speed of about 5 miles an hour. The output increases until at about 17 1-2 miles an hour the production is 12 amperes. At this point the reversed series winding holds the output no matter how much faster the car travels. The generator operates at engine speed and can be driven in any convenient manner. It can be placed on a bracket just ahead of the magneto and connected directly to the magneto shaft by a simple coupling, the company points out. It weighs 37 1-2 pounds and measures 10 by 4 3-8 inches over all.

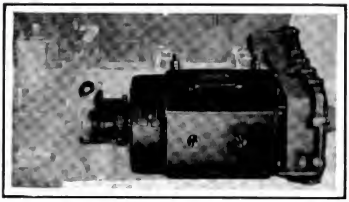
The Model GC generator is designed to be driven by either a chain, train of gears or a V-belt. It runs at 2 1-2 times engine speed, has a maximum output of 14 amperes, and begins to charge at under 7 miles an hour, while 10 amperes is the output at about 12 miles an hour. The current control is the same as that of the generator described above; that is, by a reversed series coil. The machine's compactness may be realized from its dimensions. The length is 8 inches, width 4 inches, and height 6 1-4 inches.

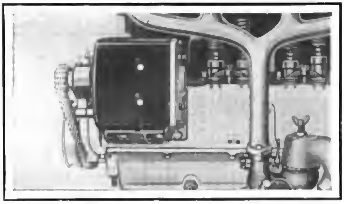
With the aim of keeping weight and size to the minimum, the small car generator has been developed with a 6 1-8-inch length and 4 1-4-inch width, and its weight is 13 pounds. It produces 6 amperes at its maximum, and is driven by a silent chain from either the pump, magneto or crankshaft at 2 1-2 times engine speed. It operates efficiently with a 40-ampere-hour storage battery.

Many Aplco Features

The Aplco line, manufactured by the Apple Electrical Co., formerly of Dayton, O., but now in Newark, N. J., is replete with new features. There is an entirely new motor-generator built in three sizes, one of these being used in a Ford installation and in addition there is a separate starting motor and two separate generators. Apple products are marketed by the Splitdorf Electrical Co.

The new models bear no resemblance to previous designs of either the Splitdorf or Apple companies before their consolidation a few months ago. The new machines are rectangular and have very smooth and neat exteriors. Simplicity has been kept foremost in the design, an example being that the armature is driven from the crankshaft by silent chain. No gears or clutches are used and the armature is the only revolving part in the system. The total reduction is provided by the chain.


Dyneto motor-generator installed on Franklin


Auto-Lite starting motor as used on the Overland

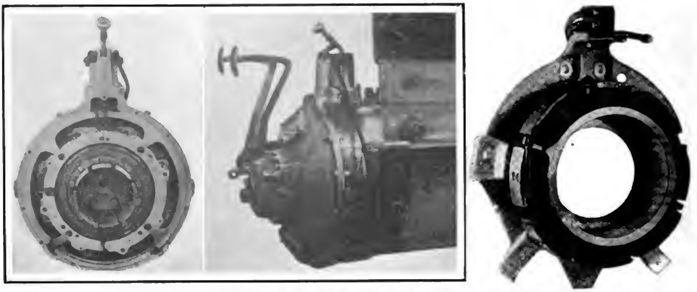
New Models Lighter

In the new equipment lighter weight and smaller dimensions are present. One motor-generator model now weighs 49 pounds instead of 75, and yet it cranks the engine at a much higher speed than formerly, due to the refinements made.

The motor-generator operates at 12 volts as a starter and 6 volts as a generator. It is a compound-wound machine in which the series and shunt fields add their magnetic strength when the machine is operating as a motor, thus giving a maximum starting torque; but when the machine is running as a generator, the current flow through the series field is naturally in the reverse direction, and therefore the series field flux opposes that of the shunt field and the net flux is the difference of the two. By this arrangement, as the speed of the motor-generator increases the voltage remains practically constant above an armature speed of 1,450 revolutions per minute.

By connecting the motor-generator across the terminals of the battery through the starting switch it acts as a motor and spins the engine until it starts, the cranking speed varying from 150 to 250 revolutions per minute. As soon as the engine accelerates to normal speed the voltage is sufficient to charge the storage battery.

An automatic indicating switch makes connection between the generator and the battery when the former is driven at sufficient speed to charge the latter; and likewise when the speed drops the connection is broken, so that there can be no discharge of current from the battery back into the generator. The indicator is equipped with an indicating dial which shows the lettering, Charge On, and Charge Off.



Left—U. S. L. Installation used on new Mercer. Right—Fields of U. S. L. motor-generator

The Ford motor-generator is mounted to the left of the motor and driven by a silent chain with a 3 to 1 ratio with the crankshaft. The instrument is supported on a bracket, which bolts to the flange on the crankcase and also to a shoulder at the base of the front cylinder. Since the driving sprocket takes the place of the fan pulley, other provision must be made for fan drive and this is accomplished through a pulley on the armature shaft.

One of the generators is designed for small machines and will furnish 5 amperes at 6 volts. The normal driving speed is 1,600 revolutions per minute and drive generally by a chain.

Another generator, the S.R.-2, is designed to run at twice engine speed and will give a 7-volt, 10-ampere current. This unit is also made with a special head containing timer and distributor. A feature of this combination is that the generator may be removed for repairs without influencing the operation of the ignition system which may still be supplied by the battery.

These machines have third-brush regulation to keep the voltage constant.

The starting motor is designed for small and medium-sized motors and drives through the flywheel. It is a square shape and is for 12-volt circuits. Its feature is the automatic releasing gear. The instant the motor starts, the contact is broken and the gear releases, even though the starting pedal is held down. This is accomplished by means of a spiral cut in the armature shaft which engages a complementary spiral in the armature bore. The moment the gasoline engine tries to drive the starting motor, which is what happens as soon as it starts, the thrust on the armature shaft throws the driving pinion out of mesh and with this motion the switch contact is broken. This motor is capable of cranking a 3 3-4 by 5 engine at 130 to 150 revolutions per minute. The normal starting current is 70 amperes although the initial kick with a stiff motor may be as high as 160.

Two Motor-Generators—Dyneto

Two motor-generators will be made by the Dyneto Electric Co., Syracuse, N. Y., for 1915. The model A is a new one designed for small-bore motors and the B is continued from last year. No radical change has been made in the new instruments although some refinements have been made. The generator has been improved so that it begins to charge the battery at a somewhat lower speed.

Twelve volts is standard although other voltages can be supplied. Either single or double wiring may be used. Silent chain drive is to be preferred although gear drive may also be used. The gear ratio is between 2.5 and 3 to 1.

The model A motor-generator has a static torque of 25 pounds at 1 foot radius, weighs 35 pounds and generates its rated output at 1,000 revolutions per minute. The model B gives a static torque of 36 pounds, weighs 45 pounds and also produces its rated output at 1,000 revolutions per minute

A cranking speed of 125 revolutions or more depending on the size of the engine is obtainable, the current draw varying under the conditions. With a stiff, cold motor the draw might run as high as 225 amperes for an instant.

A compound winding is used so that when the machine operates as a generator the net strength of the field is the difference of the series and shunt fields, and when running as a motor the strength of the two fields is added.

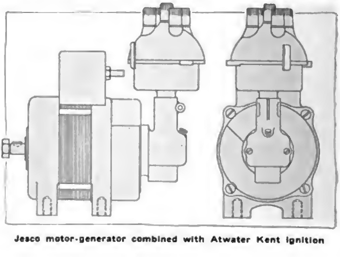
Jesco Has Several Models

Several motor-generators are made by the Jones Electric Starter Co., Chicago, Ill The 6-volt system is the one commonly supplied but 8, 12,- and 16-volt types are also made. When starting, the unit operates as a series motor and when furnishing current for lights and storage battery, as a shunt generator. Current regulation is by a vibrator which cuts resistance in and out of the field circuit. This vibrator, together with the starting switch and cutout are mounted in a case on the top of the unit.

On one model provision has been made for the attachment of an Atwater Kent Unisparker, mounted vertically.

U. S. L. Improves Unit

One model of motor-generator of the well-known flywheel type is manufactured by the United States Light & Heating



Jesco motor-generator combined with Atwater Kent ignition

Co., Niagara Falls, N. Y. The design, however, is modified to suit each installation as regards flywheel weight and torque.

Improvements have been made in armature, fields and commutator. Instead of a steel V-ring construction in the commutator, a steel reinforced moulded insulation is used, the advantages being lighter weight and greater strength. A new light and strong alloy has been adopted in the armature spider. The starting switch is now cast integrally with the crankcase.

Weight has been reduced 25 per cent. and the space occupied by the entire system about 30 per cent. The 12-volt system is standard and double wiring is recommended for starting and either double or single for lighting.

A feature of the new machine is the reduction of the maximum current output at high speeds by developing a high charging current at low engine speeds. Regulation, which is inherent, has been improved so as to secure a drooping characteristic, that is, the highest charging rate occurs at about 500 r.p.m. and then it gradually drops off. This maintains the battery fully charged under all conditions.

Considerable increase has been made in the efficiency of the machine both as a generator and as a motor.

The average speed of cranking is between 150 and 200 r.p.m. For example, a certain 3.125 by 5.5 motor is spun at 220 and a certain 4.25 by 6 motor at 190 r.p.m. The first motor requires a current of 100 amperes and the second 170.

Remy Line Complete

It is the policy of the Remy Electric Co., Anderson, Ind., to manufacture starting, lighting and ignition apparatus to meet the requirements of each particular make of engine yet it has a variety of standard models, including 6-volt starting motor, and lighting generators separately mounted. Two-armature starting and lighting machines with one armature above the other, 12-volt motor-generators and both 6 and 12-volt generators with ignition equipment integral.

The most important development in the starting line is the introduction of a motor for eight-cylinder engines. Some of the motors are arranged for connecting direct to the car maker's reduction gear, others are designed to become an integral part of the reduction transmissions, others complete with reduction gearing and others with the Remy inertia pinion, which automatically engages and disengages with the flywheel type of drive. These standard starting motors are all wound for 6 volts and the variety is such that there is a motor for every size of engine.

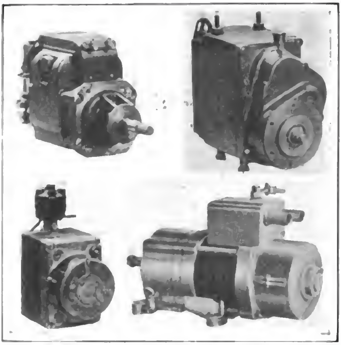
Four sizes of the two-armature motor-generators are made, these instruments combining a generator and motor in one unit, one armature being arranged above the other. The reduction gearing and over-running clutch are built into the housing and operate in a bath of oil. The 6-volt winding is standard and there is but one driving connection with the engine. The armature rotates only when the starting switch is closed and at this time drives the generator shaft through the medium of an over-running clutch of the roller type.

The single-armature motor-generators are wound for 12-volts and are built in either cylindrical or rectangular shapes and in a number of sizes. Any of these may be had with battery ignition, forming starting, lighting and ignition in one unit.

Several models of separate generators are built. Some have drop-forged pole pieces rectangular in shape and others are cylindrical. Some of these instruments are built to fit the standard magneto base and drive coupling.

Combined starting and ignition generators may be had with the ignition parts mounted in unit with the generator or separately. Two different types of battery ignition are used. One with the conventional form of magneto breaker and distributer and the vertical, with one above the other.

In addition the company is making a system of ignition which may be used in conjunction with an electric lighting system comprising generator and storage battery. In one type there is a distributer and transformer coil mounted on a base of magneto dimensions, allowing it to be mounted on the base formerly utilized by the magneto. In another type of instrument the shaft is vertical and both distributer and breaker are driven at camshaft speed.


Upper, left—Remy generator. Lower, left—Remy generator with vertical timer-distributer. Upper, right—Double armature starting motor and lighting generator. Lower, right—Jesco motor-generator

Ten Leece-Neville Models

Ten different models of starting motors, six models of motor-generators and three models of generators are made by the Leece-Neville Co., Cleveland, O., for 1915. Units are built for 6 and 12 volts and for double wiring.

Changes and improvements include the adoption of the cylindrical form for all machines. A feature of the new generators is the charging ouptput curve. Maximum output is obtained at 15 amperes and 7.5 volts on a certain 6-volt generator, and at a very low car speed. After maximum capacity is reached the output drops until at the highest speeds it is only about 10 amperes, which is not enough to harm the battery, it is said. In other words, a high charging rate is available when it is needed most, that is, when a lot of slow, city driving is done with many starts and stops, and when operation is continuous and at a high rate of speed, as might be the case on a good country road, the output is cut.

Another distinctive feature of the system is the circuit breaker combined with the switch on the dash. This has an indicating target which registers the word Charge when the battery is connected to the generator. By certain improvements it is claimed that the battery is now connected to the geenrator at a car speed of about 5 miles per hour.

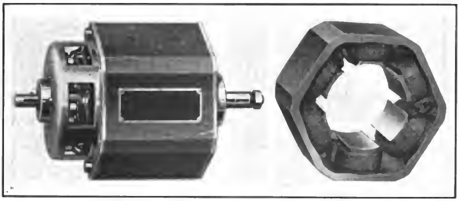
Current control is by the third-brush system.

To give an idea as to the weights, the 5-inch generator weighs 22.5 pounds, and with ignition distributer, 24 pounds.

Starting motors are equipped with all styles of drive and are capable of cranking engines at speeds of 150 r.p.m. on the average. These include clash gear meshing with the flywheel; magnetically shifted flywheel drive; Bendix drive, chain and train of gears.

Kemco Line Complete

The Kemco line has been enlarged so that it now includes starting motors, and generators of different types as well as



Simms-Huff motor-generator. Starter drive is positive and generator drive by belt

the original fan generator which is associated with the Kemco name and built by the Kemco Electric Mfg. Co., Cleveland, O. The 6-volt system is used throughout.

The complete line consists of four starting motors of graded sizes for different-powered motors. These are especially for manufacturers and may be procured with the Bendix drive, silent chain drive or gear drive with over-running clutch.

There is a universal starting motor which is designed especially for cars already in use. It is mounted in front of the radiator, taking the place of the starting crank. The reduction gears are contained in the starter casing.

Four different models of starting motors are offered. The Pound for Pound is 9 inches long and 5 inches in diameter. Its stalling torque is 35 pounds and its weight is also 35 pounds, hence the name. The Trojan is the same diameter but only 7.5 inches in length. It has a stalling torque of 21 foot pounds and a weight of 23 pounds. The Master Cranker is 5 inches in diameter by 6.5 inches long, has a stalling torque of 12 foot pounds and a weight of 17 pounds. The Little Six cranker is 4.5 inches in diameter, 5.5 inches long, weighs 13 pounds and has a stalling torque of 7 foot pounds.

Dynamo in Two Sizes

Kemco horizontal dynamos are made in two sizes, the smaller 4.5 inches in diameter, 5.5 inches long and weighing 12.5 pounds; and the larger 5 inches in diameter, 6.5 inches long and weighing 16 pounds. The former gives 10 amperes and the latter 15. Voltage regulation is by means of a Ward Leonard regulator and cutout.

The fan generator is made in two sizes, the Kemco standard being 5.75 inches in diameter and 2.5 or 3 inches wide, as desired. Weight without fan sprocket or pulley varies from 10 to 13 pounds according to width. The diameter of the fan is optional. The shaft is fitted with sprocket and friction clutch for chain drive, or V pulley for belt drive.

The Kemco Junior is for smaller cars and measures 4.44 inches in diameter by 2.69 wide. It weighs 6.6 pounds. Drive may be by V pulley or chain.

Ford System Offered

A smaller edition of the universal system is made especially for Ford cars and is used in connection with a fan generator to make a complete starting and lighting system. A Willard storage battery is part of the equipment. The starting switch is a foot-button type.

In addition to these units, lamps, wiring and complete fittings are supplied with this system, price $110. There is an automatic cutout. The electric headlights are fitted with two sets of bulbs, one for country and one for city driving.

Simms-Huff Motor-Generator

The Simms-Huff motor-generator has been added to the line of the Simms Magneto Co., East Orange, N. J. The feature of the device is the use of a belt drive when the machine is operating as a generator, the slippage of the belt being used to adjust the output to the desired amount at any given speed. Voltage regulation is inherent and is obtained by opposing the series and shunt fields. Starter drive is optional. It may be through the flywheel or by chain to the crankshaft or through the timing gears. In any case an over-running clutch must be used. As a starting motor the device operates at 12 volts and as a generator at 6 volts. By the use of a 12-volt starting current the lock torque is stated to be 24 pounds although the instrument weighs but 30 pounds.

The features of the instrument include light weight, hexagonal shape to facilitate mounting, an unusual method of disposing of the armature windings and a unique type of brush holder which eliminates all but one wire. The unit is exceptionally compact yet accessibility has in no wise been sacrificed. All the mechanism that requires inspection, brushes, brush holders and commutator, may be exposed by the removal of a single metal casing which slips over the end.

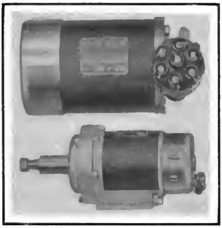
In starting, all the cells in the battery are in series to give the required 12 volts, but when the engine is running the unit automatically becomes a generator and delivers 10 to 15 amperes to the battery at 6 volts pressure; in the latter case the two halves of the battery are in parallel.

Series and Shunt Fields

A charging rate of from 8 to 15 amperes at from 12 to 18 miles per hour may be obtained by simply varying the belt tension and allowing the armature to slip. If the ammeter registers less than 8 amperes at 12 miles per hour, for instance, it indicates that the belt should be tightened, a means for this process being provided in a slotted segment and set bolt on the fan support.

The starting switch is arranged to automatically make the necessary series connections at the battery for the starter and parallel connection for lighting. In addition there are two terminals which may be used for a battery circuit in the event of dual ignition being used.

The cutout, which may be mounted on the dash, is of the usual reverse current relay type. It automatically connects the generator and battery when the charging current builds up to the proper strength. The brush holding mechanism is unusual in that all the wires with the exception of one have been eliminated by connecting each set of three brushes to a metallic ring, one of which is a permanent ground and the other, which is a single wire connection, going to the field winding. Thus six wires are done away with.



Two Leece-Neville units. Upper—Generator with ignition unit. Lower—Starting motor

Holes for Slots

The winding of the armature is another feature that is different from usual practice. Though it is of the drum wound type, the winding is passed through circular holes punched in the core laminations. The result is that the wires are thoroughly protected and cannot be thrown out by centrifugal force should the starting gear stick and cause the armature to rotate at excessive speed and additional surface is exposed to the action of the field.

Nash Generator and Ignitor

One starting motor and a combined ignition and lighting unit are manufactured by the Chicago Telephone Supply Co., Elkhart, Ind. The starter, which is known as the Briggs, is intended for all sizes of gasoline engines, a lower gear ratio being used with large motors. The machine is 5.5 inches in diameter and 9.5 inches long. It weighs 30 pounds.

The generator, also a 6-volt design, has the ignitor mounted on a vertical shaft at one end. A feature of the machine is that maximum current output is reached at a very low speed. Ordinarily the Nash generator gives 15 amperes maximum and this at a speed under 15 miles per hour. The current regulator is mounted directly on the top of the machine and consists of three relays. One cuts in when the generator develops 6 volts. The second and third relays are designed to cut resistance in series with the field coils, thus reducing the current output and flattening the curve. The latter two have positive adjustment and may be set to flatten the curve at any point.

The generator measures 11 by 5.375 by 5 inches.

North East Makes One Model

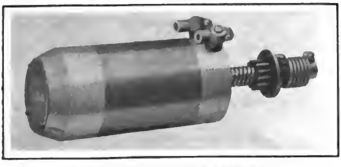
A single machine for starting, lighting and charging the storage battery, made in but one model, is built by the North East Electric Co., Rochester, N. Y. There are, however, several different methods of application, so that it may easily be attached to any car. The latest method is termed the universal application which was described in THE AUTOMOBILE for October 15. For larger cars the system operates on 24 volts and on smaller ones 12 volts is standard.

No reduction in the size of the machine has been made but its efficiency has been increased, the torque is larger and an improved regulating device has ben designed. In nearly all applications the gearbox type of drive has been eliminated, the drive generally being direct from the crankshaft by means of a silent chain.

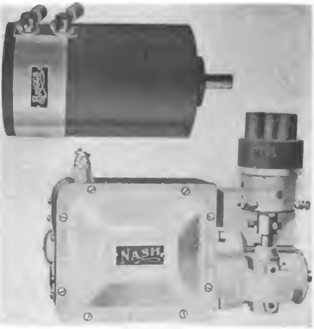
The cranking speed varies from 150 to 200 r.p.m., depending on the size of the engine while the ampere draw when running varies from 50 to 60 for an ordinary 4 by 4.5-inch four-cylinder motor, although at the instant the starter switch is closed the flow may reach 125 amperes.

The charging rate is approximately 7 amperes at 12 volts. The charging circuit is automatically closed at about 9 miles per hour. Voltage regulation is obtained by means of double field windings with a limiting relay which regulates the field resistance.

Special fittings are made so that this system can be applied to the Ford car. The motor-generator is placed at the left of the motor and the storage battery placed under the rear floor boards. The motor-generator is mounted on a bracket which bolts to the lower cylinder flange and the armature is connected to the crankshaft by a double silent chain, there being an intermediate pair of sprockets through which the fan is driven.



Kemco start'ng motor with Bendix drive



Upper—Briggs starting motor. Lower—Nash generator with ignition unit combined with it

Universal System for Old Cars

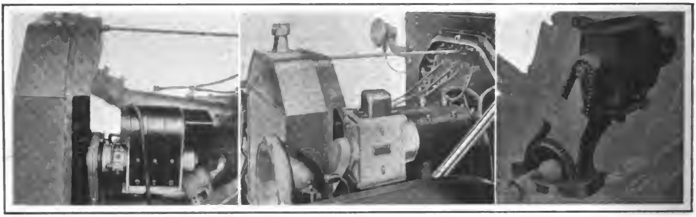
The universal system is designed especially for old cars and may be attached with very little fitting. The motor-generator is mounted between the front frame members by means of two cross bars. The rear bar is an angle iron which is bolted at each end to the webs of the channel frame section by means of small angles. In the front the unit is supported by a heavy tube which clamps to the horns of the springs.

The motor-generator is placed above the plane of the crankshaft and as the driving chain is at the front, the shaft which runs to the crankshaft passes under the unit. This shaft has long flutes milled in it and it may be cut to any length desired. The coupling which makes connection between this shaft and the front of the crankshaft is left blank and is machined to suit each particular installation.

Disco—A Motor Generator

The Disco Electric Starter Co., Detroit, which went under a re-organization last year, and has for its present stockholders a number of well-known business men, and which has acquired for its chief electrical engineer Prof. B. F. Bailey, well-known in his field, has come to the front with a new design of starting and lighting system of 12-volt type with a combined motor-generator as the main unit. The outfit in addition to this includes a storage battery, combined cut-out and regulator, lighting switch with dimmer attachment, starting switch and other lesser accessories.

The motor-generator is adaptable to any make of car. It is connected to the crankshaft by a silent chain. For starting, the motor is connected directly with the battery by means of the foot switch. As soon as the engine picks up, the unit starts to charge the battery. The connection to the battery is not made until the generated voltage is high enough, the cut-out automatically taking care of this. Combined with the cut-out in a unit on top of the motor-generator is a vol-



Left—Esterline Ford lighting generator. Center—Gray & Davis single-unit Ford system. Right—Disco Ford motor-generator

tage regulator which prevents the generated voltage from attaining too great an amount when the speed of the car is high. The regulator consists essentially of an electro-magnet which pulls down an armature and opens a contact, thus inserting resistance in the shunt field of the motor-generator which serves to cut down its generating ability.

The Disco Company is now making this motor-generator in three sizes, all of which act upon the same principles as outlined above. The smallest size for engines up to 3 1-8 inches bore measures 9 1-4 by 6 9-16 by 4 7-8 inches. The next size, which is specially adaptable to the Ford engine, is made for motors up to 4 1-4 inches bore of 60 pounds per square inch compression pressure. It has the same height and width as the smaller size, but is 11 1-4 inches long. The largest size is 14 inches in length, but has the same width and height as the others. All have the same method of attachment by silent chain, and the reduction is 3 to 1. They are all capable of turning engines over at from 180 to 200 r.p.m.

The illustration shows the method of attachment of the Ford size to a Ford motor. This motor-generator weighs 42 pounds, and with complete outfit is sold at $99 ready to install. A large forked-shaped bracket is supplied, which bolts underneath the engine and has attached to it another bracket which carries the electric unit.

The Disco systems operate with the single-wire method of connection, the return circuit being provided by grounding.

Allis-Chalmers Adds

A larger size motor-generator is the one addition to the Allis-Chalmers line. This company, located in Norwood, O., is continuing the motor-generator for smaller cars, and in addition makes separate starting motors and generators, each of which is manufactured in one model and in two sizes. Six volts are standard and either the single or double-wiring systems may be used.

Improvements consist in the refinement of details, and the only change of importance is the more liberal design of the magnetic circuit of the starting machines so that greater torque is secured.

In all models the special radial brush holders are retained and the armatures are banded together with steel wire, not only on the core, but also on the front and rear connections. These bands are anchored against any tendency to slip and after the armature has been impregnated in Bakelite it is capable of withstanding high overspeeds.

As a generator, the unit is designed to cut in well below a car speed of 10 miles per hour and to obtain full charging current as soon as possible.

No reduction has been made in the size of the smaller motor-generator, which is 5.63 inches in diameter, 10 inches long and weighs 35 pounds. The larger motor-generator, which is the new one, is 6 inches in diameter, 10.25 inches long and weighs 48 pounds.

As used on a certain car, the motor-generator is driven by a silent chain from a sprocket on the crankshaft just behind the flywheel, the ratio being 3 to 1. On another car using a motor with cylinders 2.75 by 4 inches, the motor-generator is driven through gears at a ratio of 3 to 1, the gear on the flywheel driving the sprocket on the motor-generator shaft.

On the smaller size of motor-generator the stalled current, that is the current drawn on closing the switch and before the gasoline engine moves, is approximately 300 amperes, and when cranking, the current varies from 60 to 100 amperes. The larger size motor-generator takes 500 amperes stalled current and a cranking current of 80 to 130 amperes. The drop in current from the static condition to cranking is very rapid so that very little more power is taken from the battery. A cranking speed of about 100 revolutions per minute is possible.

The separate starting motors and generators measure 4.5 by 9.5 inches and weigh about 22 pounds. The motor has a long shaft extension to accommodate the Bendix screw gear. On one newly designed motor the application has been made directly to the flywheel at a ratio of approximately 11 to 1 and the engine is cranked at a speed of 175 revolutions per minute. The generator on this installation is driven at 2.5 times engine speed.

Current regulation is by a vibrating reed regulator.

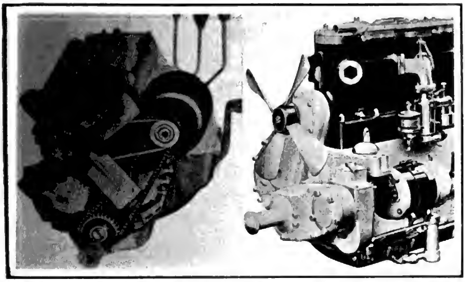
Ward Leonard Expands

A larger and smaller starting motor, a dynamo for small cars, and an engine-speed generator for four-cylinder cars have been added to the output of the Ward Leonard Electric Co., Bronxville, N. Y. The motor-generator is furnished for small cars when desired.

The two new starting motors are practically identical with the two types of last year except as to size. All motors are series wound and are designed to crank the engine at a speed of about 125 r.p.m. with an average current consumption of 125 amperes, 6 volts. This voltage is standard although 12 volts may be had. Likewise the double-wire system is recommended although the single may be used.

Only one change has been made in the new motors and that is to give slightly increased starting torque; in all other respects the machines are unaltered. The Bendix spiral drive is standard.

A small, high-speed generator for small cars with a lamp load of corresponding proportions has been brought out to meet the demand for a unit of this size. It may be driven by chain or belt. In addition a generator for four-cylinder motors, in asmuch as it is designed to be driven at magneto shaft speed, has been added. This generator supplies 10 amperes at 400 r.p.m. Up to the present, one generator has been used both for four- and six-cylinder motors, it being direct-connected to the magneto shaft on the sizes and geared up on the fours; but with the coming of the new model, the



Left—Ford motor-generator made by the General Electric Co., and known as the Genemotor. Right—North East motor-generator

1914 generator will be continued as one for six-cylinder machines exclusively and the new one will be for fours exclusively.

The generators are shunt wound, current regulation being by means of an automatic controller of the vibrating type. The company states that no change has been made in this device since it was brought out 5 years ago.

By means of this device the dynamo will not charge the battery at a greater rate than 10 amperes regardless of the motor speed. This device also acts as a cutout, breaking the circuit when the speed of the generator falls too low to generate voltage equal to that of the battery.

The motor-generator is compact for the reason that large wire of low resistance is used in the series field with the result that a strong field and high starting torque are obtained. The standard type of controller is used with this machine, thus the current is kept at a constant value as in the separate machines. This controller is short-circuited during the starting period and is automatically inserted when the engine is started. Constant current is supplied from the time the dynamo cuts in on the battery until maximum speed is reached.

The Ward Leonard company is prepared to furnish starting and lighting specialties to manufacturers of this equipment. These parts include enamelled resistance units for controllers, resistances for headlight dimming, cables, switches and combined controller and cutout. The company makes a specialty of furnishing current controllers to other makers of starting and lighting equipment and only offers its complete system to car manufacturers.

Both starting motors and lighting generators are built with either round or square housing to suit the individual manufacturer.

Many Ford Systems

In addition to the Aplco, Kemco, Gray & Davis which have already been described, there are several companies making Ford systems and nothing else in this line. Descriptions of these are given below.

Wells—Single-Unit Ford

A starting and lighting system for Fords is made by the R. C. Wells Mfg. Co., Fond du Lac, Wis. It is a single-unit motor-generator type, the machine being mounted at the right of the engine in the customary place and driving through the crankshaft by a silent chain. As a generator the machine runs at engine speed but as a motor the gear reduction between it and the engine is 4 to 1. The outfit includes current indicator, switches, storage battery and wiring harness and the price complete is $115.

General Electric Genemotor

The General Electric Co., Schenectady, N. Y., large makers of electric motors and generators of all sizes is manufacturing a 12-volt motor generator known as the Genemotor, and designed especially for Ford cars. It sells complete without lamps for $80. A. J. Pickard & Co., 1720 Broadway, New York City is the sole distributor.

The Genemotor is mounted on the left of the motor on a suitable bracket. The drive is by silent chain direct from a sprocket on the crankshaft. This sprocket takes the place of the fan pulley and the fan is driven by a new pulley attached to the armature.

The Genemotor is a fully-enclosed machine, cylindrical in shape, about 7 inches in diameter and 10 inches in length. It is firmly secured to the body of the engine by a special bracket which can be attached without fitting. There is no drilling or tapping of holes. When mounted, it is supported rigidly and is fully covered by the engine hood.

The regulation of the charging current for the battery is accomplished without the use of external regulators. The windings of the Genemotor itself are so arranged as to give the necessary regulation.

The motor starting switch is mounted directly at the top of the machine and is actuated by a pushrod passing through the dash-board of the car, and having its handle located within convenient reach of the driver. This switch is enclosed, but accessible.

When operating as a generator, it begins to supply current when the car is running at about 9 miles per hour and its windings are so arranged that over-charging is prevented.

The main switch is closed through a cam actuated by a pushrod. The contacts are of the multi-leaf pattern and the switch is provided with a mechanism which assures a quick-break on opening.

Jackson Ford Lighting System

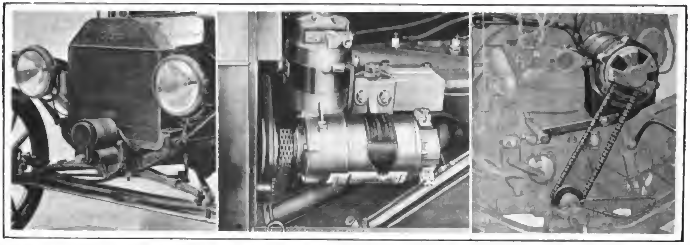
A 6-volt lighting system is manufactured by the Charles A. Jackson Co., Park Square, Boston, Mass., and it is designed for mounting at the right of the engine on a suitable bracket and is driven from a broad, flat belt which also drives the fan. To accommodate this belt a special pulley replaces the ordinary fan pulley on the crankshaft. A feature of the drive is the use of spurs on the small generator pulley which project into holes in the belt, thus giving the effect of a chain drive. Since the driving pulley is much larger spurs are not required on it.

Voltage regulation is by a centrifugal governor. A cutout is provided to prevent the battery discharging through the generator at low motor speeds.

The normal speed is 1,800, weight 9.5 pounds and the output is 8 amperes at 7 volts. The length is 8 inches and the extreme height 5 inches.

Esterline Makes Ford Dynamo

The Esterline Co., Indianapolis, Ind., has brought out a Ford generator. It has permanent magnets and is driven by a belt which also runs the fan. The feature of the machine is the use of the permanent magnets in connection with an electro-magnetic field, the result being a greatly



Left—Kemco starting motor for Fords. The generator takes the place of the fan. Center—Hartford starting and lighting system for Fords. The motor is the vertical unit and runs up to 10,000 r.p.m. Right—Wells Ford motor-generator

increased output, due to the combined strength of the field.

All the necessary attachments are furnished with the generator. It is stated that the machine can be applied in 3 hours, and that it is not necessary to remove the radiator or other parts of the car to do it.

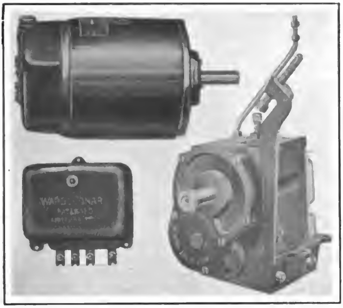
The regulation of the current is inherent. An automatic cutout is provided for disconnecting the battery when the speed of the generator drops so low that the battery would discharge through the armature windings. The cutout is mounted directly on the generator, thus reducing the wiring to a minimum.

The balance of the equipment comprises the lighting switch, storage battery, lamps and the necessary cables, the latter being marked so that no mistake can be made. Golden Glow glass reflectors are included in the equipment. They are mounted in the regular Ford lamps.

The machine has an output of 10 amperes and weighs 24 pounds.

Hartford Ford System

A high-speed starting and lighting system for Fords is manufactured by the Hartford Suspension Co., Jersey City, N. J. Motor and generator are separate units, the generator being mounted horizontally and the motor vertically, drive being from the front of the generator through a worm gear. The generator runs at approximately twice the speed of the crankshaft with which it is connected by a chain. The motor operates at a speed of from 8,000 to 10,000 r. p. m. The advantage in the high speed is that low weight is secured. The whole system weighs 54 pounds.



Upper, left—Ward Leonard starting motor. Lower, left—Ward Leonard combined cutout and regulator. Right—Fisher starting and lighting unit for Fords

The cranking speed is about 300 r. p. m., and the voltage is 12. The price is $100, complete except lamps. A 50 ampere-hour battery is furnished.

The unit is attached to the left of the gasoline motor, and is mounted in a bracket which is bolted to the cylinder casting. Both the generator and the motor can be quickly removed for inspection.

Fisher Ford Outfits

The Fisher Electrical Works, Detroit, continues to make its electric lighting system which is attachable to any car and sells for $37.50, and has also perfected a cranking and lighting outfit for Ford cars. The main unit of the latter—the motor and generator—is housed integrally, though there is a separate armature and field for both the motor and generator, one being positioned directly above the other.

The Ford outfit is designed for chain drive, and consists of brackets, switches, 12-volt, 35-ampere storage battery and wiring. The price is $120. The outfit is designed for attachment by any owner, and full directions for this work are sent with it. A sprocket is fitted to the front end of the crankshaft just back of the starting crank ratchet. The ratio is 1¼ to 1 between the generator and engine.

The generator is operating whenever the engine is running. Its energy goes to the storage battery to be used for lighting and for driving the electric motor. Gear connection between the armature of the motor and that of the generator is a part of the unit itself, and when the electric motor is operating, its power goes through this gearing and thence through the chain to the crankshaft.

The Fisher lighting system has for its main unit a 24½ pound generator which delivers its full voltage at 300 r. p. m. and at 380 r. p. m. is charging the battery at the rate of 1 ampere. At 950 r. p. m. it is charging at a 6-ampere rate. It has a regulator which is incorporated with it and which prevents the delivering of over 8 amperes at any speed. This regulation is automatic.

The unit is adaptable to any type of drive, such as belt, chain, gearing, or couplings. A simple installation is to attach it so that the fan belt can do double duty. The outside dimensions are: length, 9 3-16 inches; width 5¼ inches; height 6⅞ inches. It is designed to be driven at the same speed as the crankshaft.

Electric Touring Field Enlarged

E. V. A. A. Issues Annual Book on Routes and Charging Stations

NEW YORK CITY, Jan. 23—The ninth edition of the New York Electric Vehicle Assn.'s book of Electric Automobile Charging Stations and Route Maps, has been issued. This book, which is an annual publication, has several new features in the 1915 edition in addition to the map, which was prepared by the Automobile Blue Book Publishing Co. There is a list of all charging stations in this city and within a radius of more than 100 miles, together with the distance of each from Columbus Circle, the maximum amperage and voltage available, the hours during which service can be obtained, the cost per kilowatt, and the price charged for boosting. One of the new features is a map of Manhattan and the Bronx, showing the location of all charging stations, numbering fifty-one.

Routes Extended

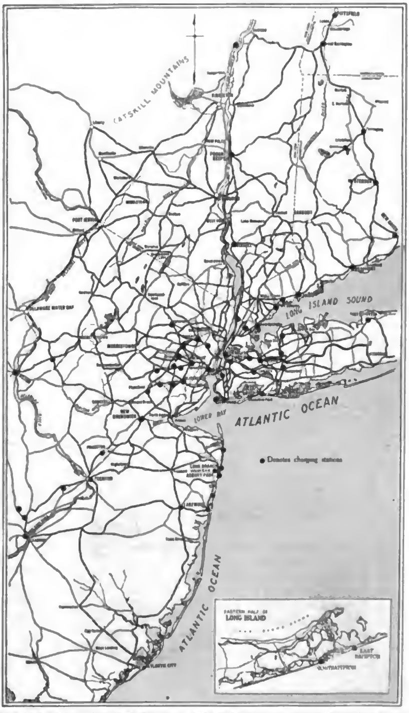
Last year's edition mapped out seven tours for the electric car tourist, giving convenient charging stations and the mileage between them. This year, with the help of the map, the tourist may pick out many more tours, extending to the north as far as Pittsfield, Mass., to the south as far as Atlantic City and Philadelphia, to the west as far as Easton and to the east, extending through all the important towns in Long Island, as far as Port Jefferson.

The added charging stations this year between this city and Philadelphia, and points through New Jersey, should especially attract the electric tourist to that state. Looking over the map, more than ten charging stations are shown between this city and Philadelphia, all of them conveniently placed. Starting out from this city for Philadelphia by way of Newark, Elizabeth, Plainfield, New Brunswick, Princeton, Trenton, and from there to Philadelphia, the tourist will pass through many excellent stretches of roads, and will find no inconvenience in the matter of charging stations, as each of the preceding places has charging stations. From New Brunswick, a run may be made to Easton by way of Somerville and Washington.

Many Charging Stations

All the territory inside of New Brunswick, Morristown and Paterson, is well supplied with charging stations, thus affording the electric tourist many interesting trips through the Orange Mountains and the surrounding country. But the electric car owner is not restricted to this one state in his touring activities; there is Long Island, for instance, whose charging stations are just as well placed as in New Jersey. The run to Port Jefferson, a distance of about 57 1-2 miles, can easily be made by way of Long Island City, Flushing, Mineola and Roslyn. A run along the eastern half of the island may also be made by way of Port Jefferson and across to Southampton.

The association has sent copies to all local electric owners. Offices are at Irving Place and Fifteenth street, city.



Map prepared by The Automobile Blue Book Publishing Co. for the Electric Vehicle Assn.'s book on charging stations and route maps

The AUTOMOBILE

PUBLISHED WEEKLY

Vol. XXXII Thursday, January 28, 1915 No. 4

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
231-241 West 39th Street, New York City

BRANCH OFFICES
Chicago—910 South Michigan Avenue Detroit—95 Fort Street, West
Boston—1035 Old South Building Cleveland—516-517 Swetland Building

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

ADVERTISING
T. B. Van Alstyne, Advertising Manager
W. I. Ralph B. Mathewson Louis R. Smith
Howard L. Spohn H. H. Gill James P. Hunting
F. B. Barnett, Cleveland C. H. Gurnett, Chicago Chas. Anthony, Detroit
Guy W. Motz, Cleveland F. J. Robinson, Chicago

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

The Engineering Foundation

THE Engineering Foundation, inaugurated by the United Engineering Society, is the name given to a fund to be devoted to the advancement of the engineering arts and sciences in all their branches, to the greatest good of the engineering profession and to the benefit of mankind. The initial gift for the foundation is from Ambrose Swasey, past president of the American Society of Mechanical Engineers, who contributes $200,000.

The purposes of the foundation are as broad as the engineering profession itself, the intention being to aid in valuable research and scientific work wherever it is found. The trustees are representatives of the mining, electrical and mechanical engineering societies, and the Society of Automobile Engineers is represented by one of its vice-presidents, F. R. Hutton, who is also secretary of the United Engineering Society.

The movement is in line with the suggestion of developing a broad engineering society which will embrace all the sciences and of which the different specialized societies will be component parts. The unity of the engineering bodies would create a spirit of co-operation which could be of the greatest use in increasing the efficiency of all the component parts through the prevention of overlapping work. At the same time there would be no reason why any would lose their identities or cease to be in the closest relationship with the industries that they represent.

The gift is for the greatest good with no restriction on where it should be placed and the result is twofold. First the stamp of recognition which the United Engineering Society places upon the work in question and secondly the financial aid to carry out the purposes recognized. It is to be earnestly hoped that Mr. Swasey's gift is the commencement of a new era in engineering unity and progress.

The Chicago Show

ONCE more the exhibition of the middle west shows that the automobile public awaits with the greatest interest the coming of this annual event in the yearly cycle of the automobile industry.

While the number of new announcements is generally not so great at the Chicago show as it is at New York, there are still a large number of concerns who await the opening of the later event before exhibiting for the first time the plans they have made for the coming season. This is the year of eights and naturally the announcements of the four additional names at Chicago is regarded with the most widespread interest; but on the other hand there are announcements of new sixes and fours which, while not as spectacular, are also far-reaching in their effects.

Accessories are such an important phase in the automobile industry that the amount of space taken by the exhibits of these small articles takes a large percentage of the total space and certainly a large share of the attention of the visitors at the show. The new devices on display at Chicago constitute an important feature of the exhibition, many of them making their first appearance there.

Industrial Relations

A MOVEMENT which may mean much to the development of better industrial relations and closer co-operation between employer and employee, with a resulting increase of manufacturing efficiency, is given stronger emphasis by the investigation being conducted in New York City by the United States Commission on Industrial Relations. The intense interest displayed in this movement is indicated by the way in which the entire country is closely following the investigation, especially the testimony of prominent manufacturers who, as employers of large numbers of men and women, have made some endeavor to infuse into their relations with these employees the idea of profit-sharing and other forms of co-operation which bring more satisfactory working conditions as well as increase the profits of the employer and the wages of the employee.

While at present it is problematical just what will be the outcome of the investigation now in progress, the latter is of the utmost importance as pointing out that the ever-growing interest in the movement which it represents will ultimately bring far-reaching results.

European Trade After the War

The Possible Market for American Cars—S. A. E. Debates Question of Producing Special Export Models *

NEW YORK CITY, Jan. 27—It would be an utter impossibility exactly to forecast the conditions that will prevail in Europe after the present condition of affairs has terminated, but out of the mists of uncertainty there emerge two definite and unassailable facts. The first is that literally huge numbers of automobiles of all kinds and sizes, both pleasure type and commercial are being consumed by the armies and will have ceased to exist absolutely by the time the war is ended. The second is that all Europe will be greatly impoverished for it will take the work of a generation or more to pay the stupendous bills that are being piled up by each belligerent nation.

Victors and vanquished alike will have to apply the whole energies of their peoples to repairing the damage to their national exchequers.

The Pleasure Car Field

So far, the American trade has not thought it worth their while to manufacture a car or two solely for export, though it has been done in other less progressive countries. The author would like to suggest that the time is now ripe for a real threshing out of this subject and that good might result to both parties; the manufacturers here on the one hand and the buying public in Europe on the other.

It is, of course, a large undertaking to manufacture a car solely for overseas consumption, but it would be worth while if the assured market was sufficiently big, and it is going to be far bigger than ever before. Remember that many of the European automobile factories are dormant so far as car production is concerned; that not a few of them are destroyed, that their workmen are scattered and even their engineering staffs largely absent, and it is sufficiently obvious that the European trade will hardy be ready to tackle a changed outlook immediately upon the cessation of hostilities.

In one respect cars for export have already to be altered, this being that the right hand steering position is needed in England and expected on the Continent, although by rights the now standard left hand arrangement is the correct one for all places with a right hand rule of the road. It is to be questioned whether some of the other alterations to make American cars more acceptable to foreign importers could not be made almost as easily, so that to manufacture for export would not mean manufacturing from A to Z. It was obvious at the New York Show that a really big effort is being made here to increase the power output of the small fours, and conversation that the author has had with one or two manufacturers shows that there is a strong idea that a quite light four or five passenger car has a big future before it in America, if only greater power can be obtained at reasonable manufacturing cost, and without increasing the dimensions or weight of the motor. Take the best practice in six cylinder work as exhibited at the Show, apply the same principles of design to a four cylinder job with say a 3 1-4 by 4 1-2 inch motor and you would have features acceptable to both American and European buyers.

Turning to the matters of smaller detail that are, and are likely to continue, essentially different, perhaps these may be indicated by a short list of reasons that have, to the author's direct knowledge, prevented the sale of American cars to English people who had seriously considered buying.

Of these the black or very dark finish customary on less expensive American automobiles is one of the most important. The average car in England or on the Continent is light colored, buff and pale grey being favorite tints.

Next in importance is the height of the seats and the upright nature of the backs thereof; for while this may be right enough for rough roads of America a much easier reclining arm-chair position is far the pleasantest on the smooth highways of the old world.

Next may be placed the height off the ground, since the European is accustomed to low built cars and naturally thinks that the low build looks correct; as in fact it is for the same reason that the lower seating is right.

Yet another question of bodywork is that the door handles and carriage fittings generally on most of the exported cars are below the European standard of design and finish.

It should be explained that the author has not in mind the cheapest of all imports to Europe, but rather the cars for which the equivalent of about $1,250 is asked, or even more. Europe has no five passenger cars at this price and the man who wants that capacity has no choice between a used European car and a new importation.

Turning to the chassis, a really neat looking motor is an immense advantage and, here too, sales have been lost by reason of rough external finish, for in Europe rough exterior can pretty safely be taken as indicative of rough interior also. Fifty cents worth of sandblasting on aluminum and cast iron and an equal amount spent upon the proper polishing of brass parts is worth dollars of advertising. Another mechanical detail that is not approved is the brakework, especially the contracting band brake on the rear wheels. This is intrinsically unlovely and it is never efficient, as was found out long ago by many users.

Brakes of internal type side by side on the wheels are acceptable and are easy to provide, while they are a feature that the American public will demand too, as soon as they find out their good points. Another thing which appeals to the mechanically minded purchaser, which is a common kind in England, is a rather higher speed capacity. The British driver does not want to do everything on top, but he does not like to find that forty miles an hour is the all-out limit of a nominal twenty horsepower automobile; improvement in the motor will tend to cure this, but meanwhile a little increase in gear ratio would be a pretty good substitute.

The Truck Market

It is possible to have fairly definite ideas about the future state of the pleasure car trade, but the truck business is a very different matter. We all know how the truck trade is at the moment, but it is the veriest guessing to predict what it will be like. We have only one fact to go upon and that is there will be a shortage of horses for industrial work which must encourage many to adopt mechanical methods of handling goods years sooner than they would otherwise have done. There is a general impression in England that the demand will be for the two-tonner first of all, with a possible exception in the vehicle of three tons capacity, but it is the smaller kind from one to two tons that must appeal most strongly to small business houses who will be turned to motors by the high price of horses. It is the profound conviction of the author that there is a gigantic field for a strong van to carry a maximum load of 3,000 pounds rated therefore at one ton, but it is essential that the first cost be low. In the field where such a machine would find buyers low first cost is the deciding factor, because the outlay of several thousand dollars on one vehicle is often impossible to small traders, even though its maintenance may be less than that of the horses he now employs. Cannot America make a thousand dollar one-ton truck along the ordinary lines of design, a real truck and not a bastard pleasure car? If it can be done there is a fortune in it.

---

*Digest of a paper to be read before the Metropolitan section tomorrow evening by A. Ludlow Clayden.

War Hurts Italian Car Builders—Lancia

NEW YORK CITY, Jan. 26—Vincenzo Lancia, the Italian automobile manufacturer, arrived in this country January 21. A quick trip was made to Baltimore to inspect the new models of American cars then on exhibition. He returned to this city Saturday, where he is making his headquarters with Adams & Montant, the Lancia representatives in this country. He will probably return to Italy January 30.

Mr. Lancia states that the Italian passenger car manufacturer has been greatly affected by the war. A few cars are still being turned out, but most of the work in the plants is on motor trucks, which are in great demand. The earthquake, which occurred after his departure, will further depress industrial conditions. Turin, the center of automobile manufacturing in Italy, was not in the zone of trouble.

"The small American cars are wonderful at the price," he said, in speaking of the impressions he gained on his visit to the show in Baltimore. "We cannot begin to meet them on a price basis. Also there has been a decided improvement in bodies on the American cars of all prices."

Arbitrary Methods Mean Industrial Unrest

Democratization of Industry Is Advocated at Investigation Held by U. S. Commission on Industrial Relations — Necessity for Workmen to Organize Acknowledged by Prominent Manufacturers

NEW YORK CITY, Jan. 23—An investigation of the industrial unrest and the remedies for that and other industrial and economic problems has been held this week at the City Hall by the United States Commission on Industrial Relations. A number of the speakers were prominent manufacturers and philanthropists, among them being G. W. Perkins, director in the United States Steel Corp.; Henry Ford, E. J. Berwind, director in various coal mining companies; Samuel Gompers, president of the American Federation of Labor, and Daniel Guggenheim, president of the American Smelting & Refining Co. and director of the Guaranty Trust Co.

All of the speakers agreed that arbitrary methods result in industrial unrest. Mr. Guggenheim advocated the "democratization of industry," State or Federal social insurance, including health and old-age insurance, and the obligation of the Government to find employment for those who would work, but find no private employment. By democratization he meant, in a word, that the man who performs the labor shall have a voice in the industry. He also said that workmen must organize, even though there are good and bad unions; that the individual worker will get nowhere unless he organizes.

"Industrial unrest is on the increase, I think," proceeded Mr. Guggenheim. "The greatest canker in the world is the canker of envy. I think we are getting away from the old idea that we must ruin competitors to succeed."

Mr. Perkins said he does not believe that competition is any longer the life of trade, but rather the principle of co-operation and organization in industry, including both labor and capital, is the ruling factor. He urged profit-sharing as a worthy supplement to the wage system for compensation of workers; fixed the cause of industrial unrest on the defects and maladjustments of Federal laws and administration, suggesting the formation of a Federal commission on economics, and asserted that under Federal regulation and complete publicity large business units, instead of being a detriment to labor or trade, can be of great benefit to both.

Mr. Gompers declared he would oppose the Perkins proposition to put labor under the same control as capital, his point being that if labor were compelled to incorporate its funds would constantly be at the mercy of legal attempts to confiscate funds which the laboring men had saved. He also said that the two great troubles from which labor has been suffering are the constant influx of immigration and the failure of the workers themselves to organize and have a voice in shaping the conditions under which they worked.

Henry Ford, who preceded Mr. Gompers on the witness stand, stated concerning the effect of centralized control of labor, that any manufacturing institution that is successfully making a single product should increase the business and its plant and make more work to employ more men.

After briefly reviewing his life history, Mr. Ford read into the record the answers to ten questions previously submitted to him by the Commission. In his answers he briefly described his profit-sharing plan and its results; the reasons for assuming so large a measure of responsibility, not only for the labor conditions in the plants, but also for the social and moral surroundings of the employees; to what extent it would be desirable to give the employees an insight into the operations of the company and a voice in the determination of working conditions and his ideas toward private philanthropies, stating that he had little use for charities.

May Discharge Employee for Belonging to Union

Supreme Court Holds Kansas Coercion Law Invalid— Thirteen Other States Affected

WASHINGTON, D. C., Jan. 26—That an employer may refuse to employ and may discharge a man for belonging to a union, was the decision of the Supreme Court, handed down yesterday. The Kansas coercion statute, so-called, making it unlawful for any individual or corporation to coerce or influence any person to enter into an agreement not to join or remain a member of a labor organization as a condition of such person securing or continuing in the employment of such individual or corporation, was annulled as unconstitutional by the Supreme Court.

The decision, which is regarded as of the first importance in the labor world, was announced by Justice Pitney. The case was that of T. B. Coppage, a superintendent of the St. Louis and San Francisco Railway at Scott, Kans., convicted of violating the law in threatening A. R. Hodge, a switchman, with discharge if he did not sign an agreement to withdraw from the Switchmen's Union.

The other laws which, according to Justice Day, are invalidated by the decision, are those of California, Colorado, Connecticut, Indiana, Massachusetts, Minnesota, New Hampshire, New Jersey, New York, Oklahoma, Oregon, Pennsylvania, Wisconsin and Porto Rico.

Badger Brass Sues for Infringement

CLEVELAND, O., Jan. 23—The Badger Brass Manufacturing Co., Kenosha, Wis., on January 21 brought suit in U. S. district court, Cleveland, against the Guide Motor Lamp Co., manufacturers of lamps and automobile accessories, charging infringement on a patent lamp socket. The complaint alleges the Guide company is using without authority the lamp socket for which Walter E. Christian was granted a patent May 27, 1912. R. H. Welles, treasurer of the Badger Brass Mfg. Co., brought the suit through his attorney, Albert H. Graves.

Seat Spring Patent Upheld in Detroit

DETROIT, MICH., Jan. 22—Judge Tuttle yesterday handed down a decision in favor of Theodor L. A. Adler and William G. Sullivan in their suit against the Jackson Cushion Spring Co., Jackson, Mich., charging infringement of Patent No. 991,187, covering spring construction for automobile seats. The court held that the patent was infringed.

The suit was brought May 21, 1913, Adler and Sullivan charging that the Jackson concern copied the invention of the patent 991,187 granted to them May 2, 1911, manufactured and sold it. The defense of the latter company was that the patent in question was antedated and hence void.

Charges Infringement of Tire Carrier Patent

NEW YORK CITY, Jan. 25—The Garage Equipment Mfg. Co. has brought suit against the Charles Weiland Co., charging infringement of its Patent No. 46,360 covering a tire carrier design for automobiles.

The bill of complaint states that Grant F. Discher, Milwaukee, Wis., assigned his patent on this design to the Garage Equipment Mfg. Co., June 10, 1914, and that the latter company received a patent on it for 7 years from September 8, 1914. This company charges that the Weiland company seriously injured its business by making and selling large quantities of tire carriers containing the design of the patent both after the granting of the patent and before the filing of the bill of complaint in this suit. The Garage

Equipment Mfg. Co. alleges that the Welland company is still securing large gains from the sale of these devices in spite of having been notified of infringement of the patent.

The Garage Equipment Mfg. Co. asks for a preliminary and a final injunction; that all of the alleged infringing devices now in the possession of the Welland company be destroyed, or turned over to it for this purpose; that the court compel the Welland company to make an accounting of the alleged profits from the sale of the device, and that such damages be tripled.

—

CLEVELAND, O., Jan. 23—The Lindsay Auto Parts Co., Indianapolis, Ind., brought suit in U. S. district court, Cleveland, Thursday, January 21, against the Winton Motor Carriage Co., charging infringement of driving axle patents. The action asserts that patents were issued to Thomas J. Lindsay May 9, 1898, for a driving axle invention he assigned to William Harmon, then both assigned to the Lindsay Auto Parts Co. Losses to the extent of $3,000 have been suffered, according to the bill of complaint. Charles Martindale, attorney, Indianapolis, represents the complainant.

—

$20,000 Verdict for Curtain-Holder Inventor

DETROIT, MICH., Jan. 23—Yesterday a jury in Judge Mayne's Wayne County circuit court awarded $20,000 damages to W. A. Paul, an inventor of a curtain holder for inside curtains on automobiles, against J. N. Collins, J. A. Bennett and the Novelty Leather Works, all of Jackson, Mich.

It was claimed by Paul that prior to July 1, 1912, he conceived and invented "a certain curtain holder pertaining to the use of inside curtains for automobiles," that he made a working model, showed it and the plans to Collins, and made actual demonstrations for the purpose of securing the financial aid of Collins' company, the Novelty Leather Works, to be able to get letters patent and market the device. It was agreed, so Paul claimed, that in consideration for allowing the Novelty Leather Works to make and sell his invention he was to receive 25 per cent. of the receipts of the business derived from his invention. He also claimed that Collins and Bennett conspired to defraud him out of his rights, and that patent No. 1,066,448 filed by Collins July 22, 1912, and granted to him July 1, 1913, was his—Paul's—invention.

Plaintiff Paul asked for $50,000 damages. The jury allowed $4,500 as back royalties and $15,500 as future royalties.

The case will be appealed, the attorneys for Collins and Bennett claiming that the circuit court has no jurisdiction, and that the case should have been heard in the United States courts.

—

Army Truck Bill Is Passed

WASHINGTON, D. C., Jan. 23—The army appropriation bill, carrying $101,000,000 was passed by the House today. The bill which carries funds for the maintenance of all branches of the army during the coming fiscal year, includes $50,000 for armored motor cars.

—

Debate Over Cars in Indian Bill

WASHINGTON, D. C., Jan. 23—A provision in the Indian appropriation bill appropriating $15,000 for the purchase of twenty motor cars for the use of superintendents, farmers, physicians, field matrons and other employes of the Indian field service, aroused a big debate in the house of representatives. Many members were opposed to the appropriation, while others urged it. It was finally decided to leave the provision in the bill.

—

New York Automobile Bond Bill Up Again

ALBANY, N. Y., Jan. 24—A bill has been introduced bv Assemblyman M. D. Perlman, providing that no motor vehicle shall be operated until the owner has filed a bond, approved by the secretary of state in tho sum of $5,000 for the payment of any judgments for damages caused to persons or property by the automobile.

—

To Raise Speed Limit in Delaware

WILMINGTON, DEL., Jan. 25—A bill is pending before the Delaware Legislature—it passed the house without opposition—increasing the motor speed limit for Delaware outside of the cities and towns from 20 to 25 miles an hour and in the towns from 12 to 15. A bill is pending in the Senate to require all vehicles to carry lights at night. Both houses have passed an act permitting the secretary of state to use a rubber stamp in signing his name to automobile licenses.

Prior Art Defense in Bearing Suit

—

Chalmers Representative Alleges Previous Use of Anti-Friction Bearing

CLEVELAND, O., Jan. 26—In the action of the American Ball Bearing Co. against Edward B. Finch, representing the Chalmers Motor Co., before Judge Clarke today, prior art testimony was offered by the defense to show that Chalmers ball bearing steering knuckle practice was in use previous to the patent grant on which the complainant alleges infringement. Final argument will be heard and a decision probably rendered tomorrow. The witnesses called today included Walter C. Baker, President of the American Ball Bearing Co.; Howard E. Coffin, Vice-President of the Hudson Motor Car Co., Herbert N. Rich, B. I. Tuttle, B. B. Neuteboom, Consulting Engineer of Detroit, and James G. Heaslet, Vice-President of the Studebaker Corp.; F. C. Hinkley, of the Chalmers Co. was present.

Yesterday evidence was taken reviewing that presented at the previous hearings. The American Ball Bearing Co. brought suit March 5, 1913, alleging in its bill of complaint that Edward B. Finch as a representative of the Chalmers Motor Co. and the Metal Products Co., urged and induced the use of anti-friction bearings in Chalmers motor car construction, in alleged infringement of patents issued to Walter C. Baker and assigned to the American Ball Bearing Co. The patent is No. 753,820, and was issued February 24, 1902, according to the complaint, and has to do with the efficiency of the steering knuckle. Licensees of the American Ball Bearing Co. include the Lozier Motor Co., Pierce-Arrow Motor Car Co. and the Baker Motor Vehicle Co., according to the bill of complaint and an offer was made the defendant, on behalf of the Chalmers Motor Co., to adopt the patent, the papers allege.

The action filed June 25, 1913, by the Kardo Co., substituting for the American Ball Bearing Co., against Henry J. Adams, former representative and at that time dealing as the Reo Motor Sales Co., is on the U. S. district court calendar for hearing Wednesday. The same attorneys will appear in this case, it is probable. The Kardo Co., following up the American Ball Bearing Co.'s suit, alleged infringement of Patent No. 792,690, issued to Alanson P. Brush, of Detroit, for bevel-gear driving and compensating mechanism. The bill of complaint established that Brush assigned to the Baker Motor Vehicle Co. and the Baker Motor Vehicle Co. assigned to the American Ball Bearing Co., with the patents of the latter corporation now under the control of the Kardo Co. Transfer of the suit was made to the Kardo Co. October 3, 1914.

—

Michigan to Tax Weight $.25 Per 100?

LANSING, MICH., Jan. 26—An automobile tax bill was introduced last night in the House of Representatives by Representative Newel Smith which provides in addition to a tax of 25 cents per horsepower also a tax of 25 cents for every 100 pounds of weight.

The reason for adding a tax on the weight of motor cars is because many low-powered cars are much heavier than many high-powered vehicles, and the latter do not wear out the roads as much as the former. Furthermore, this system will also provide a more equitable taxation and trucks and other commercial vehicles will have to pay a more just proportion considering that they wear the roads more than the passenger cars.

It is estimated that if the measure is adopted it will mean a revenue of from $700,000 to $850,000 annually, which is to be used exclusively for building, improving and maintaining the state's roads and highways. A sum not to be over 5 per cent. of the total is to be set aside for salaries and expenses of the highway department.

—

LOS ANGELES, CAL., Jan. 18—At a meeting held here today, attended by representatives of the state motor vehicle department, the Automobile Club of Southern California and officers of the traffic division of the local police department, regulations governing motorists visiting in Southern California were drawn up.

Motorists from outside states carrying 1915 license plates on their cars will receive the same consideration as autoists carrying the latest California number plates, notwithstanding the price paid for the plate nor in which state it was purchased.

Kelly-Springfield Gets War Order

Canadian Government Orders 150 of 3 1-5-Ton Trucks—Also 30 a Month During War

NEW YORK CITY, Jan. 25—After practically 2 months of investigation and delay, the Canadian government has placed an order of 150 trucks for war purposes with the Kelly-Springfield Motor Truck Co., Springfield, O. J. L. Geddes, president of the company, states that the trucks are of the 3 1-2-ton type. He also states that the order calls for thirty trucks a month until the war is ended.

Although the trucks are to be made at Springfield, the Kelly company has offered to take over an assembly plant in Canada to complete the order.

Porter to Use High-Speed Knight

NEW YORK CITY, Jan. 27—Finley R. Porter, who recently founded the Finley Robertson Porter Co. to manufacture the F. R. P. car, a speed creation, announces that his company will be located in Indianapolis, Ind., where it will bring out a special small racing car under the name F. R. P., using a 3 3-4 by 6 1-8 inch four-cylinder Knight motor of 207 cubic inches piston displacement and capable of 3,500 r.p.m.

Mr. Porter, who, as chief engineer of the Mercer company, has had great experience in the racing field, states that it is the intention of the company to enter this car in practically every sanctioned contest during the coming year.

The motor will develop, it is expected, 130 brake horsepower and the car will be capable of 105 miles per hour. Other specifications are 108-inch wheelbase; V radiator; pump cooling; Bosch magneto; weight about 1,900 pounds; cone clutch; four-speed selective gearset located amidship; bevel drive; drop frame; semi-elliptic springs all around with the rear end of the rear springs taking the drive; torque rod but no radius rods; and 34 by 4-inch Rudge-Whitworth wire wheels.

The same general construction as used in the car formerly announced is followed, the same high class steel being used in the chassis.

Designing New Gramm Truck Model

LIMA, O., Jan. 23—Preliminary plans have been announced to local stockholders of the Gramm Motor Truck Co., for the reorganization by the Geiger-Jones Co., of Canton, O., which was underwriter for the original issue of preferred stock, and which has just taken over the common stock of John North Willys.

The plant will be, it is understood, under the personal management of representatives of the Geiger-Jones financial house. Under the new plan the Garford plant at Elyria, O., will be merged with the Gramm plant at Lima, where both Gramm and Garford trucks will be made.

The Gramm company is now capitalized at $1,250,000, with $500,000 of this preferred, a large portion of which is still held in the treasury. The capitalization of both common and preferred, it is said, will be reduced 50 to 60 per cent. consent already having been secured by the reorganization committee from two-thirds of present stockholders.

The common stock has never paid a dividend, but the preferred requirements have been paid and all mortgage indebtedness to local banks, which originally financed the big plant and real estate, have been paid off.

J. N. Garver, representing the Geiger-Jones Co., states that designers are now at work designing an entirely new motor truck to be manufactured as soon as the reorganization of the company is completed.

Monitor Eight-Cylinder Car Appears

COLUMBUS, O., Jan. 26—The Cummins Auto Sales Co., North Fourth street, Columbus, O., has entered the field as a manufacturer of an eight-cylinder automobile. The first car is about completed and will be shown for the first time at the Columbus Automobile Show, January 30 to February 6. The name will be the Monitor. The company is also preparing to place on the market the Monitor Jr., a four-cylinder car to sell at $675.

The eight-cylinder car's weight will not exceed 2600 pounds, according to the statement of the builders. It will have Timken axles both in front and the rear and will develop 35 horse power. The motor is cast in two unit blocks set at 90 degrees in crank case. It will have a unit power plant with sliding gear transmission. It will be equipped with a self-starter and generator.

The wheelbase is 110 inches and the tires will be 33 by 4, with demountable rims. The cooling system will be something unique. It will have a deeper radiator and two separate pumps, one at the bottom of each block of the motor. There will be four connections with the radiator. The body will be of the approved stream line style and will be especially roomy. Five passengers will be carried with comfort. The front springs will be semi-elliptical and the rear springs will be three-quarter underslung elliptical. Spicer universal joints will be used.

It will have a one-man top with Jiffy curtains, crown fenders and the running board will be aluminum bound, covered with linoleum. It will have left-drive and center-control. The upholstering will be full leather. The body will be royal blue with black running gears, fenders and hood. The price is $1,275.

Automobile Securities Quotations

NEW YORK CITY, Jan. 26—The general tone throughout the automobile and allied securities market was steady during the past week, and most of the changes recorded were slight. One of the features of the week's trading was the rise of Kelly-Springfield tire stocks, the common gaining 15, first preferred 3 and second preferred 5. Other gains recorded during the week were: Firestone Tire common 5; General Motors common 3; U. S. Rubber preferred 2; and Willys-Overland common 4 1-2. Practically all the declines were small, being largely due to market fluctuations.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	195	..	250	..	..
Ajax-Grieb Rubber Co. pfd	98	101	100	..	..
Aluminum Castings pfd	97	100	95	100	..
J. I. Case pfd	..	..	75	85	..
Chalmers Motor Co. com	..	92	..	96	..
Chalmers Motor Co. pfd	93	95	90	93½	..
Electric Storage Battery Co	..	..	48½	49½	..
Firestone Tire & Rubber Co. com	244	252	370	376	+5
Firestone Tire & Rubber Co. pfd	105	..	109	111	..
General Motors Co. com	45	47	90	91½	+3
General Motors Co. pfd	84	85½	93	94½	—1
B. F. Goodrich Co. com	22	22¼	30	30½	—1
B. F. Goodrich Co. pfd	86½	87½	96	97	+ ½
Goodyear Tire & Rubber Co. com	235	235	194	196	..
Goodyear Tire & Rubber Co. pfd	98	100	102	103	+1
Gray & Davis, Inc., pfd	90	100	..	..	..
International Motor Co. com	..	5	..	1	..
International Motor Co. pfd	..	15	..	10	..
Kelly-Springfield Tire Co. com	52	54	93	94	+15
Kelly-Springfield Tire Co. 1st pfd	121	125	82	83	+3
Kelly-Springfield Tire Co. 2d pfd	..	..	105	107	+5
Maxwell Motor Co. com	4	5	16½	17½	—1½
Maxwell Motor Co. 1st pfd	27½	28½	53	54	— ½
Maxwell Motor Co. 2d pfd	8	9	21	21	..
Miller Rubber Co. com	..	..	158	165	..
Miller Rubber Co. pfd	..	..	101	103	..
New Departure Mfg. Co. com	120	125	..	120	..
New Departure Mfg. Co. pfd	102	104	101	..	..
Packard Motor Car Co. com	..	..	..	100	..
Packard Motor Car Co. pfd	95	100	93	..	..
Peerless Motor Car Co. com	15	25	15	20	..
Peerless Motor Car Co. pfd	75	80	..	55	..
Portage Rubber Co. com	..	40	30	36	..
Portage Rubber Co. pfd	..	90	80	85	..
*Reo Motor Truck Co	6½	7½	12	12¾	+ ¾
*Reo Motor Car Co	14½	15¾	25	25¾	..
Splitdorf Electric Co. pfd	40	50	..	..	—1½
Stewart-Warner Speed Corp. com	52	†53	51	†52½	..
Stewart-Warner Speed Corp. pfd	94	†98	99	†102	..
Studebaker Corporation com	26	26½	42	43	+1
Studebaker Corporation pfd	76¾	77¼	94	95	..
Swinehart Tire & Rubber Co	69	71	69	71	..
Texas Company	..	..	133	134	..
U. S. Rubber Co. com	62	62½	57	58	—1
U. S. Rubber Co. pfd	102½	103¼	104	105	+2
Vacuum Oil Co	213	216	199	201	—1
White Company pfd	105	110	108	110	..
Willys-Overland Co. com	64	66	91½	92	+4½
Willys-Overland Co. pfd	92	95	93	95	..

*Par value $10; all others $100 par value.
†Ex. dividend.

CHICAGO, ILL., Jan. 23—The Stewart-Warner Speedometer Corp. has declared the regular quarterly dividend of 1 1-2 per cent. on its common stock and 1 3-4 per cent. on its preferred stock, both payable February 1, to holders of record January 23.

DETROIT, MICH., Jan. 25—The revised traffic ordinance was adopted at last week's common council meeting and will go into effect March 1. Its principal new provision is that all vehicles, whether automobiles or horsedrawn, must carry a tail light.

Market Reports for the Week

NEW YORK CITY, Jan. 27—Few changes occurred in this week's market reports. Most of the materials remained constant. Tin went up $1.25 per 100 pounds, with small demand and resale lots at concessions. On Friday and Saturday, lead rose to $3.70, but immediately dropped to the opening price, $3.67 1-2, which was held until the close. Electroiytic copper dropped $0.00 1-2 per pound, and the Lake product rose $0.00 23-40. On Tuesday, electrolytic was offered more freely in first and second hands. There is almost no demand for home consumption. Antimony rose $0.01, closing at $0.16. This metal has had a gradual rise within the last few weeks. Rubber was a little more active this week. Manufacturers manifested a little more interest in the market than for some time past, according to reports current, though there seemed to be little doing among the dealers. The market retained a steady tone for fine Up-River Para, which closed at $0.62. No changes occurred in the oil and lubricants markets.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.15	.15½	.16	.16	.16	.16	+.01
Beams & Channels, 100 lbs.........	1.21	1.21	1.21	1.21	1.21	1.21	......
Bessemer Steel, ton.	18.50	18.50	18.50	18.50	18.50	18.50	......
Copper, Elec., lb..	.13¾	.14	.13⅞	.13½	.14⅛	.14¼	—.00½
Copper, Lake, lb..	.13⅘	.13⅞	.13⅞	.13½	.14⅛	.14⅛	+.60 23/40
Cottonseed Oil, bbl	6.60	6.60	6.60	6.60	6.70	6.70	+.10
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime...	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.....	3.67½	3.67½	3.70	3.70	3.67½	3.67½	......
Linseed Oil.......	.60	.60	.60	.60	.60	.60	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.55	.55	.55	.55	.55	.55	......
Petroleum, bbl., Pa., crude	1.50	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.71	.71	.71	.71	.71	.71	......
Rubber, Fine Up-River, Para......	.62	.60	.60	.62	.62	.62	......
Silk, raw, Ital.....	..	3.90	..	..	3.90	3.90	......
Silk, raw, Japan...	..	3.52½	..	..	3.52½	3.50	—.02½
Sulphuric Acid, 60 Baume.......	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.......	34.25	34.75	34.78	35.00	35.75	35.50	+1.25
Tire Scrap........	.05	.05	.05	.05	.05	.05	......

Racine Rubber Profits $570,000

RACINE, WIS., Jan. 21—At the annual meeting of the stockholders of the Racine Rubber Co., it was announced that during the year ending December 31, 1914, the total earnings amounted to $570,000 and the total sales had been $2,400,000. At the present time the company has outstanding $310,000 in 7 per cent. cumulative preferred stock and $733,500 in common stock and has a surplus of $180,000. During this year the company will employ 500 to 600 men, the annual payroll amounting to more than $300,000.

According to officers of the company orders already on the books indicate that during 1915 sales will aggregate near $3,500,000. All the officers have been re-elected, they being, G. B. Wilson, president and general manager; H. L. McClaren, vice-president and general sales manager; L. T. Vance, general factory manager and Stuart Webster, secretary-treasurer.

Republic Truck Capital Increased $200,000

ALMA, MICH., Jan. 21—At a meeting of the stockholders of the Republic Motor Truck Co., it was voted unanimously to increase the capital stock from $50,000 to $250,000. Although the Republic company added to its original plant last year it is likely that a further extension will be made during the present year. An average of twelve trucks are made daily and it is hoped to increase this output gradually.

IN the Rostrum for January 21, page 165, it is stated that the ordinary 6-volt, 16-candlepower tungsten-filament head lamp consumes 240 watts. This is incorrect, the watt consumption being approximately 16 or 1 per candlepower as previously stated in the same paragraph. The formula for amperes when candlepower and voltage are known, which it was intended to give should read, for this type of lamp: amperes = watts-per-candlepower × candlepower ÷ voltage. With this lamp the result would be 2.66.

Large Rubber Shipments Coming

Lusitania Brings Over 200 Tons for Our Manufacturers — 1,000 More Tons Coming on Menominee

NEW YORK CITY, Jan. 23—The Lusitania, with 200 tons of plantation grades of crude rubber, docked in this city today. Of this amount, 100 tons are consigned to the United States Rubber Co. and 90 tons to the B. F. Goodrich Co. B. G. Work, president of the Goodrich company, returned from London on the boat.

In a report made by Mr. Work at the Union League, he explained the conditions under which Great Britain lifted her embargo on rubber on January 9 and also stated that American exporters are now upon their honor strictly to observe the regulations agreed to in order that no further embarrassing trade difficulties with Great Britain may be precipitated. He also stated that in a week or so exportations amounting to $250,000 daily will be released and 250,000 idle laborers will be enabled to return to their work. A large number of permits for shipping crude rubber have been issued by the British Government, said Mr. Work. Cargoes will be allowed to go direct from here to France and Russia.

The Menominee, which set sail last week from Liverpool for this city, is bringing an additional 1,000 tons of plantation rubber, of which 350 are for the United States Rubber Co. Ths consignees for the balance are not obtainable here at the moment. The Franconia will be the next steamer after the Menominee on which shipments of crude rubber will be made. It is learned that the United States Rubber Co. will have a shipment on that boat also.

Akron despatches say that ths officials of the rubber manufacturing companies there have announced that full forces of men will be put to work shortly and that in the near future it is expected that employment will be given to nearly all the men who are idle today. The Goodrich company states that 2,000 additional men will be put to work by April 1.

Crude rubber in Brazil shows a declining tendency, as the result of the activity of importers and manufacturers in the United States in increasing their stocks of plantation grades from London. At Manaos there are 1,000 tons and at Para 1,100 tone available for purchase, the rubber being held. There is a light demand for this rubber.

The United States Rubber Co. has notified the trade that there will be no change in the prices of its products until March 1, unless competitive conditions or some other striking developments should make such action necessary.

Federal Rubber Capital Increased $1,000,000

MILWAUKEE, WIS., Jan. 23—The Federal Rubber Mfg. Co., of Milwaukee, with factories at Cudahy, Milwaukee county, on January 20 filed an amendment to its articles of incorporation, increasing the capital stock from $2,000,000 to $3,000,000. The additional issue of $1,000,000 is to be used for the accommodation of the growth of the business.

Byron C. Dowse, president of the company, explained that the company has under way an extension and improvement scheme involving $500,000 or more. When this is completed by July 1, the capacity of the tire works will be doubled. The plant at present is operating 20 hours a day and the working force numbers 1,200. The force is gradually being increased and is expected to reach 1,600 when the latest factory addition, just put under way, is finished.

Republic Rubber May Issue $2,500,000 Preferred

YOUNGSTOWN, O., Jan. 23—At its annual meeting January 25 the Republic Rubber Co., this city, will place before its stockholders a plan to issue $2,500,000 preferred stock, with the proceeds of which the preferred stock now outstanding will be redeemed. The new issue of $2,500,000 to retire old stock will bear the same rate of interest as the stock to be redeemed, but will have a longer maturity term attached to it, likely 15 years. It is stated that due to growing business it will be necessary in the near future to increase the size of the plant.

N. Y. Fire Marshal Office Abolished

State Assembly Passes Bill Dropping Obnoxious Garage Regulations

NEW YORK CITY, Jan. 26—The office of New York state fire marshal and the set of garage regulations, which the present incumbent, T. J. Ahearn, promulgated, have been abolished. The measure which brought about the abolishment was introduced by Majority Leader Hinman and was passed through the Assembly last night by a vote of 93 to 38, the Republicans voting solid and carrying the Progressives with them. The measure will go to the Senate next week, where it will probably receive the same action given it by the Assembly.

The abolition of the office brings to a successful end the fight which has been waged by the Automobile Trade Assn. of New York State, headed by R. H. Johnston, of the White Co., and attorney Chas. Thaddeus Terry, and secretary C. A. Stewart. At the request of this association the rules which applied to all cities in New York State with a population of 1,000,000 and over, were suspended indefinitely, pending an investigation and a proposal to redraft them to make them feasible and fair.

Bosch Offers $1,900 for Race Prizes

NEW YORK CITY, Jan. 26—The Bosch Magneto Co., this city, offers $1,900 for the Vanderbilt Cup and Grand Prize races, to be held on Washington's Birthday and February 27, respectively.

The distribution of the Bosch prizes is as follows: To the winner of the Grand Prize race $500; to second, $150; and to third, $100. The only condition to these prizes is that the driver in each instance use a Bosch magneto for ignition purposes during the race. In the case of the Vanderbilt Cup race, the winner of the first prize receives $300; second receives $150, and third $100. The condition is the same as in the Grand Prize race.

A second set of prizes has been arranged for the drivers in case they use during the race Bosch plugs in addition to Bosch magnetos. In each case if his ignition equipment is completely Bosch, the first three winners are to be awarded an additional $100.

New Enamel Process Saves Time

NEW YORK CITY, Jan. 23—The Fickling Enameling Corp., Long Island City, has started operations in its new enameling plant and has introduced methods which are stated to save considerable time in the production of a hard, durable coat.

The work is done under what is known as the Radio process. Humidified, water-washed air is pumped into a series of large ovens by a fan blower and superheated by coming into contact with radiators. The ovens are operated under low-heat temperature conditions and, according to officials of the company, the varnish will dry in 3 hours, whereas with the ordinary method it takes 3 days with the use of heated air. It is stated also that each coat is dried all the way through instead of merely on the surface, and for that reason there is no danger of discoloration through sweating. By this method an entire automobile is japanned in 3 days, the fenders and other small parts being enamelled.

Business Good at Detroit Show

DETROIT, MICH., Jan. 23—The Detroit Automobile Show came to a close Saturday night with more cars sold than ever before in the history of the show. The business of the week was also good from the point of view of agencies established. Practically every hotel in the city was filled during the show week and a good percentage of the visitors were dealers from all over the United States.

A feature of the week was the number of banquets and conventions held, a brief summary of these being as follows:

The King Motor Car Co. gave its annual dinner to the parts and accessory manufacturers who furnish either parts or accessories for King cars. Including the officials of the company, there were 135 guests. Artemas Ward, Sr., presented each of the guests with a book on food which retails for $10.

At the Tulier a banquet was given by the Olds Motor Works, Lansing, Mich., attended by more than fifty members of the organization.

The Edelweiss cafe was the rendezvous for the banquet given by the Paige-Detroit Motor Car Co. to its dealers from the Middle West, more than 150 being present. A feature of the evening was the Paige Movies Show.

From January 20 to 22 the annual dealers' convention of the Federal Motor Truck Co. took place. More than 150 attended and some came from all the states in the Union. The banquet was served at the Ponchartrain.

Over 600 at Overland Dinner

CHICAGO, ILL., Jan. 26—The show week dinner of the Overland company, held tonight at the La Salle was a record-breaker in the way of attendance, there being more than 600 guests, most of them dealers. In the way of a novelty the company had a Wild West entertainment before the dinner, the eighteenth floor of the hotel being converted into a Western mining camp, with gambling houses, saloon, dance hall and jail. Each guest was furnished with $500 in phony money with which to gamble and each wore a sombrero and red bandanna handkerchief.

Champion Plug Salesmen Hold Convention

TOLEDO, O., Jan. 23—The annual salesmen convention of the Champion Spark Plug Co., this city, was held at the factory January 19, 20 and 21, the salesmen carrying out a regular detailed program during the 3 days, Monday and Tuesday being devoted to business discussions while on Thursday the company entertained the salesmen in Detroit, where they inspected some of the large automobile plants as well as attending the Detroit show.

Rayfield Organization Meets in Convention

CHICAGO, ILL., Jan. 22—The annual convention of the Rayfield carbureter organization was held January 21 and 22 at the Findeisen & Kropf Mfg. Co. plant, here. The carbureter question was discussed in all its phases. The changes in the construction of motors and the fuel question were given due consideration, inasmuch as these two important factors in automobile construction are closely allied with the carbureter.

Thursday evening the men were entertained at a banquet given by the firm in the dining room of the Chicago Motor Club. Friday evening the entire party was taken to the Cort Theater.

Continental Motor to Increase Plant

MUSKEGON, MICH., Jan. 25—Several temporary frame buildings are to be added to the local plant of the Continental Motor Mfg. Co., and when they will all be completed it is expected that several hundred men will be added to the present working force which now numbers 1,200 men. The first addition to be made is a machine shop, 60 by 100 feet and about 100 men will be employed in it.

DETROIT, MICH., Jan. 25—While officials of the Continental Motor Mfg. Co., did not care at this time to go into the details of the proposed enlargement of their plant in Muskegon it was learned that such increase in business has come lately that in order to be able and take care of it day and night shifts are being employed in the Detroit plant. The total number of men was stated to be 1,600 of which 400 constitute the night force.

NEW YORK CITY, Jan. 26—There are more than 200 passenger cars and trucks listed in the Twelfth Annual Handbook just issued by the National Automobile Chamber of Commerce, this city. Copies may be secured from the offices of the N. A. C. C. upon receipt of $0.25 in stamps.

NEW YORK CITY, Jan. 26—Col. Charles Clifton, president, has appointed J. Walter Drake, sales manager of the Hupp Motor Car Co., a member of the Legislative Committee of the National Automobile Chamber of Commerce. The other members are: H. H. Rice, Waverley, chairman and J. I. Farley, Auburn.

HARTFORD, CONN., Jan. 26—The West Works of the Pope Mfg. Co. have been purchased by P. Garvan, Incorporated, a local paper house. The property has been appraised at $110,000 so that it is finally disposed of for approximately 73 per cent. of the assessed value. This sale disposes of all the property of the Pope company in this city and under the jurisdiction of Col. George Pope, the receiver, the main works on Capitol avenue having been sold recently to the Pratt & Whitney Co. for $300,000.

Factory Miscellany

ENDURANCE Tire Adds—The Endurance Tire & Rubber Co., New York City, has awarded a contract for the erection of two factory buildings, one 80 by 252 feet and the other 35 by 37 feet.

Bartlett Adds—The Bartlett Automobile Co., Stratford, Ontario, plans to construct a new factory, estimated to cost $50,000.

Beaver Co. Equipping—The Beaver State Motor Co., Gresham, Ore., is installing equipment, including a milling and boring machine. The improvements will cost about $25,000.

Royal Equipment Adds—The Royal Equipment Co., Bridgeport, Conn., manufacturer of brakes and other automobile specialties, will erect an additional factory, 60 by 90 feet, three stories and basement.

$100,000 Plant for Stewart-Warner—Plans have been prepared for the Stewart Warner Speedometer Co., Chicago, Ill., for a six-story factory, 77 by 125 ft., to be erected at Wolfram and Lincoln streets, at a cost of about $100,000.

Willard Adds $25,000 Plant—The Willard Storage Battery Co., Cleveland, O., has secured a building permit for the construction of a factory building on East One Hundred and Thirty-first street to cost about $25,000.

Detroit Electrical Plant Sold—The plant of the bankrupt Detroit Electrical Appliance Co., Detroit, Mich., which made the Deaco starters, has been sold by the Detroit Trust Co., at public auction for $24,350 to Lipson & Schmidt.

Tool Manufacturer in Cincinnati—The Parts Mfg. Co., Cincinnati, O., has been organized to manufacture interchangeable parts, tools and fixtures. It also specializes in the machining of automobile parts and production of repair parts for all cars.

French Battery's Chicago Factory Branch—The French Battery & Carbon Co., Madison, Wis., has established a direct factory branch in Chicago. The company is capitalized at $50,000 and the articles filed in Illinois give the Chicago interest at $1,500. F. M. Brown is president and C. T. Ellis secretary.

Locomobile Adds—The Locomobile Co. of America, Bridgeport, Conn., has taken on new manufacturing space by leasing an additional floor of the Bridgeport Engineering Co's building, and will employ between 150 and 200 additional hands. It is buying new machinery.

Briscoe Dealers at Factory—About seventy Wisconsin dealers handling the Briscoe car were the guests of the Briscoe Motor Co., Jackson, Mich., recently. They visited the factory, were given business talks by officials of the company, discussed business conditions in their territory, made suggestions for improving business.

New Overland Plant—The contract for the erection of a large addition to the Willys-Overland plant, Toledo, O., has been awarded. The building will be constructed of concrete, brick and steel and will be 1,000 feet long, 200 feet wide and three stories high. An order for 35,000 barrels of cement has been placed for the construction work.

The Automobile Calendar

Jan. 23-30........	Montreal, Que., Show, Allen Line Liverpool Bldgs., Montreal Automobile Trade Assn., T. C. Kirby, Mgr.
Jan. 23-30........	Portland, Ore., Show.
Jan. 23-30........	Chicago, Ill., Automobile Show, Coliseum and First Regiment Armory.
Jan. 25-30........	Fall River, Mass., Show.
Jan. 25-30........	Buffalo, N. Y., Show, Broadway Auditorium, Buffalo Automobile Dealers' Assn.
Jan. 30-Feb. 6....	Columbus, O., Show, Memorial Hall, Columbus Auto Club and Columbus Auto Trades Assn.
Jan. 30-Feb. 6....	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Automobile Trade Assn.
Feb.............	Portland, Ore., Show: Portland Auto Trade Assn.
Feb.............	Battle Creek, Mich., Show, Rathbun & Kraft Bldg.
Feb.............	Toledo, O., Show, Toledo Auto Show Co.
Feb. 1-6..........	Louisville, Ky., Show, Louisville Auto Dealers' Assn., First Regiment Armory.
Feb. 2-7..........	Kalamazoo, Mich., Show, Armory.
Feb. 3-6..........	Geneva, N. Y., Show.
Feb. 4-6..........	Marinette, Wis., and Menominee, Mich., Show, Armory, Marinette, Twin City Auto. Assn. of Marinette.
Feb. 8-11.........	Peoria, Ill., Show, Coliseum.
Feb. 8-13.........	Toledo, O., Show, Terminal Bldg., Toledo Auto. Shows Co., H. W. Blevins.
Feb. 8-14.........	Kansas City, Mo., Show.
Feb. 8-14.........	Troy, N. Y., Show, Troy Auto. Dealers' Assn.
Feb. 8-15.........	Wilmington, Del., Show, Hotel duPont.
Feb. 9-12.........	Eau Claire, Wis., Eau Claire Auto Dealers' Assn.
Feb. 9-12.........	Peoria, Ill., Show, Peoria Auto & Motor Cycle Dealers.
Feb. 10-13........	Davenport, Ia., Show.
Feb. 15...........	Fort Wayne, Ind., Show, Fort Wayne Auto Trade Assn.
Feb. 15-20........	Grand Rapids, Mich., Show, Klingman Furniture Exposition Bldg., Grand Rapids *Herald;* C. L. Merriman.
Feb. 15-20........	Omaha, Neb., Show, Auditorium, C. G. Powell.
Feb. 15-20........	Bridgeport, Conn., Show, State Armory; B. B. Sterber.
Feb. 16-18........	Bloomington, Ill., Show, Deere Bldg.
Feb. 18-20........	Racine, Wis., Show, Racine Automobile Dealers' Assn.
Feb. 22...........	Newark, N. J., Light Car Club of N. J., Hillclimb at Teaneck.
Feb. 22...........	San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Feb. 22-25........	Allentown, Pa., Show.
Feb. 22-27........	New Haven, Conn., Show, Second Regiment Armory; W. N. Lindsay.
Feb. 22-28........	South Bethlehem, Pa., Show, Coliseum; J. L. Elliott.
Feb. 23-27........	York, Pa., Show, Coliseum Hall.
Feb. 23-27........	Syracuse, N. Y., Show, Arena, Syracuse Motor Vehicle Trade Assn.
Feb. 23-27........	Syracuse, N. Y., Show, Armory, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27........	Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 25...........	New York City, S. A. E., Metropolitan Sec. Meeting: Report of Research Committee on Kerosene Carbureters. Research Com. Report on Non-Electric Continuous-Torque Transmission.
Feb. 27...........	San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama-Pacific Exposition Grounds: Promoter, Panama-Pacific Exposition Co.
Mar. 1-5..........	Wilkesbarre, Pa., Show. Vehicle Trades Assn.
Mar...............	Benton Harbor, Mich., Show, St. Joseph and Benton Harbor, St. Joseph Garage, St. Joseph.
Mar. 3............	Albany, N. Y., Associated Garages of America, General Convention.
Mar. 4-6..........	Springfield, Mass., Show; J. H. Graham.
Mar. 6-13.........	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13.........	New York City, Made in the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13.........	Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13.........	Canton, O., Show, Auditorium, Stark Co. Auto Show and Electrical Exposition.
Mar. 8-13.........	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 8-13.........	Utica, N. Y., Utica Automobile Trade Assn.
Mar. 13-20........	Harrisburg, Pa., Show Arena, Harrisburg Dealers' Assn.
Mar. 14...........	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17...........	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
April	Calumet, Mich., Show, Coliseum.
April 3...........	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
May 17-18.........	Boston, Mass., A. A. A. Annual Meeting.
May 29............	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9............	Galesburg, Ill., Two-mile Track Meet.
June 16...........	Chicago, Ill., Speedway, 500-Mile Race, Speedway Park Assn.
June 25...........	Sioux City, Ia., Track Meet.
July 4-5..........	Tacoma, Wash., Road Race.
Aug. 2-3..........	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21........	Elgin, Ill., Road Race.
Sept. 20-25.......	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

CONNELL Goes to Milwaukee—H. L. Connell, for the past 2 years secretary and treasurer of the Detroit section of the Society of Automobile Engineers, has left for Milwaukee, Wis., where he will cooperate in establishing a motor car testing laboratory and will be a member of the engineering faculty of the Central Continuation School. Mr. Connell has been connected with the experimental and truck engineering departments of the Packard Motor Car Co., and was engineer of the Commerce Motor Car Co.

Bunker Resigns—E. F. Bunker has resigned his position with the Perfection Spring Company. His resignation takes effect February 1.

Sabourin Mgr.—The General Motors Truck Co. has established a direct factory branch in Tacoma, Wash., with G. A. Sabourin in charge.

Weibel Firestone Mgr.—H. Weibel, a Cincinnati man, has been appointed manager of the Cincinnati, O., branch of the Firestone Tire and Rubber Co.

Estep Makes Change—Ralph Estep, formerly with the Packard Motor Car Co., Detroit, Mich., has joined the Cheltenham Advertising Agency, New York City.

McFarland Joins Cole—J. S. McFarland, purchasing agent and assistant superintendent of the Ohio Carriage Co., Columbus, O., has joined the staff of the Cole Sales Co., Indianapolis.

Brown in Packard Engineering Dept.—G. C. Brown, formerly with the Buffalo Electric Vehicle Co., is now with the engineering department of the Packard Motor Car Co., Detroit, Mich.

Brier Seattle G. M. C. Manager—Bruce Brier, well-known in the Seattle automobile field, has been named sales manager for the G. M. C. trucks and has established offices at 1400 Broadway, Seattle, Wash.

Director of New Orleans Assn.—Ginder Abbott of the Abbott Automobile Co., New Orleans, La., agent for the Packard and Jeffery cars; has been elected a member of the board of directors of the Assn. of Commerce of that city.

Zettler Mgr.—Judge Hugo Wegener, who has represented the Kisselkar at Marshfield, Wis., for some time, has established a salesroom and garage and taken on the Grant agency. Frank Zettler has been appointed manager.

Anselm Makes Change—Roy W. Anselm, until January 1 president and general manager of the Anselm-Ganahl Motor Car Co., is now connected with the Kardell Motor Car Co., St. Louis, Mo., distributors for the Reo and Chevrolet cars.

St. Louis Assn. Elects.—The annual banquet and election of officers of the St. Louis Carriage, Wagon and Automobile Builders' Assn., St. Louis, Mo., was held this week and the following men were selected as officers: President, John Cook; Vice-president, Fred Heimburger; Secretary A. E. Spaete and Treasurer, Henry Uhlenhalt.

Peoria Club Elects—At the annual meeting this week of the Peoria Automobile Club, Peoria, Ill., new officers were elected for the ensuing year as follows: President, Valentine Jobst; vice-president, S. L. Nelson; secretary, W. A. Bunn, and treasurer, C. E. Ulrich.

Fussey Re-Elected—At the annual meeting of the stockholders of the Detroit Brass Works, Detroit, Mich., J. W. Fussey was re-elected president, A. L. Hanson, vice-president, E. B. Whitcomb, treasurer, G. C. Hall, secretary. These officers and E. D. Bronner and O. P. Benjamin, constitute the board of directors.

Change of Plans in Boston—There has been another change in the handling of the Garford and Willys Utility trucks in Boston, and the R. E. Taylor Co., that now has them as an agency proposition, has placed J. H. Cafferty of New York in charge as manager. They were handled first as an agency by the R & L Co. and later as a factory branch proposition.

Grand Rapids Assn. Elects—More than fifty of the Grand Rapids, Mich., automobile and accessory dealers, garage owners and tire repair men have organized the Grand Rapids Automobile and Accessory Dealers' Assn. W. D. Vandercar was elected president; Carl P. Palmer, vice-president; Earl R. Corbin, secretary and Floyd G. Withrow, treasurer.

Wright a Manufacturing Agent—D. A. Wright, who for several years past has been connected with the Yale & Towne Mfg. Co., New York City, as district manager in the West, has opened an office for himself as manufacturers' agent at 140 South Dearborn street, Chicago, Ill. Mr. Wright is specializing on labor-saving and pneumatic machinery, cranes, hoists and trolley systems.

Ryan Joins Detroit Lubricator Co.—James Ryan, who has had 12 years experience in the automobile and carbureter business as engineer and demonstrator, and who during the last 3 years was representative in Indianapolis, Ind., for the Rayfield carbureters, recently resigned to become associated with the Detroit Lubricator Co., Detroit, Mich., manufacturer of the Stewart carbureters.

Findlay Co. Elects—The Electrical Motor & Construction Co., Findlay, O., has voted to increase its capital stock from $15,000 to $30,000 and to construct at once an addition to its present location, a building 50 by 122 feet, two stories. Stock rooms and repair shops will be located in the second story. The new officers of the company are: F. E. Hurley, president; O. D. Donnell, vice-president and R. J. Berry secretary.

Tri-City Dealers Elect—At the annual meeting of the Tri-City Auto Dealers Assn., Rock Island, Ill., composed of dealers of Rock Island, Moline and Davenport, the following officers were elected for the ensuing year: President, G. F. Burmeister, Davenport, Iowa Auto and Tire Co.; vice-president, P. C. Peterson, Davenport, Peterson Auto Co.; secretary-treasurer, Ross Beede, Rock Island, Interstate Auto and Supply Co.

Clare Joins Chase Truck—W. A. Clare, formerly in the research department of the Burroughs Adding Machine Co. and later with the Service Recorder Co., in charge of motor transportation problems, has joined the ranks of the Chase Motor Truck Co., Syracuse, N. Y., and will have charge of the Dealers' Aid and Research Department, which was established by H. T. Boulden, who recently became general sales manager of the Chase company.

Garage and Dealers' Field

Baker Rim Makes N. Y. Lease—The Baker Rim Auto Supply Co. has leased space at 250 West Fifty-fourth street, New York City. The Regal Auto Painting Co. has also leased space in this building.

New Winton Detroit Quarters—A new sales room is to be erected on Woodward avenue, Detroit, Mich., between Medbury and Hendrie avenues for the Winton Motor Car Co. The new headquarters will consist of a two-story building, 71 by 212 feet.

Representing New Products—Clarence N. Peacock & Co., New York City, in addition to the Ames equalizing springs, has secured the distribution for the Standard Steel Spring Co., the S-M-H chain tool, the Clincher tire plow and the Boyce hand horn.

Apperson Pa. Quarters Established—W. Taylor, recently appointed wholesale distributor of the Apperson car in Eastern Pennsylvania, Southern New Jersey, Delaware and Maryland, has established his headquarters in the Abbott Bldg., Broad and Race streets, Philadelphia, Pa.

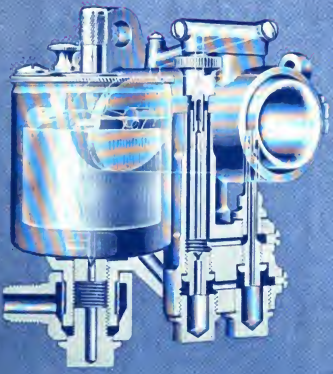
Frisco Fiat Agent Moves—Latham, Davis & Co., San Francisco, distributor of Fiat and Stutz cars, is now located in new quarters on upper Van Ness avenue. Hereafter this company will have J. P. Edwards as president, a new comer to the automobile trade of the Coast.

Larson's Permanent Broadway Branch—C. H. Larson, the Oldsmobile dealer in New York City, has arranged to have a permanent Broadway branch at 1800 Broadway, the store from which the Rauch & Lang electric cars are being moved to the combination electric car display store at Central Park West and Sixty-second street. Mr. Larson intends to move into the new branch about February 1.

Book on Lubrication—A new book on lubrication has been issued by the Platt & Washburn Refining Co., New York City. Beginning with a brief history of the discovery of oil and its various uses, the book gets down to specific information of interest to owners of automobiles, motorboats and motor trucks, with a list of "Lubrication Don'ts." The company found by comprehensive investigations that there are ten systems of lubrication employed in internal combustion engines. A detailed description of the ten systems follows, supplemented by charts in color.

The Horizontal Zenith

ZENITH
The Carburetor Universal



Attaching directly to the cylinder walls this horizontal type of the famous Zenith eliminates piping and further simplifies carburetor installation. Combine this with the extreme simplicity of the compound nozzle and the limit in precise carburetion has been reached.

SEND FOR THE NEW STORY, "THE COMPOUND NOZZLE EXPLAINED."

Zenith Carburetor Co., Detroit, Michigan, U.S.A.

THE SEASON'S SMARTEST COUPE

The latest Overland Coupe is artistically simple and smart.

The design is far from the commonplace or the conventional type generally offered.

The electric control buttons on the steering column is an advantage seldom found even on the highest priced cars.

The tires are large—35 inches x 4½ inches. Also they are non-skids all around.

Immediate deliveries.

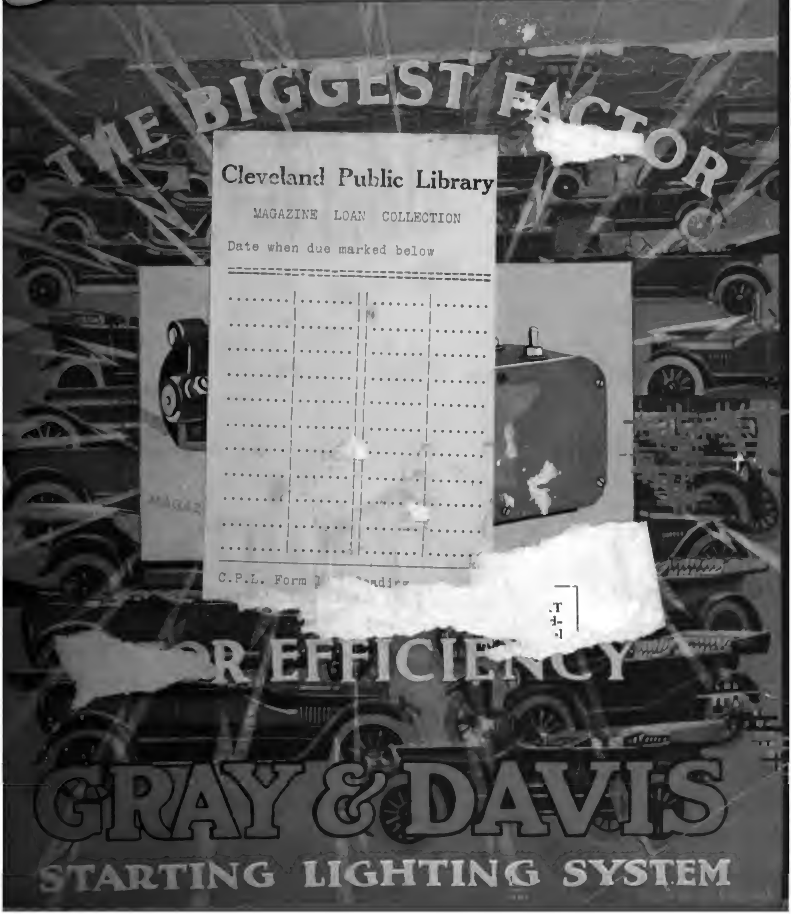
Catalogue on request. Please address Dept. 38

The Willys-Overland Co.
Toledo, Ohio

[illegible]

The AUTOMOBILE

MAGAZINE LOAN COLLECTION



Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form

Follow the White Foot Prints

The distinct superiority of Multibestos has been proved time and again, both by engineering tests and in the every-day service of thousands of car owners.

That it may be distinct in appearance as well as in quality, we mark it with "White Foot Prints."

Not only do the "White Foot Prints" protect the users of Multibestos, but they also afford a great convenience to the dealers who are handling it—for the marks are spaced exactly and can be used for measurement when cutting from stock to fill orders.

So we say to car owner and dealer alike:

Follow the white foot prints,
They lead to satisfaction in brake lining.

Standard Woven Fabric Company

FACTORY, FRAMINGHAM, MASSACHUSETTS

SALES BRANCHES

Boston—F. Shirley Boyd, 903 Boylston Street
Chicago—F. E. Sparks, 1430 Michigan Boulevard
Philadelphia—N. A. Petry Co., Inc., 1427 Vine Street
San Francisco—Fred Ward & Son, Inc., Corner First and Howard Streets

MULTIBESTOS REG.U.S.PAT.OFF. PAT.APPD.FOR
MULTIBESTOS
MULTIBESTOS
MULTIBESTOS REG.U.S.PAT.OFF.

Vol. XXXII New York—Thursday, February 4, 1915—Chicago No. 5

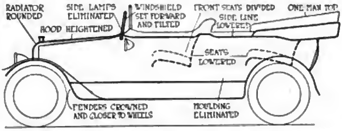
The AUTOMOBILE

Marked Improvement in Body Design

Tendencies Brought Out at New York and Chicago—Touring Cars Better—All-Weather Type Popular

By George J. Mercer

BODY designs for 1915 as exemplified by the cars on exhibition at the National shows in New York and Chicago, show a marked trend toward European practice as compared with the bodies of 1914. Touring bodies show the most radical changes, the side lines from the front of the hood being better; seats being lower and the rear ones narrower; windshields are set ahead of the rear line of the cowl' and tilted backwards; front seats are often divided, single doors being used for cars with the divided front seats with four offset doors for bodies with tonneau cowl; body top line continues from back to front without being broken by seat or trimming; bodies are without mouldings on sides or doors; tops are better than last year; disappearing extra seats; tires are carried at the rear and tank either at the rear or under the cowl. The dash lamp has been well-nigh eliminated, while the hoods are generally made wider at the rear to give better body lines in conformity with the rounded radiator and better-shaped mudguards now in use. An important development in all types of cars is the lower effect obtained by dropping the frame, using smaller tires, etc.



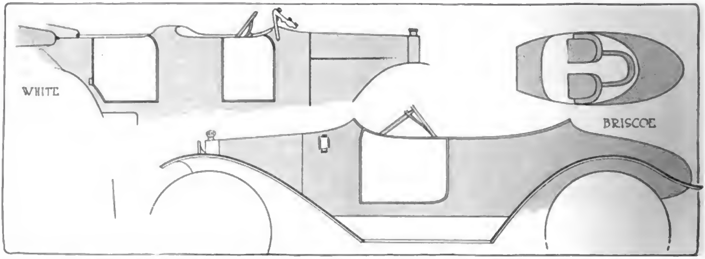
Body Tendencies—Heavy line denotes average car for 1915 while lighter one indicates 1914 body. Tinted portions show the difference between the two. Note better design throughout for 1915

Among the closed bodies the big tendency is toward the all-weather design, though there is also a tendency to push the lighter types, the increasing popularity of the sedan and the all-weather bodies and smaller town cars having resulted in the practical elimination of the berline. Limousine and limousine-landaulet remain stationary as seven-passenger bodies, although they are made more luxurious and comfortable than the types at the exhibitions a year ago.

Runabouts are comfortably built and similar to last year's designs, showing a tendency to use the rear compartment for carrying spare tires.

The electrics showed about the same number as exhibited last year. Rauch & Lang have a brougham similar to the private electric used in Europe and also showed a runabout that is like the conventional gasoline body. Waverley showed a four-passenger car with staggered seats and having oval glass in the rear corners, while the Detroit electric has a five-passenger body with revolving chairs. The Ohio showed a body with a rounded roof. All the upholstery effect is delicate, the glass space is large and the appearance of all the designs is airy and pleasing.

A striking feature of the shows this year was that they were primarily manufacturers' exhibitions, practically all the designs shown being factory-made products. Show jobs and special cars made up to attract attention were fewer than ever before. It speaks well for the exhibits as a whole that the standard product looked so well for exhibition purposes, despite the fact that in many cases the price has been reduced. From a general survey of the exhibits it is evident that the car-buying public is essentially conservative in its tastes, a similarity of effort being apparent in the output of the different makers, although there is a noticeable tendency to break through the thin skin of uniformity on all sides by the marked improvement in the finish of details and the obvious attempt to excel in



Upper left—White touring car, showing deep back of front seat for compartment. Note top line of body. Right—Briscoe full streamline roadster with diagram of seating arrangement

refinement. No healthier sign could be asked than this and there is still room for progress.

90 Per Cent. Consistent Streamline Types

Over 90 per cent. of the bodies on show were a consistent streamline from the radiator to the widest part of the body, although no touring body was true streamline at the rear. Several reasons exist to keep the present rear line of the touring body as it is, despite the advantages of stream lines in eliminating wind eddies that stir up the dust. One reason is the additional cost; another, and perhaps the best reason, is that the body looks more trim with the line used at present, than with any projecting rear that has been designed; also, the tank is placed at the rear on many cars, and the inlet must be left clear of body extensions for filling. Another reason is that the tires are uniformly placed at the rear and the present shape suits this arrangement. The time is coming when the tires at the rear will be inclosed and the streamline ending of the body will be the tire inclosure.

Non-wind-resisting principles can be applied to touring bodies as never before. Bodies are narrower, with room for two passengers on the rear seat as a rule; the side line of the body is a gradual slope from the radiator to the rear round corner; in many cases the windshield is placed at an angle so as to incline backward; the top edge of the body is rounded over, and without mouldings on the body or doors a true flush side is accomplished; running boards are clear and guards rounded over, coming well forward on the front wheel; the rear guards follow the contour of the wheel; dash lamps are left off many cars altogether and the back of the driving seat, instead of showing above the side line, is covered with a cowl that swells slightly toward the center, and the top line of the body shows an unbroken line from the cowl to the rear end of the car.

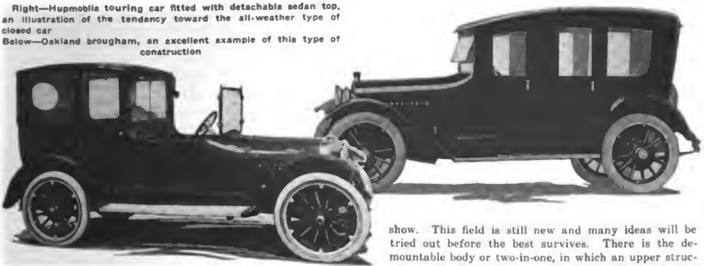
Trimming Below Body Line

The trimming hardly projects above the body line, several illustrations of this type of body being shown. The average perpendicular height of the body sides is 22 to 23 inches. The seat cushions are nearer the floor, the gasoline tank being placed either at the rear or under the cowl to permit of lower driving seats; one wide door each side and directly opposite is the rule and the driving seat is individual with an aisle for passage to the front from the door which opens directly to the rear seat. Extra seats are less comfortable, they are made lower and fold compactly either in a space provided or directly against the rear of the driving seat. These extra seats are never in evidence except when in use, the backs on some being made to telescope, so that they will fold compactly and yet be sufficiently high when in use. Robe rails and foot rails are found in most bodies and seat cushions are thick with only a moderate slope from back to front. Seat backs are thick and nearly every body exhibited has tufted trim-

Above—Mercer touring car, showing smooth lines, tilted windshield and rounded-over edges, clean running boards and crowned fenders

Right—Pathfinder touring car, illustrating tendencies in radiator and front-of-car construction

Right—Hupmobile touring car fitted with detachable sedan top, an illustration of the tendency toward the all-weather type of closed car
Below—Oakland brougham, an excellent example of this type of construction



ming. A few of the cheaper cars have imitation leather, but the majority use a good quality of pebble grain black leather, though a few use motor cloth. The National touring body has movable seats and the Cadillac has one revolving seat beside the driving seat.

One-Man Tops Used

The tops are another part of the touring body that show improvement. With not over two exceptions, all the bodies have one-man tops, sensible fasteners being the rule, while the gooseneck, or socket, is sometimes below the body top line and projects out through the panel. When the top is up it is fastened to the stud at the top of the windshield post and straps are seldom used. The top curtains are either stored in a receptacle in the top at the front or attached to the bows, so the curtains are always easy to get at. The Jeffery, among others, uses the Jiffy curtain and the Fischer body has the disappearing top as made by Vanden Plas.

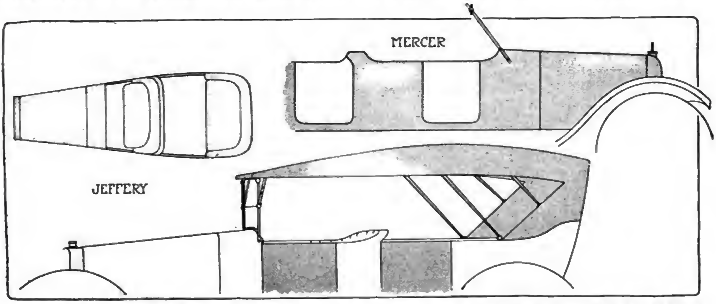
The All-Weather Car

In the closed car field, the trend in designing is toward the development of the all-weather car. The public wants something that is cheaper and lighter and more easy to operate than the landaulet, while the cheap landaulet is like a taxicab. The bodies that have been produced to supply this want show the only real originality in designing at the show. This field is still new and many ideas will be tried out before the best survives. There is the demountable body or two-in-one, in which an upper structure is added to the runabout or the touring body and thus converts it into a coupé or a limousine, Hupmobile, Kissel and Kline being examples of this. Pierce has a stock model on these lines, White has a cabriolet type, Reo has a collapsible type with new character and there are the usual number of coupelets. Springfield has the convertible design that has been marketed for some time past and in addition it has a permanent roof body that is new in design. Locomobile has a similar one made by Henley.

Permanent Roof Has Its Followers

The permanent-roof body has advantages that will meet the wants of a large part of the buying public. The roof is the same in appearance as the limousine roof, and, not being made to fold, it will always look clean and substantial and not creased like a folding top. The front windshield and the rear or back panel are permanent, and the intervening space between front and back can all be opened or closed in a few seconds. These sides are glass frames hinged to swing downward and inward inside the body and doors. The only work needed to put them from one position to the other is to revolve the frame on its hinges. Both these examples are the sedan type and the Springfield body is illustrated, the dotted lines showing the frames in position and the full lines the body opened out.

Sedans are found in increased numbers, being a popular type of body for the driver-owner, and the single doors on

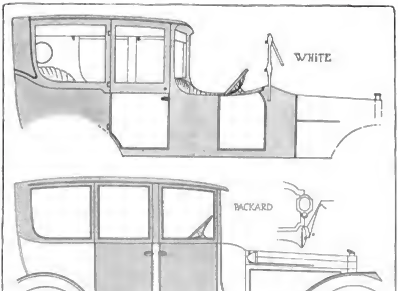


Jeffery touring car, showing body lines and blending of hood and cowl. Note one-man top, which type has been widely adopted during the past year. Upper right—Side view of Mercer, showing slanted windshield each side can always be placed so that they will be of generous width, even on a chassis with short wheelbase. The popularity of the sedan shows the want of compact, lightweight closed bodies and the sedan is taking the place of the berline. Not one of the latter was on exhibition. The town cars exhibited by White and Locomobile show how conservative is the trend in designing for the most exacting of car buyers. Town cars are only purchased by those who can afford to buy luxurious machines and both these designs, which are illustrated herewith, are as near to the horse brougham as it is possible to make them, particularly the Brewster body on the Locomobile. Even the fenders are like those on a brougham, and the whole appearance would easily take one back to the days before automobiles were thought of. Both these designs look as fitting for use on a car as on a horse-drawn vehicle. The Locomobile is more the real brougham type than the White as both are delicately trimmed and both will carry extra passengers inside. These cars are essentially two-passenger designs. The White body is provided with a windshield and a demountable roof to cover the driver, but the Locomobile body has no such provision, the driver's compartment being left entirely open.

There were not many limousine or landaulets shown. Those on exhibition were large and two had chauffeur lights, or windows beside the driving seat, something generally conceded to be going out of practice, two had arched doors and the roofs for the most part had slightly rounded edges. Not more than one or two had the extreme round to the upper rear corner that was common last year, the roofs had a moderate dip back and front; approximately the fronts averaged a drop of 3 to 4 inches and the rear 1 to 2 inches from a horizontal at the center of the crown of the roof. All the limousines and landaulets were seven-passenger bodies and in keeping with the general display seen at the shows last year.

Workmanship Is Good

The workmanship is good and the interior trimming designs show originality. The sedans, the town cars and the demountable or two-in-one bodies are the closed bodies that show the most improvement in design, the coupelets being practically the same as last year. The coupé on the Pierce is an attractive design, in which the seating arrangements for four passengers were cleverly worked out, the driving seat holding three by offsetting the driver's portion forward and opposite the rest of the seat at the front is a folding seat for one. It was a crowded space, but was nearer the arrangement provided in the electrics than any other gasoline car exhibited. The design was like the Pierce demountable last year. The improvements in touring body designing were the most noticeable because there were more of these bodies exhibited than any other.



Four types of closed car construction. Detail sketch of Packard shows mud splasher connection with frame, almost as continuation of mud guard. That of Cadillac illustrates use of rounded glass in front windows, which is a graceful and increasingly-popular construction in closed cars

Disappearing Extra Seats

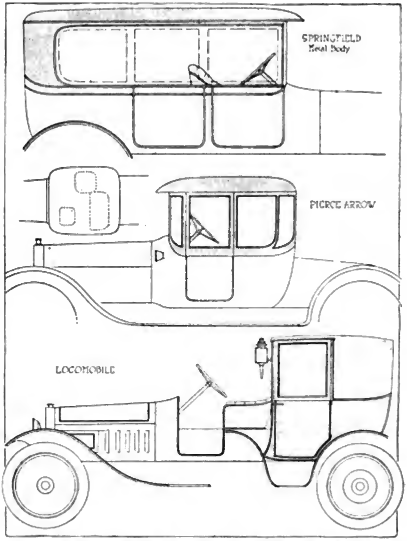
The extra seats in the closed bodies are about evenly divided between the newer disappearing variety and the old swinging seat, the tendency being, however, toward the disappearing kind. Front seats are made individual on account of the general custom of having a passageway between, but the rear seats are not made thus, as was the case on some of the foreign cars last year.

An Original Runabout Design

The runabouts shown are nearly all the conventional type that carry the line of the seat to the cowl, seating two or three. A compartment at the rear is generally used for spare tires, few providing for an extra seat, the Fiat being one of the few. The Mercer, Cole, Oakland and Chevrolet showed sporting runabouts and the Briscoe shows the most original design in the exhibition. This is illustrated herewith. Seating is for three and the middle passenger sits well back of the individual side seats, the rear of the body is egg-shaped and is the ideally streamline body of the shows. Many of the runabouts show a rear shape that is near streamline, but in many cases the effect is lost by the carrying of tires at the rear. The guards on the Briscoe runabout are different from those on any other car exhibited. The Chevrolet top, which is made by the combination of the windshield and the dust shield supporting a deck curtain that forms a roof, while not new in practice, is still a novelty.

Radiators Are Higher

The general trend in radiator design is toward great height and not towards increased width, the flat front surface being minimized by rounding the edges with the greatest curve at the filling cap. On many cars both radiators and hoods have been radically altered. While last year many of the bodies had unbroken lines from the radiator to the body width, this year the lines of the sides are made straighter, the hood has been made a little wider at the rear and many of the bodies are narrower, so that the side surfaces are graduated in more easy lines from the radiator to the widest part of the body. Heretofore one's conception of the rear seat of a touring body was that it was the most comfortable three-passenger seat on any body. Though this is still true of many designs, the narrower body, either six or four-passenger, is growing in favor. Two noticeable examples are the illustrations of the Jeffery and the Mercer. That of the Jeffery is a plan view and shows how the hood and body lines are made to blend to produce the modified streamline. On the Mercer this is more ideally carried out on the radiator and the tilt of the windshield to 55 degrees. Both these bodies have tonneau cowls and the top edge of the body is rounded over with no mouldings on the sides of the body or the doors. The White touring body is another example. This company has taken the crown off the hood. Touring bodies with clean, straight lines are too numerous to mention in detail. The rounding of the front edge of the radiator is also general, all styles from a 1- to a 6-inch radius being seen. The majority use the small radius, and it is astonishing how this will soften the appearance of the front of the car.



Two upper illustrations are of convertible types, the detail sketch showing seating arrangement of Pierce-Arrow. Lower shows brougham, which is strikingly similar in design to the horse-drawn brougham

Headlight Supports Stronger

The number that use the V-type radiator is approximately the same as last year. The Pathfinder uses this V in conjunction with a rounded top as do Oakland, Paige, Moline and Reo. The Reo has the top cap projecting forward like a hook. Regal places the filling plug on an L-pipe under the hood thus leaving the surface of the radiator clear, the Chalmers big six being another illustration of this.

Franklin is the only car using the Renault hood. This is an ideal hood to eliminate wind resistance, but in this case this advantage is neutralized by using a jutting-out dash.

The fronts of all cars show improvements, the supports of the headlights are more substantial, tie rods across between the lamps are used on all cars and in many instances, rods, or stays, are continued to the guard brace, thus reinforcing the lamp support and making the guards stiffer. One car has the lamps fastened direct to the guard brace with a rod between. With the exception of Pierce and Briscoe, the balance have the headlights fastened to the frame.

Many cars dispense with the dash lamps and make the headlights do double duty.

The blending of the hood line into the cowl is uniformly good on all touring and runabout bodies, and the method of fastening and designing the windshield is also good.

Blending-in the Windshield

On some of the body designs that are newest in design, the windshield is placed forward of the back edge of the cowl. The White and the Mercer are illustrations of this. The shield can be set at an angle and the plan view of the cowl shows a line that is elliptical, and the back edge of the cowl blends with the top line of the body in a curve. The effect from the side is to make the cowl look more like a logical continuation of the hood line. A number of illustrations are given, and on the Overland a lamp attachment is integral with the windshield foot. The windshields on these bodies are made to look a unit with the body, the supports and the frame surrounding the glass are lighter-looking than formerly and in nearly every case, made to swing in two sections, the lower half swinging inwardly for ventilating the body.

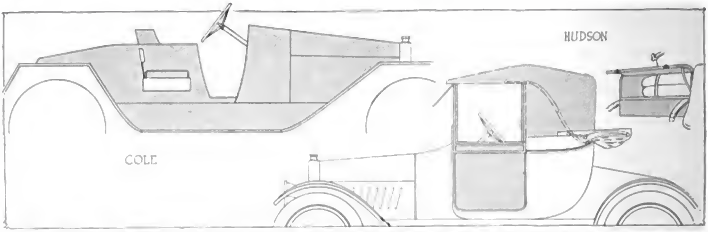
There was only one cowl with a ventilator on the top and there was not, to the writer's knowledge, a single ventilator on the side of the cowl. Pierce has the ventilator at the base of the shield, but this would only be the equivalent to the windshield that has the lower part swing inward.

Wire wheels show a slight increase, again being most noticeable on cars fitted with runabout bodies.

Running Boards and Shields

Running boards and running-board shields have received more attention this year, the majority of makers using linoleum-covered boards with metal binding. A few use the cast aluminum boards and some prefer pressed pyramid metal in place of linoleum. The latter is used on most of the cars for covering the floorboards in the driver's compartment. Flush-sided bodies extending wider than the frame have necessitated the more general use of the running-board shield, this generally extending a little beyond the body, the space between it and the chassis being utilized for tool compartments, as on the Overland. Every car on exhibition had a clean, unlittered running-board, and, with two or three exceptions, the extra tires were carried at the rear. The tire supports are part of the regular equipment and many of them are made to carry the weight of the tire by resting against the demountable rim instead of having the tire weight rest on the tread of the shoe. Most of the carriers have a locking device to prevent theft.

There have never been at any previous shows so many cars having well-designed and well-made mudguards. At least



Left—A roadster type which has been described as Cubist. Note the straight lines and the extra seat shown in white which slides into the body like a drawer. Right—Popular cabriolet construction. Detail sketch shows method of carrying spare tires in rear compartment

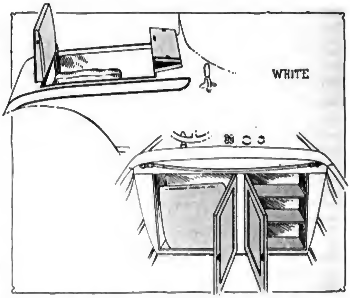
75 per cent. of the cars on exhibition have guards with crowned tops, the majority having the slight crown with a flat margin along the edges while a few have the true dome guard in which the skirt or flange is one with the top. The Pierce is a good example of this, the front guard coming well over the wheel at the forward end and inside wing of the guard looping down to entirely cover the front of the chassis frame where it joins with the mud-splasher. Packard cleverly combines the guard wing with the splasher, the side wings of the latter being very deep and covering the opening between the frame and the spring forward of the radiator. These two examples are illustrated herewith. Over half of the cars at the shows were equipped with splash guards.

Tail Light on Mudguard

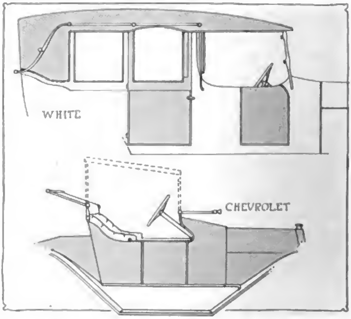
The location of the tail light on the rear guard is also more common, most of the guards encircle the wheel and the rear of the guard is lower than the frame so that tail lights can be placed on the guard and be the same height as when formerly placed on the frame, also the gasoline tank is more commonly placed at the rear and space is needed either beside or between the tires for filling. On several of the runabouts space is provided in the rear compartment to carry the extra tires. One illustration is given of the Hudson showing the tires in position. Pierce, Paige, Chalmers, Buick, Cole and others use this plan. On the Pierce coupé and the Dodge Bros. runabout the method of attaching the rear guard to the body is worth noticing; in place of the V-shaped pocket between the guard and the body, the inner wing of the guard is shorter than usual and attaches to the body on a line well up near the top line of the guard. The wing is concave, forming a gutter which will easily shed all deposit.

Tasteful Trimming Effects

The trimming material on the closed bodies showed more lavish display of color than the exterior of the bodies. On the town cars delicate shades of broadcloth are used and hardly any broadlace; on one town car the broadlace was replaced by a flat band of broadcloth and padded to look full. Pierce and Packard both showed closed bodies that were trimmed with material that was new in design. Packard had one body trimmed in a tapestry with green and brown markings and the curtains were brown. This was a sedan and the driving seat was trimmed with leather, while the back was of material to match the rest of the body. On this body the relish around the window openings on the outside of the body was painted a pale yellow. No broadlace was used on the body trimming, the doors had locks and all closed body doors had the double catch. Another Packard was trimmed with a green pin stripe velour or plush material and green silk curtains to match. One Pierce limousine had the seat backs and



Two details of the White. Upper—Folding extra seat in rear compartment of runabout. Below—Compartment for folding tonneau seat and cupboard in back of front seat on touring car



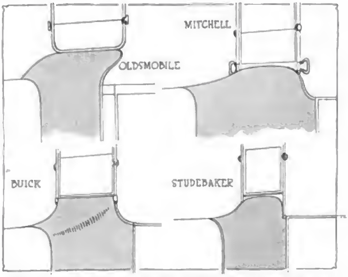
Upper is another illustration of the tendency toward all-weather cars. Lower shows novel roller top which works like a window shade sides trimmed with a gray mixed material below the waist line and above this the trimming was a green plush. The garnish rails also were covered with the same cloth. Most of the bodies had grab handles and the majority had pillar lamps and some had the lamp that hangs from the top. Pierce uses a system of semi-indirect lighting for its closed cars. The window glass was without exception of the frameless variety and regulators for lifting were used to some extent, but there seemed to be more bodies using the lift straps than there were last year. Lift straps this season are all made to slide in a slot in the trimming and do not hang loose as formerly. The interior of the bodies are equipped with reading and dome lights and corded hat slings. Small arm rests are the rule on the rear seat, but they are the soft variety and do not stand out beyond the trimming over 1 1-2 inches. Arm holders are used on a few designs, cord robe hangers are used and foot rests or pillows are in all bodies. Cadillac was one of those having wood trim along the top line of the trimming.

Mahogany Interior Finish

Wood used for the interior finish was uniformly mahogany and the metal finish was nickel or silver. Toilet cases were not to be seen, probably on account of the danger of theft, but it seems to be the tendency to use the built-in toilet case in place of the older style. Many of the closed bodies had round corners to the window openings and many of the rear windows were smaller than they were last year. Oval-shaped rear windows are used more than last year.

Dark Colors the Rule

Painting of the cars is uniform both in color and quality, the dark colors being used almost altogether, although there were a few grays, one coupé was painted yellow and red, there was one yellow and black touring body and one black and white car. Packard had a green and black sedan and Pierce had one touring body, gray and black, and one in two shades of brown. There was also one cream and black touring body on a Winton, one touring body was trimmed with art finished leather and there was the Cole runabout and one other with red leather. Blue and black are the prevailing colors and the finish is good throughout, the guards and hoods showing a particularly heavy bodied finish. Windshield metal parts and lamps were for the most part black and there was far more nickel than brass finish used.

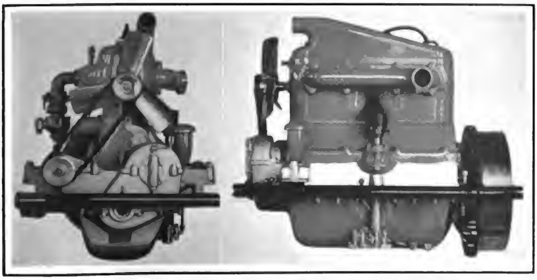


Four types of cowl, illustrating various methods of mounting windshields

America's Smallest Knight—The New Moline

THE illustration herewith shows the new Moline-Knight motor, which is of interest because it is the smallest Knight engine which has so far appeared in America. In general design the new motor is almost identical with the larger Moline-Knight motor but has a bore of 3.5 and a stroke of 5 inches. It is a block-casting, a clean exterior appearance and the only way that the new engine can be distinguished from its older prototype is in the novel way in which the ignition wires are carried up through the cylinder head between the two central cylinders. The only exposed wiring with this scheme is in the ignition connections, where the short leads go to the spark plugs.

Ignition is supplied by the Connecticut battery system and the balance of the electrical equipment to be used in connection with this motor on the new small Moline-Knight car is made up of a two-unit starting and lighting system. Lubrication is by force feed through the hollow crankshaft by means of a gear-driven pump, as in usual practice. Cooling is by thermosyphon and another external change in the motor is in the alteration of the exhaust manifold to give a more direct flow for the gas and hence tend to reduce any possible back pressure in the exhaust line. The car in which this motor will be placed has a wheelbase of 118 inches. The power is transmitted to a leather-faced cone with cork inserts and the gearbox is a selective sliding three-speed design located amidship and having double-universal joint connections between the engine and transmission.



Left—Front view of new Moline-Knight motor. Right—Left side, showing clean design

War Trucks Arrive in France

220 Quickly Put Into Condition for Service at the Front—Each Truck Goes Through 25-mile Test—Some Damage on Rough Ocean Voyage

By W. F. Bradley

Special Representative of THE AUTOMOBILE with the Allied Armies in France

LE HAVRE, Jan. 1—Two hundred and twenty automobile trucks, 1 day's supply of wheat for the French army of 4,000,000 men, miles of barbed wire, scores of machine tools, and tons of horseshoes and shoe nails, forming America's contribution to the armies of Europe, have been brought together under one roof. The 220 automobile trucks, brought over on one steamer, represented a portion of that order for 2,540 placed by Lieutenant Lumet, the representative of the French army, with the White, Pierce, Packard, Kelly-Springfield and Jeffery companies.

Quick Action the Rule

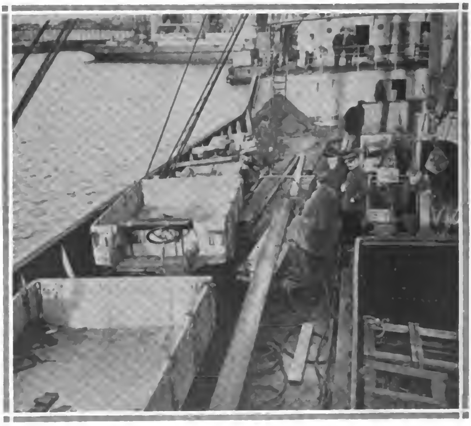
These automobiles are coming into port with regularity. Without a moment's delay they are unshipped, unboxed, filled with gasoline, oil and water, tested, and sent off to the scene of military operations. The sight in itself is interesting. As the cases are slung out of the hold they are placed on a lighter, lowered on the dock side a few yards away, and immediately attacked by gangs of French soldiers. The work is done in the open, by the side of a busy road down which natives, fresh English troops and train loads of French and Belgian wounded pass in an almost endless procession.

One gang of soldiers takes off the top and the sides of the case, another set puts on the wheels, more fill up with gasoline and water, others armed with crowbars separate the planks forming the case and load them on the truck. There is labor in abundance, for military labor is cheap in France; there appears to be a superfluity of men, but the work goes on with rapidity and every hour a group of trucks is moved away under its own power to a big military garage in town.

Each of the firms having supplied trucks has sent experts to France in order to examine the machines before handing them over to the military and to give the necessary instructons to drivers. At the time of my visit to Havre the men present were L. G. Williams and E. Selman for the Pierce Company, John L. Greene and Fred D'LaBarre for Packard; W. H. Morgan, E. W. Bassett and E. M. Shields, and two Englishmen, for the White Company, and two representatives of the Kelly-Springfield Company. No Jeffery trucks were being received, although some were at work in town, and no representative of the company was present.

Twenty Trucks Wrecked

The task of the American engineers has been considerably increased by the fact that some of the trucks were carried on deck during a very rough passage. One steamer, which came in while I was at Havre, carried 220 trucks, all of them boxed, and forty of them fastened on deck. Of these forty there were twenty which could only be sent to the junk heap. The boxes had entirely disappeared, having been burst in by the heavy seas and the wood carried overboard. Having no protection, and merely held down by the ropes which had originally passed over the boxes, the trucks whipped backwards and forwards across the deck until frames were broken, wheels and axles carried away, fenders reduced to crumpled iron, and steering wheels represented by two or three spokes. Somebody is to blame for having shipped automobiles as deck cargo in mid-winter. Even the trucks carried in the hold suffered slight damage by reason of the cargo shifting. Packard had several cases of broken steering wheels owing to



Scene on board one of the transports on arrival at Havre. Note that all the trucks were completely boxed when they left New York an upper truck breaking through a lower one. The reels of barbed wire placed on top of the cases were also responsible for some of the damage. White appears to have suffered most severely, but this may be attributed to the fact that these machines were in a majority on the deck. Pierce trucks were the least damaged, there being but one out of 166 which needed any attention. This firm used 1 inch planking for its boxes, while some others considered half-inch boards sufficient. These latter were liable to break through under the weight of the truck.

Water Causes Damage

Even when no damage was done, a lot of annoyance was caused by water getting into magnetos and carbureters. In a shack by the side of the docks a dozen American engineers dissected sodden magnetos, hung armatures to dry over a stove, patiently got the rust out of distributers and bearings, and removed the brine from carbureter jets. To protect against rust most of the cylinders had been filled with oil. This added to the starting difficulties, some of the vehicles having to be towed before the motor would respond. Notwithstanding these difficulties, there was practically no delay, the trucks being got away from the dock side as fast as they could be unloaded from the steamer.

25-Mile Trial Trip

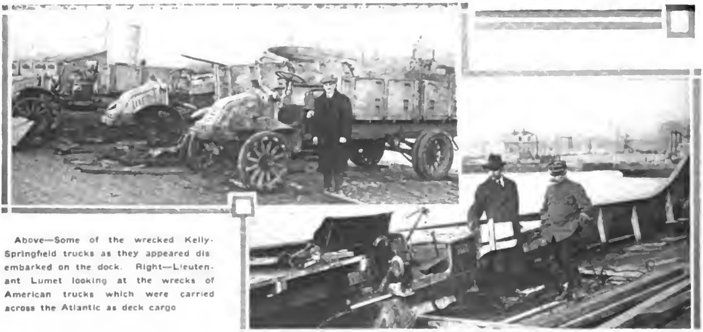
Two big depots have been established in Havre for the reception of the trucks. They are only kept here a few hours, for every day a convoy of about twenty is sent out for a 25-mile road test. The factory representatives go with these convoys, give all necessary attention to the machines and a certain amount of instruction to the drivers. Instead of coming back to the depot the trucks enter an important fort and from then on are entirely military property. The work of the factory representative ends with this trial trip. From the fort at Havre the vehicles are sent in important convoys to Versailes or Montlucon, from which towns they are drawn upon by the forces in the field.

Ignorant Drivers

There is very little time to instruct the military drivers in the handling of the trucks, and unfortunately in many cases this instruction is badly needed. In France no person is allowed to take charge of an automobile until he has passed a practical government test, and in asking for volunteer drivers for the automobile section the army appears to consider that the possession of the official driving license is proof of ability. As a matter of fact this is not so; many men appear to have struggled through a superficial examination and in the intervening period to have forgotten the little they ever knew about automobiles. There are cases of men who had not learned to use any other than first and second gears; who never declutched, but stopped by using the brakes and stalling the motor; who did not know that water had to be put in the radiator; who as a preliminary to starting flooded the cylinders with gasoline until it ran out of the exhaust pipe. By the side of these were men who were first class in every respect and who could be relied on to get the very best service out of the trucks. Good drivers are not lacking in France, and the easier life at the steering wheel, compared with that in the trenches is sufficient to bring them forth. But the army has made the mistake of taking all who offer themselves. It thus happens that a gardener who once went round the block on an old single-cylinder machine is put in charge of a first-class truck while a skilled mechanic is wasting his talents as an infantryman. To overcome, in a certain measure, these adverse conditions, the Paris branch of the Packard company is making arrangements for the transfer of all its former drivers from the line regiments to the new Packard trucks.

Upper—French soldiers interested in a Kelly-Springfield being prepared for them. Middle—A Pierce unpacked, stocked with gasoline, water and oil, ready for service with the French army. Lower—Messrs. Greene and D'LaBarre preparing a Packard for waiting French soldiers

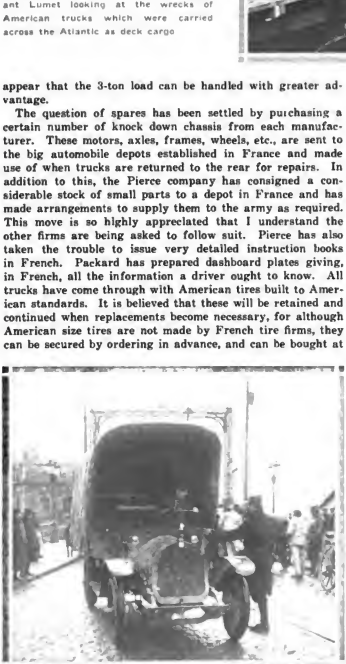
All French purchases have been for 2- and 3-ton models. Orders for 4- and 5-ton trucks have been placed with American manufacturers, but these have come from the English army authorities. There appears to be a divergence of opinion as to the value of the two types. The French, who really ought to know conditions in their own country better than anybody else, some time ago decided that a 3-ton load was the maximum that ought to be carried. The English are bringing over 4- and 5-ton types for work under the same conditions. As the roads behind the line of troops have seriously deteriorated during this winter campaign, it would



Above—Some of the wrecked Kelly-Springfield trucks as they appeared disembarked on the dock. Right—Lieutenant Lumet looking at the wrecks of American trucks which were carried across the Atlantic as deck cargo

appear that the 3-ton load can be handled with greater advantage.

The question of spares has been settled by purchasing a certain number of knock down chassis from each manufacturer. These motors, axles, frames, wheels, etc., are sent to the big automobile depots established in France and made use of when trucks are returned to the rear for repairs. In addition to this, the Pierce company has consigned a considerable stock of small parts to a depot in France and has made arrangements to supply them to the army as required. This move is so highly appreciated that I understand the other firms are being asked to follow suit. Pierce has also taken the trouble to issue very detailed instruction books in French. Packard has prepared dashboard plates giving, in French, all the information a driver ought to know. All trucks have come through with American tires built to American standards. It is believed that these will be retained and continued when replacements become necessary, for although American size tires are not made by French tire firms, they can be secured by ordering in advance, and can be bought at any time from the French factory of the Goodrich company.



A Jeffery truck being driven by French soldiers

The stories of American junk sold to the French army are ridiculed in France. Lieutenant Lumet, who was sent to America as the representative of the French army, confined his dealings to Packard, Pierce, White, Kelly-Springfield, and Jeffery. An attempt was made to get him to deal through an intermediary, but the French envoy refused to be tied in any way. He personally visited the factories and only purchased what he knew to be reliable goods. The French were fortunate in their choice of a representative, for in civil life Lieutenant Lumet is head of the technical committee and laboratory of the Automobile Club of France, and is one of the few experts not tinged in any way with trade connections. It is a known fact that some of the purchases made by the Allies were carried out by intermediaries having no technical knowledge, but with a high financial interest in the transaction. France is satisfied that she has got honest goods at an honest price and has made good business connections.

Of the 2,540 trucks ordered by the French army more than half have now been delivered. Owing to congestion there was a little delay in handling the first consignments at the docks, but this has now been overcome, and as fast as steamers arrive they are unloaded and the trucks sent away. In many cases an hour does not elapse between the placing of the boxed truck on the dock side and its departure for the army depot. At this rate of progress the first order should be completed by the end of January. Before the end of the year one of the central depots had 300 American trucks in readiness to go to the front at a moment's notice. Before these lines get into print it is certain that several hundreds of the trucks will be within sound of the big guns.

Taking Forty American Trucks to the Front

FORTY American trucks, eastward bound, passed through the gates of Paris without attracting the least attention. They were driven by French army chauffeurs, they carried a few French soldiers, they were accompanied by a couple of French touring cars with sub-officers aboard. But the public is not sufficiently initiated to distinguish between French and American trucks; a French soldier is too common a sight to cause the eyes to be raised; indeed, it is the healthy-looking man in civilian dress who attracts unfavorable attention these days. Thus the convoy passed out of Paris, bound for the firing line, with even less attention being paid to it than to the string of market carts coming in at that particular moment. The drivers of those carts had to comply with civilian regulations, and there was the town tax to be collected, for war does not lessen the activity of the tax collector.

Those forty American automobiles were divided into two convoys. In the lead were twenty Pierces and a mile in the rear were twenty Packards, all 2-ton models. A month before those machines were respectively in Buffalo and Detroit. Ten days before they had been swung out of the hold of a steamer at Havre, they had received their last finishing touches at the hands of American engineers, and had then been sent by road to an important automobile depot outside Paris, where they formed part of a fleet of 6,000 automobiles of every known make and type, ready to be moved to the front in accordance with orders from headquarters. This reserve depot is not the only one maintained by the Allies in France. In the center is another important station where an equally large number of automobiles is maintained for such calls as the headquarters staff thinks it necessary to send out. We are all in ignorance of the general plan, and it would serve us little to know it. But this much can be perceived—that at a certain critical moment the general staff may decide to rush some momentarily weak point, and when that moment arrives it will be necessary to move the men up quicker than they can be transported by train. This is one of the few romances of war, that troops who are 30, 40, 50 or 60 miles away can in a few hours be carried forward and flung into the battle line before the enemy has had time to realize their existence. This happened in the rout of the Germans crowding on Paris—and it may happen again.

The two convoys in which we are interested were engaged in no such dashing scheme. They had laid in the reserve depot 3 days when the order came to move them up to the gare regulatrice—the railroad distributing depot—occupied by the 5th army corps. At 7 a. m. the next morning they moved away to a signal given by whistle.

Never, until I joined this convoy, did I realize the importance of good drivers for automobile trucks. In reality there were two convoys, for the twenty Pierces and the twenty Packards were in the hands of different officers, having identical orders and instructions to keep in touch with one another. The Packards went away first, although the order should have been inverted, for it was soon evident that the Pierces were governed for a higher speed. However, matters soon righted themselves outside Paris, when the Packards were drawn up to wait for a straggler and the Pierces went ahead. After 3 hours' running with the convoy of Pierces, the truth was impressed that there is nothing more monotonous than traveling with a well regulated convoy. A maréchal des logis, a meek, unmilitary type of man with little initiative, rode on the first truck and let things take their course. The driver of the leading truck was a professional chauffeur who had, up to a week before, been at the wheel of an armored car. He understood automobiles, he had a mechanical instinct which put him at ease with a make of machine he had only known for a few hours, and his knowledge of the country was sufficient to remove all hesitancy at cross roads. Thus the officer buried himself in his greatcoat, or awoke to smoke a cigarette, and occasionally to look back at the line of trucks trailing over the sand-colored road. If there were any inexperienced drivers in the convoy, they knew enough not to make themselves conspicuous. Each man kept his position in the column, maintaining his regulation pace of 30 yards from the truck ahead, and when occasional stops were made at the entrance to important villages, it was to discover that there were no stragglers, and that there were no interpositions in the numbers 1 to 20 carried on the tailboard of each truck. At each of these stops the touring car bringing up the rear would run to the head of the column, report to the officer and receive instructions from him, and 5 minutes later the column would be on the move again. A railroad train never moved with greater regularity, and during the 2 days I spent with them I never saw a driver in this convoy open his tool box or do any other work on the truck than the removal of the floorboards to give him the benefit of the heat of the motor.

The second column, to which I dropped back in quest of more incidents, was in charge of a young, energetic maréchal

Left — Column of Packard trucks lined up in a village back of the firing line

Right — Some of the Pierce war supply trucks on the road in France

A supply column of Pierce trucks in the service of the French army

des logis, who had not been long in discovering that he had been given a difficult task. Five of his twenty drivers were green hands, and those five men were capable of disorganizing the entire convoy. Even on a straight, easy, road the difference between the two convoys was apparent. On hills men clung to top gear much longer than was necessary; when when they tried to change down they fouled their gears, came to a stop, allowing the truck behind to close up to such an extent that there was danger of a collision. The order in which they were numbered was not long maintained. The good drivers got in the front, the first half dozen vehicles came along with some regularity, while the others followed at varying intervals, and one man was nearly always an hour behind the leader.

During the afternoon, when traveling over the hilly country between Meaux and Lizy-sur-Ourcq, where one of the fiercest phases of the Battle of the Marne was fought, the driver of a Packard used his brakes in such a way that he bogged his truck in one of the ditches used last September by the Germans in their retreating fight over this country.

It was almost dusk when this incident occurred. Experienced men might have had the truck out in half an hour, but the green hands labored with pick, shovel, and rope for a couple of hours before the Packard was back on the road. It was then dark; only side lamps were fitted and not a man in the convoy knew the road. The next trouble was on a winding down grade, when a driver charged a tree in endeavoring to get round a bend. His radiator was damaged, but by frequent stoppages for water he was able to keep going. Before midnight the inexperienced men were physically exhausted; the more competent drivers were suffering from nerves, and the blunt expressions of opinion which were passed from man to man did not tend towards harmony. It was not until 1 a. m. that the convoy ran into the gendarmerie courtyard indicated as the stopping place for the night. But the last few yards brought another accident. One of the men, worn out and nervous with the work he was little accustomed to perform, missed the entrance to the yard and took his truck on a bee line for a low bank. The Packard mounted it, but in doing so smashed its crankchamber. The men were dismissed at something after 1 a. m.; the convoy of Pierces, which had left Paris at the same time, had reported in at 6 o'clock, and the men had all been off duty at 6.30 p. m.

Men, Not Trucks, at Fault

Next morning the Pierce convoy was ready to move off at 8 o'clock, every unit being in perfect shape. The second convoy had one truck which must be towed and a second which needed frequent applications of putty and water to its radiator. Thus, in the first column the men were enthusiastic on the subject of American trucks. In the second, while they had sufficient sense to recognize that the men and not the trucks were at fault, there was no superfluous enthusiasm on any subject.

The fault was that men had been selected without sufficient inquiries as to their ability to handle a truck, the government driving license being considered sufficient guarantee. One man admitted that he had never previously driven anything but a motorcycle. Another, evidently the son of a wealthy family, had had just sufficient driving experience on one of his father's cars to get the government ticket. The lurid remarks of a professional Paris chauffeur who was obliged to drive behind the young man of wealth would be interesting reading, if they could be translated.

Trucks Climb Hill Well

The Pierces moved ahead and were not seen again until night. Despite the truck in tow and the vehicle with the leaky radiator, the second convoy moved forward much better than on the previous day; the men were shaking down to their work. Nevertheless, the maréchal des logis was kept busy running up and down the line in his endeavor to prevent some of the stragglers dropping off altogether. As the man at the head of the column was unacquainted with the country, I offered to act as pilot into and through the town of Chateau-Thierry. There are two roads out of this pillaged and bombarded riverside town, one of them comparatively easy, the other very difficult to climb. In order to have the opportunity of seeing what the trucks and drivers could do under really severe conditions, I took the difficult road, and, getting into low gear, watched the convoy climb the greasy hill side. Nothing happened; at the sight of the hill and the thick mud all the men got into low gear and the hill was climbed with more regularity than any previous portion of the road had been covered.

Our journey ended at Fismes, where there is a railroad station from which these trucks have to deliver food and ammunition to the troops billeted in the villages and farms around, and in the firing line a few miles to the north. In this stage of the war the work is of a very regular nature, adhering closely to a prepared schedule. The movement of the troops is measured in inches and yards, thus day after day these American trucks going out from the station to the bivouacs, or to designated points immediately behind the trenches, with as much regularity as they might undertake a delivery service at home.

Before they were put into this service there were some staff changes. The men who had shown their incompetence on the initial run were removed from the steering wheel and replaced by others of proved ability. Whereas on our run to the front there had been but one touring car for twenty trucks, there were two for each convoy—one ahead and one

Line of Packard trucks in French army with touring car which convoys them astern—for all the work along the front. The mistakes which only entailed a delay on the run from Paris would certainly be followed by death or capture when working near the firing line. Further, at least two men were carried on each truck, and both were armed, for although it is not the business of the supply columns to fight, the men have to be prepared to resist an attack.

The district in which these two American columns are now working was the scene of one of the most bitter phases of the Battle of the Aisne. At that time the lines here were held by the English, who drove the enemy back, step by step until they got them over the rivers Vesle and Aisne, and into the heights above the Aisne, where they have been strongly entrenched for some time. Much of the work has to be done away from the main highways, the surfaces being equivalent to those of the average country road in Indiana or Ohio at this period of the year. At places, where shells have fallen, or traffic has been particularly heavy, it is necessary to go further west to get the equivalent of the roads over which the columns are working. The difficulties are increased, too, by the fact that there is more traffic than on similarly surfaced roads at home. Despite efforts to keep traffic as much as possible moving in one direction, there must be a certain amount of passing. The congestion in these small railroad stations, of no importance until war broke out, is difficult to describe. It is like a busy approach to the New Jersey ferry, with the space reduced one half, all the civilians removed, and automobiles representing 90 per cent. of the traffic.

Noises of War Many—Signs Few

As to the direct signs of war, there are few. There are more sounds than signs. The boom of the heavy artillery, the sharp crack of the French 75 mm. guns, the hiss and plop of shells maintain an unending concert, but nobody but a newcomer pays any attention to them. It is so impersonal, there is so little to see—men may remain within sound of the guns for weeks without seeing a battery in action—that until a shell drops in the immediate neighborhood the truck drivers look upon their business as the real thing and the fighting something distant and intangible which does not directly concern them in any way.

These forty American trucks I was able to follow to the front represent but a small company of the American automobiles now serving with the Allies. The present time is one of repairs and preparation, and the arrival of foreign machines in big quantities is making it possible to overhaul, and replace when necessary, the French trucks having been on duty since the outbreak of hostilities.

Recent Court Decisions—Driver Loses

By George F. Kaiser

ALABAMA court refuses to let woman driver recover damages for injuries from a motorist.

In a recent Alabama case a woman started an action for damages for injuries, alleging that a motorist was negligent in failing to stop his car when her horse became frightened. The horse upset the buggy in a ditch and the woman was thrown out and injured.

The court said that the common law rules requiring reasonable care on the part of automobiles to avoid injuring others made them liable only for negligence, because they had the right to use the highway in common with other vehicles and further, that the rule is, and always has been, that while a person may travel on a highway with a conveyance, or a loaded vehicle which is liable to frighten horses, he must, while doing so, exercise reasonable care to avoid accidents and injury to others traveling on the highway.—*McCray vs. Sharpe*, 66 *South* (*Alabama*) 441.

Discount and Commission

In a late Georgia case the court held that a contract, in order to provide for a discount and a commission, must be clear in its provisions referring to them.

The court said that when a contract is too vague and indefinite as to the relation established between the parties, and it is impossible to determine whether a contract is one of agency or purchase, both a discount on the price of cars purchased and a commission on the selling price being claimed, the discount and the commission are so inconsistent as to be incapable of enforcement, unless it is alleged that there is a discount and a commission in addition thereto.—*Jones vs. Americus Automobile Co.*, 83 *S. E.* (*Georgia*) 642.

Conditional Sale Held Valid

In a recent Missouri case a conditional sale was attacked but was held to be valid by the court.

A manufacturer had sold an underground gasoline tank on conditional sale. No part of the purchase price had been paid. The party buying the tank subsequently resold it to another party who purchased it in good faith. The resale was in violation of the conditional sale contract and the manufacturer brought an action of replevin to recover back the tank.

The Missouri statute required that conditional sales contracts be acknowledged and filed like chattel mortgages.

The court decided that when the statute governing conditional sales refers to the statutes on chattel mortgages, and the latter are modified, the former are also modified by implication. Filing in the office of the recorder of deeds by the manufacturer was, therefore, held to be sufficient notice to the person who took the property on the resale. The manufacturer was allowed to have its property back.—*Company vs. Garwitz*, 170 *S. W.* (*Missouri*) 927.

Motorist Responsible

A motorist has no right to assume that a pedestrian who is walking in a place secure from danger when first seen will continue to exercise ordinary care not only in crossing a street but in continuing on his way.

A pedestrian sued a motorist to recover damages for being run down and injured by the former's automobile. It was decided that the motorist had no right to assume, as he turned down the state highway, that the pedestrian would continue in the direction he was going, unless he gave reasonable notice of his intention of going in another direction. The pedestrian was therefore allowed a judgment against the motorist.—*Lane vs. Sergeant*, 217 *Federal*, 237.

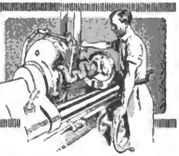
Conviction Not Proper

In a criminal action the state must show that the road where a motorist exceeded the speed limit was a "public highway."

A motorist was arrested and convicted for operating his motor car on a public road at a greater speed than 18 miles an hour. He appealed from the conviction on the ground that it had not been proved that the road upon which the automobile was running was a public highway.

The court thereupon held that his conviction was improper and must be reversed.—*Allen vs. State*, 169 *S. W.* (*Texas*) 1151.

The Rostrum



Braking with Safety

EDITOR THE AUTOMOBILE:—Putting the brakes on a car running at a speed in excess of 20 miles an hour on a slippery, hard surface, such as asphalt, is a proposition that is accompanied by so much risk that it should be dealt with effectively. While traveling down an important avenue during the last rainstorm a horse vehicle suddenly attempted to cross in front of my car. I instinctively put on the brake as hard as I could and locked the rear wheels. The result is that I transformed my car into a virtual sled and crashed sideways into the sidewalk, breaking my rear right wheel. This set my mind to work and as a result I have evolved a sand box arrangement by means of which an extra hard pressure on the foot brake trips a small trigger and releases a flow of sand in front of the rear wheels. This can be set in damp weather and the feeling of security it gives in traveling on wet pavement is remarkable.

New York City. F. K. B.

Communications

¶ *The editor of the Rostrum is anxious to secure from car users and others communications dealing with the overcoming of difficulties, in making repairs and in the numberless other phases of every-day automobiling. This department is mutual and is a common ground upon which an interchange of ideas and opinions can be made as freely as in the clubroom.*

¶ *The ingenuity of the motorist who has his own garage and enjoys working upon his car is originally responsible for many of the improvements made by manufacturers. In fact, it is known that every maker is more than anxious to learn the opinions of the users of cars and is more than anxious to benefit from the experience gained by the mass of automobilists.*

Advantages of Various Cylinder Shapes

EDITOR THE AUTOMOBILE:—Would you kindly explain the superiority and relative power of the T-head, L-head and I-head motors?

Asbury Park, N. J. H. A. STEINER.

—The advantages of T-, L- and I-head motors have been discussed at considerable length and no definite answer that has satisfied all automobile engineers has been arrived at. This is evidenced by the fact that there is a large percentage of devotees to each type. The advantages claimed for the T-head are principally in the ability to use large valves without getting too great an overall length to the motor. The valves, instead of being in one long straight line, are in two lines on each side of the cylinder. The advantage claimed for the L-head is that it needs but one camshaft, also that the number of parts in driving the valves is correspondingly cut down and a clean exterior can readily be secured with a more accessible arrangement of the auxiliaries. The advantage claimed for the I-head motor is that the combustion space can be more nearly hemispherical and hence approach what would be theoretically ideal for the elimination of heat losses through exposed surface. These sum up the principal advantages claimed for each type of cylinder, although there are many other constructional and detail questions which are also urged but which really are more a matter of individual design than of fundamental principle.

Using Crankcase Oil for Gearbox

Editor THE AUTOMOBILE:—1—Are the so-called anti-rust preparations injurious to the cooling system?

2—Would a reviver of enamel brighten up my fenders or would you advise varnish?

3—Where can I get the 1915 Blue Book for New York State? Has it been revised so as to give roads that were completed last fall?

4—I have found that the higher test gasoline I use, the more power I get and the hotter my engine gets. Will I injure my motor by using a mixture of motor and illuminating gasoline if the water circulates freely and does not boil? The dealer tells me his motor gas tests 64 and the illuminating gas 72-76 and sometimes more.

5—I have a 1913 model 25 Buick and the instructions are to use gas engine oil in the transmission. I change the oil in the crankcase about every 500 or 600 miles. Would the oil I take out be all right to use in the transmission or would it wear the gears? I use it on harvesting and sawing machinery and gas engines and it seems to lubricate.

6—Would straining it purify it or would it need to be filtered or are the lubricating properties gone?

Lebanon, N. Y. W. J. FISK.

—1—We have had no reports of where any of the preparations which are on the market that are sold especially for automobile radiators have done any harm. There are occasions, however, where boiler compounds have been used which contain corrosive substances that have acted injuriously on the radiator and water connections. For this reason before using any preparation it should be known that it is intended particularly for radiators and nothing else.

2—Varnish would probably brighten up your fenders satisfactorily. Before applying the varnish it is necessary to be particularly sure that the surface is clean and bright. The varnish then used should be the best grade of finishing varnish.

3—The Blue Books for 1915 will be published in April. They will be revised to contain all the roads finished up to the time of going to press.

4—As long as the cooling water does not boil it is certain that the motor is operating within the safe range of temperature.

5—It is a good idea to use the oil from the crankcase in the gearbox. After use for considerable time in the motor the oil takes on a gummy consistency which renders it unfit for good motor lubrication but good for use in lubricating the gears in the gearbox on account of its tendency to adhere to the gear teeth.

6—It is better to strain it for use in the gearbox.

Inquiries

¶ *The purpose of the Rostrum department is primarily to aid in the solving of motorists' problems. Readers of* THE AUTOMOBILE *are requested to allow our editorial staff aid in the solution of difficulties as they arise and perhaps through this assistance reduce the cost of upkeep of their cars and gain a useful knowledge in the economical phases of the vehicles which they use for recreation or business.*

¶ *Answers are made both through the mails and through these columns, the only requirements being that the letters are legibly written on one side of the paper, and are accompanied by the name and address of the sender in order that they may be taken care of through the mails should that be deemed advisable. A nom de plume will be used should the sender so desire.*

Principles of the High-Tension Magneto

Editor THE AUTOMOBILE:—Will you kindly explain through the Rostrum the principles upon which a high-tension magneto is constructed? I would also like to know how this differs from a low-tension magneto with which a high tension spark plug is used and also how it differs from a magneto which is used in connection with a low tension make and break system such as is commonly employed for motor boats?

New York City. M. F. B.

—The principles employed in the high-tension magneto in which a high-tension current is given by the instrument itself and the low-tension magneto in which a high-tension current is secured by an external coil, are not fundamentally different. Speaking in an elementary manner, the only difference between the two is that the high-tension instrument contains the coil within itself, while the low-tension instrument used in connection with high-tension ignition has an external coil.

With the high-tension magneto it is general practice to put the secondary winding which produces the high-tension current on the same armature upon which is located the primary winding. With the low-tension magneto using the high-tension spark system the low-tension current is produced by the primary winding on the armature of the instrument and the high-tension current is produced by an exterior step-up coil. In either case the high-tension current is induced by an abrupt interruption of the primary circuit. The phenomenon of induction is relied upon to produce the high-tension current in either case. In one make of magneto, which is really a compromise between the high- and low-tension types, the coil is not wound on the armature but is entirely separate from it and detachable. It is housed, however, in the arch of the magnets. There are other magnetos which do not carry the secondary coil upon the armature but in which the secondary winding is an integral part of the machine itself.

In the low-tension instrument used in connection with a low-tension make and break system only one winding is used with no secondary coil. The primary circuit is completed at the make-and-break mechanism in the cylinder and when the circuit is broken a small electric arc is drawn which ignites the combustible charge in the cylinders.

Spark Retarded in Overhauling Motor

Editor THE AUTOMOBILE:—I have a four-cylinder Maxwell equipped with Splitdorf magneto ignition system. The magneto is in good condition such as the points, distributer, spark levers, etc., but there seems no noticeable increase in running of the motor when you advance the spark. This car has been overhauled recently by a reliable concern. Will you kindly tell me what can be wrong with it?

Buffalo, N. Y. J. SMITH.

—Since the magneto is in good condition it would seem very possible that when the motor was overhauled and the magneto re-attached to the engine that probably an error was made in its timing. If the throttle is opened and the engine does not pick up in speed it would seem evident that the magneto had been timed very late and it is suggested that an earlier timing be given it. This can be done by advancing the magneto driving gear one or two teeth in relation to the gear which drives it. Try shifting it one tooth further forward first.

Sizes of S. A. E. Tap Drills

Editor THE AUTOMOBILE:—Will you please give me the size of tap drills for the A. L. A. M. or S. A. E. threads in 1-16 from 1-4 to 1 inch inclusive?

Jacksonville, Fla. R. A. SCHELL.

—The tap drill sizes for the S. A. E. threads from 1-4 to 1 inch inclusive by steps of 1-16 inch are given in the following table:

Sizes of Taps Threads	Drill Sizes* Inch
1-4 inch x 28	7-32
5-16 inch x 24	17-64
3-8 inch x 24	21-64
7-16 inch x 20	3-8
1-2 inch x 20	7-16
9-16 inch x 18	1-2
5-8 inch x 18	9-16
11-16 inch x 16	39-64
3-4 inch x 16	43-64
7-8 inch x 14	25-32
1 inch x 14	29-32

* Note—The tap shall be between .002 inch and .003 inch large.

Spiral Gear in M. & S. Differential

Editor THE AUTOMOBILE:—Will you please describe and illustrate with drawings the M. & S. differential?

Tifton, Ind. E. G. D.

—The M. & S. differential has spiral teeth cut in an angle of 45 degrees to take the place of the bevel pinions as used in the bevel gear differentials or spur pinions in the spur gear types. In Fig. 1 is shown the spiral gear A which fits to the inner end of each axle driveshaft. This gear meshes with two other spiral gears B placed diametrically opposite one another and besides these there is another set of these gears which mesh with a gear corresponding to the gear A but connected with the other axle driveshaft. Gears A and B are connected by two other spiral gears C placed in diametrically opposite positions with their axes at right angles to the gear B.

This practically completes the mechanical makeup of the M. & S. differential consisting of eight spirally cut gears which to again mention are located as follows: Two on the inner ends of the axle driveshafts and six in the housing which carries the large ring gear G which receives the drive from the propeller shaft. It is claimed that with the M. & S. differential the drive instead of being given through the wheel which meets with the least resistance to turning is, on the contrary, given through the gear which offers the greater resistance. For instance, if one wheel were raised on a jack and the motor was started the raised wheel would remain stationary and the power would be transmitted through the wheel on the ground.

Another feature claimed for the M. & S. differential is that in turning a corner both the inner and outer wheel aid in driving, the division of the power between the two wheels being in proportion to the distance required to be traveled by each.

A paper on the M. & S. differential was read before the Detroit Section of the Society of Automobile Engineers in September, 1913. In his explanation of the differential, W. F. Neuhl, who read the paper, said: "The two axle gears each have rotative powers through tractive distance of either

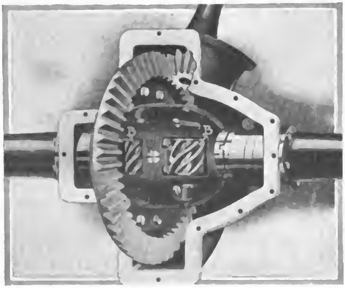


Fig. 1—View of the M. & S. differential with the differential housing cover removed

wheel, when the car is turning, or one wheel has to travel a longer distance than the other, thereby causing the six gears, namely, the four gears B and B1 and two gears C which are anchored in the gear housing to rotate on their axes, permitting one wheel to advance proportionately to the retard of the slow wheel. These gears always present the same pulling face when power is applied to the master or ring gear G regardless of differentiation; consequently equalizing power on the turn.

"On the other hand, the conventional type of differential is governed slowly by the tractive effort and distance of travel of the wheels.

"The M. & S. differential is automatic the same as the conventional bevel or spur type and operates forward or backward. The engine can be used as a brake upon the wheel with better results than it can be used on the bevel or spur types. It is standardized in size and can be adjusted to any car of any size and installed in any floating type in one hour's time."

In other words it is claimed that this differential fulfills all functions of the ordinary type and instead of driving the wheel having the least traction, that having the greatest is given the more power.

How to Preserve Chains

Editor THE AUTOMOBILE:—I found by personal experience that one set of tire chains with the right care will outlast at least two pairs without any care.

Upon examination of an old chain it will be found that all the wear and strain is on the link upon which the cross chain is fastened.

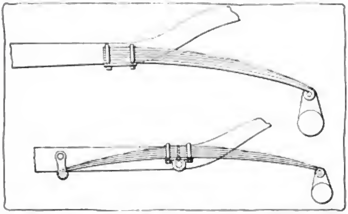


Fig. 2—Two forms of cantilever. Upper—One-quarter elliptic cantilever. Lower—One-half elliptic cantilever

When a cross chain wears through and breaks, it will be found a good plan to fasten it to the link ahead of the one it was previously fastened to and to continue said operation until all the cross chains have been changed.

Cleveland, O. L. A. KUNZMAN.

Grinding Valves on Ford

Editor THE AUTOMOBILE:—1—In cranking or starting my Ford car this winter I use hot water, pouring it on the carbureter to cause the gasoline to vaporize, but when the engine starts running just one cylinder will fire, turning the engine over for 4 or 5 minutes before the others commence firing. What is the cause for this? I keep the plugs clean. Sometimes the engine will miss on high speed. The commutator was worn from lack of oil but I had a new one put on. The car has been driven 5,000 or 6,000 miles. The compression is pretty good. Do you think the valves need grinding?

2—Please describe how to grind valves on Ford cars.

3—Have also had trouble with the carbureter leaking. I have had it examined but could find nothing wrong. The repairmen ground the valves slightly with powdered glass. Also used shellac on the float, but it still leaks.

Agency, Mo. W. R. D.

—1—It is probable that the valves need grinding if they have not been ground during the 5,000 or 6,000 miles you have been driving.

2—Valves are ground in the following manner: First the valves must be removed by draining the radiator, remove the cylinder head, remove the two valve covers on the right side of the engine, raise the valve spring with the valve lifting tool and pull out the small pin under the valve spring seat. The valves can then be lifted out by the head preparatory to grinding.

In grinding use a prepared paste of ground glass and oil or some similar good compound. A convenient way to use it is to place a small amount in a flat dish adding a spoonful or two of kerosene and a few drops of lubricating oil to make a thin paste. This is then placed sparingly on the bevel seat of the valve and it is then rotated back and forth through a period of about a quarter turn with a Ford grinding tool. This operation is illustrated in Fig. 4. After this has been done a few times lift the valve slightly from the seat, change its position, and then continue the rotating motion. This is continued until the entire surface is smooth and bright. At no time should the valve be turned through a complete rotation as this is apt to cause scratches running around the entire circumference of the valve and seat. When the grinding is completed the valves should be removed from the cylinders, thoroughly washed in kerosene, and the valve seat wiped out. Extreme care should be used to see that no abrasive substance gets into the cylinder or valve guide. This can be avoided if the grinding paste is applied sparingly to the bevel face of the valve. Often as an extra precaution a ball of cotton waste about which is tied a cord to assist in its ready removal is inserted in the valve port to keep the abrasive material from entering the cylinder.

3—Regrind needle valve and replace the float.

Not Advisable to Port Cylinders

Editor THE AUTOMOBILE:—1—In timing a four-cylinder 3 3-4 by 5 1-8 motor for racing, with a quick getaway, would it be advisable to port the cylinders?

2—If so, at what point above the top of the piston when the piston is at bottom of its stroke?

3—How large should the ports be?

In order to use a large amount of oil on the bearings without having an over-supply in the combustion chamber, I cut out a section on the side of my pistons, or the skirt, leaving 1 1-2 inch of same at the bottom. I also drilled holes in cutout section. This lightens the piston and greatly reduces friction.

Skidmore, Mo. A. L. Carter, Jr.

—1—It is no longer practice to cut auxiliary ports in the bottom of the cylinders, and it would not be advisable to alter your motor. It would mean a large expense and in all ordinary circumstances would require a considerable amount of rearrangement to take care of the waterjacketing and the arrangement of the manifold and it probably would give no material gain.

2—When it is done the top of the port is so arranged that the piston will uncover it at about the same time that the exhaust valve opens through a mechanical operation.

3—The port should be of a depth such that when the piston is at the bottom of its stroke it is on a level with the bottom of the port. As regards the amount that it extends around the cylinder this will have to depend on the total valve area that you desire and the size of the exhaust valve now in place.

Chandler Has 3.375-Inch Bore

Editor The Automobile:—1—The Chandler six is said to develop 35-45 horsepower. Will you kindly advise me through your columns the bore and stroke of the Chandler motor?

2—Kindly explain the method of cooling the motor.

South Euclid, O. A Reader.

—1—The Chandler has a six-cylinder 3.375 by 5-inch motor. This gives an S. A. E. horsepower rating of 27.40 and a piston displacement of 268.4. Block test figures are not at present available although a maximum of 48 horsepower is claimed.

2—The motor is cooled by water, circulated by means of a pump. The pump is a centrifugal design which forces the water through the jackets and then through a honeycomb radiator.

Quarter and Semi-Elliptic Cantilevers

Editor The Automobile:—What is the difference in action and what advantage has one over the other, of the two illustrated types of cantilever spring construction?

Meadville, Pa. Raymond E. Devore.

—The difference between the quarter-elliptic cantilever and the semi-elliptic cantilever construction as shown in the illustrations, Fig. 2, is not so great as would be gathered from the difference in appearance. In the quarter-elliptic cantilever the entire load is taken by the short length of spring suspended at the two points. As a natural consequence this type of spring is used principally on light cars and was a common type of suspension for the cyclecar of a year ago. The semi-elliptic cantilever, on the other hand, has a three-point connection, one point at the axle and two on the frame and has a greater length of spring over which the flexure is taken. The Automobile published last week a discussion on the cantilever spring question which went more fully into the engineering details of this question.

Spark Advanced Too Far

Editor The Automobile:—I have a model 35 Studebaker and I disconnected the pump and magneto shaft in order to take up a little play and also adjusted the carbon brushes. I am getting a good spark and at the right time, but when I try to crank the motor it kicks back. Can you tell me where the trouble is likely to be?

Allston, Mass. G. A. W.

—The cause of the trouble is that the spark is advanced far enough for ordinary running but is too far for cranking. The result is that the spark occurs before the piston has reached upper dead center and the explosion, instead of forcing the motor ahead, throws it back in the reverse direction. The magneto should be so arranged that the spark occurs at full retard on exact dead center. Magnetos are generally set so that the brake in the primary braker box occurs at this point.

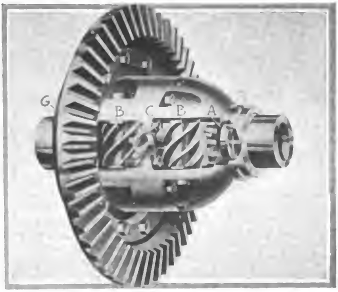


Fig. 3—Phantom view of the M. & S. differential showing the layout of the spiral gear compensating mechanism

On the model 35 Studebaker there are two methods of connecting the pump and magneto shaft, one is adjustable and the other is not. If you have a car with the adjustable coupling the timing may be altered by taking the pin from the circular flange of the coupling and shifting the coupling to retard the spark a distance of one hole on the coupling flange. If the car you have does not have the adjustable coupling you will have to disengage the timing gears and retard the magneto gear one tooth.

Loose Rings Cause Spark Trouble

Editor The Automobile:—We have a Ford car that misses in the front cylinder. It will run from 1 to 20 miles and then it will miss. The spark plug gets oily and will not fire. You can put in a new plug and it will do the same thing. The valves are all right. There have been new cylinders and new pistons put in the engine. It has run about 600 miles since. The ignition is all right. It has a master vibrator.

Round Lake, Minn. Claude H. Jenkins.

—Evidently there is a leakage of oil due to loose fitting rings or pistons. Remove the piston and rings and examine them carefully. Replace them so that the joints of the three rings will be equally spaced around the cylinder as it is possible that they are all in line now.

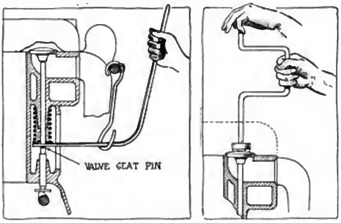


Fig. 4—Illustrating methods of removing the valve spring and grinding the valves on a model-T Ford

The Engineering Digest

Von Marchthal's System for Verifying or Replacing the Division Disks Used for Gear Cutting

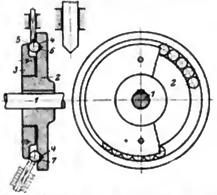
SINCE it has become widely recognized that very high accuracy in the cutting of the wearing surfaces of gear teeth is indispensable for obtaining silent running and for reducing wear to a minimum, so that the silence will continue for a considerable length of time (if other provisions for this purpose are also made), the old methods for insuring this accuracy have naturally been improved, the economical pressure of series-manufacture at the same time rendering it necessary that the improvements should be simple. The division disks with graduated holes or notches commonly used for ordinary lathe and milling-machine work must now at least be made from a templet which itself has been produced under all possible guarantees of accuracy. And those manufacturers who purchase gears from specialists, if not in possession of any of the modern gear-testing machines, should have other means at their command for verifying their accuracy or inaccuracy minutely.

E. M. von Marchthal of Vienna whose patented devices in this line are largely based upon the use of steel balls as measuring units sets forth in *Werkstattstechnik* of February, 1914, the construction, uses and advantages of his system, paying special attention to their employment for verifying the divisions of pitch circle disks.

His development of the subject represents one side of the German viewpoint, according to which great accuracy in gear-cutting is a better expedient for obtaining silence and durability than the use of silent chains or roller chains, especially in connection with the careful heat treatment of the gears (to avoid slow as well as immediate distortion after quenching) which is now taken up rather widely among German automobile manufacturers. Some of the remarks and illustrations from Marchthal's article are here reproduced.

Opinions are divided as to whether the generator method or the division method gives the greater accuracy for gears, but lately the preference has swung to the division method provided the milling cutter is designed specially for the number of gear teeth wanted and the division is accurate. It is urged against the generator method that the worm mills not only are more liable to warping in the hardening than the disk cutters but also are incapable of producing a theoretically correct profile of the gear tooth, always and unavoidably leaving marks of the notches in the worm. These marks could only be avoided by having a continuous helical cutting edge, which would work as a grinder, and unfortunately no material is known which would not be rapidly worn down by such use.

Graduated division disks continue therefore to be necessary for the accurate production of gears, and they are everywhere produced either from a standard templet or directly by the use of a worm and wormwheel. And as the standard disk in the first place has been produced in the same manner, there is really only question of one production method to insure the accuracy of the graduation and that one depending upon the accuracy of the worm and wormwheel. But the production of accurate wormwheels is difficult and time-consuming, as all specialists in this line know. The use of novel machine elements is thus indicated as desirable for securing accurate graduation, and the author's patents (German 260,485 and Austrian 58,501) describe the method he has devised by making use of the very high degree of accuracy which is an accomplished industrial fact in the manufacture of steel balls.



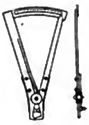


Fig. 1—Simplest form of Marchthal pitch circle divider. Fig. 2—Magnifying caliper for use with it in examining dividing-disks

The method consists in placing such balls, all true within an error of 0.001 mm., in a circle and susceptible of being reached from the outside by means of an index. Fig. 1 shows the instrument in its simplest form in face view and section.

The balls are placed in a groove 4 of the glasshard disk 2, which is mounted on the divider shaft 1, and are held close together in this groove by the hardened edge of disk 3. It may occur that the balls are found to be too loose in the

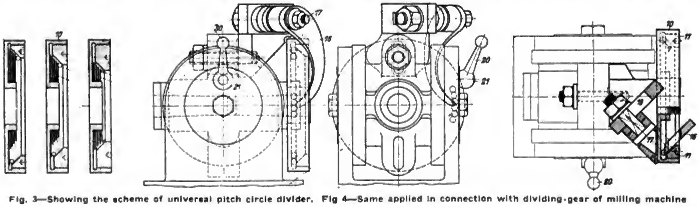


Fig. 3—Showing the scheme of universal pitch circle divider. Fig 4—Same applied in connection with dividing-gear of milling machine

groove when they are placed in it, but this can be remedied by grinding the conical surface 6 of the groove; and if such grinding were continued too long, so that there would not be room for the last ball, similar grinding of the other surface 7 would again enlarge the circle. Generally it is the best plan, however, to keep the groove so narrow that the last ball projects from 0.1 to 0.2 mm. above the rest, so as to produce a little tension in the whole circle of balls when the last one is pressed into its place by disk 3. The index can be made as a sliding pin, as at top of Fig. 1, or as a lever and can be inserted radially or obliquely in the intervals between balls. To obtain maximum accuracy from the arrangement it is indispensable that the hardened surfaces of the groove run true to the same axis and that there be no lost motion in the bearing of the index.

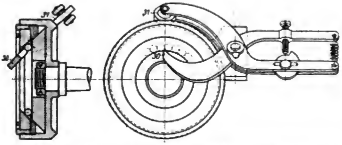


Fig. 5—Scissor-index, to obviate misalignment in shaft bearing for very fine measurements

In Fig. 3 there is shown a way of applying this principle for a very large number of divisions. Tension plates 11 of different dimensions are used in connection with underlaying plates and steel balls of different diameters in the same tension box. By this scheme it is possible to make all divisions from 24 to 194 with only one apparatus, using two tension plates and 7 ball sizes from 1-16 to 3-8 inch diameter. It is found in practice, however, that the use of thin multiple underlaying plates of uniform thickness leads to some inaccuracy and this feature has been dropped in favor of single underlaying plates of different thickness. Fig. 4 shows in three views the application of this universal divider in connection with a well known division gear the shaft of which can be fixed after each adjustment by means of a cam-and-lever pinching device 20, 21. In a later development the one-sided pressure resulting from a device of the same character, which was used at first, was seen to cause a small irregularity when accuracy charts were taken and was replaced by what may be termed a self-contained locking device.

A question of one-sided pressures comes up also with regard to the index, and Fig. 5 shows one shaped like a pair of scissors and provided with a roller 31 to take up the pressure of the index edge 30 upon the shaft bearing of the apparatus. As the only thing such pressure could take effect upon is the oil film in the bearing, the precaution is unnecessary, even for very accurate work, if radially acting index levers are used as by the arrangement of Fig. 1 and care is taken to have that portion of the work piece which is being worked or observed in the same radius in which the index pressure upon the balls is exerted.

While the introduction of large balls in the universal divider can be done conveniently by hand and without auxiliary tools it is advisable when the balls are small and the number of divisions large to make use of a magnet in the maner indicated in Fig. 5. Either a number of horseshoe magnets placed in the conformation of a star or a single shallow bowl magnet—26, 27 in the illustration—may be used. Its winding 25 is excited by the current from a few dry cells or from a direct-current lighting circuit. If this device is to be used, the housing 10 of the divider-disk must, however, be made of non-magnetic material, so that the balls 7 may be drawn outwardly during the tension adjustment.

The new method can be applied advantageously to the production of division sectors such as are frequently used for the milling of sector gears. Fig. 7 shows the details in elevation and cross-section. A pin at one end and a setscrew at the other form the end abutments for the ball row and a coverplate holds it down. With this form of the apparatus the ball diameter should preferably at least equal the pitch of the sector gear whose accuracy it is to control.

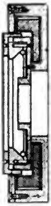
If the ball groove is made rectilinear there is produced a divider rule which can be used, especially with balls whose diameter represents a multiple of π, for the production of toothed racks with π pitch.

Used as a Check for Accuracy of Disks

Marchthal describes at length and with numerous curvographs the application of the device for verifying the ordinary division disks and tracing their inaccuracies to their mechanical sources, which may lie not only in unequal intervals between holes but also in slightly eccentric mounting or eccentric locating of the circle of holes. Similarly one instrument may be used for verifying another of the same kind. In instances where great accuracy is required the readings are made with the aid of a microscope. The simplest method, which is used mainly for small division disks with the holes not more than 5 to 10 mm. apart, may here be mentioned.

One of the ordinary multiplying calipers for measuring tenths of a millimeter, shown in Fig. 2, comes into service. To the short lever ends there are secured shoes which carry slightly conical pins extending at right angles with the scale plane, and the distance of the pins from the pivot of the measuring arm is made half as large as that of the measuring edge, so as to enable the operator to read 0.05 mm. directly on the scale and to estimate still smaller values.

The division disk to be examined is placed on a table and the conical pins of the instrument are successively inserted in the division holes, in which operation it is to be observed that, when the multiplying lever is at rest, the two conical pins should be held at a distance from one another smaller than the interval between the holes of the division disk, so that the hand will be moved by the insertion of the pin. The overhanging portion of the scale may be held in horizontal suspension by a thread to obviate oscillations.



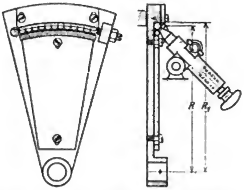


Fig. 6—Showing use of magnet in assembling the instrument
Fig. 7—Division sector for the cutting of sector gears

Among the advantages claimed for the system in its entirety are the following: (1) High accuracy at small cost, (2) suitability for industrial use, because the index can be shifted from ball to ball (unless the number of divisions is very small) and can be operated by weight or spring independently of the sense of touch of the workman, (3) durability, (4) special merits for the production of master disks by reason of the many changes of adjustment of which the instruments are capable and the use of verniers avoided.

Great Variety in Carbureters

Designs for 1915 Show No Real Changes in Principle—Minor Improvements Tend Towards Increased Efficiency—Very Few Entirely New Designs

THE ideal carbureter should supply a suitable mixture at all motor speeds and not a mixture that varies in strength irregularly. It should be readily adjustable to suit different motors, or to comply with the altered conditions of summer and winter, mountain or plain. It should be cheap to make and above all, it should get the utmost power from the least quantity of fuel and should be innocent of all waste. A little thought shows what a long road is still before the carbureter experts, but there are things that show the expert to be a good distance ahead of the average manufacturer. In the French Grand Prize race in 1913 big cars, some of them four- and some six-cylinder, covered several hundred miles at speeds between 60 and 100 miles an hour on an allowance of fuel equivalent to 14 miles per gallon. All who finished had plenty of gasoline to spare and none fell out through using up their allowance. When one reflects upon the horsepower hours that were given by the few gallons in the tanks of those cars, and compares it with the horsepower hours of work that the average car owner obtains from his gasoline it is obvious that there is nothing unreasonable in saying that there is still room for huge improvement in the fuel economy of every-day automobiles.

Carbureter Development

There have been two schools of carbureter design, the manufacturing and the scientific. Speaking generally neither has paid proper regard to the other, the manufacturer preferring to adopt haphazard methods of design and the theorist failing to allow for the limitations of practical machine work. Each have lately given way a little and, as a result, we have several carbureters in which the accuracy of workmanship approaches that of a cheap watch. Years ago when gasoline was good and of light gravity almost any sort of apparatus would produce a combustible mixture but as it becomes heavier the problems become greater. Also the small speed range of old type motors greatly simplified the conditions. Now we want high power, very slow idling and even operation over a very wide range of speed indeed. Just as the modern motor is far more complicated than its ancestor in that it has far more parts and calls for far more accurate making, so does the carbureter for it needs to be a less rudimentary sort of instrument.

Types of Carbureters

If we have a jet of known dimensions we can calculate the rate of air flow past it that will be necessary to withdraw a definite quantity of gasoline per second. Supposing that we make the size of choke tube round the jet such as to give the correctly proportioned mixture for high speed running of the motor, then we know that the jet will fail to supply enough fuel at low motor speeds and we shall have to arrange a supplemental supply from some other source. If we go the other way to work and suit the jet and its choke tube to slow running we must reduce the rate of *increase* in suction as the motor speed rises, by admitting free air through some opening other than the choke tube. If we adopt neither of these alternative schemes we can devise an apparatus to vary both jet area and choke tube area simultaneously so as to proportion the effective *size* of the carbureter to the motor demand.

There are difficulties in the way of each system, but they are mechanical difficulties and we may therefore hope that some day will see them overcome. Meanwhile it may be useful to review briefly the troubles in the application of each of the three systems, since it is far from being decided which of them will be ultimate.

Moving Part Carbureters

The system most popular in this country is the fixed jet and choke tube with a valve of sorts to weaken down the mixture as it tends to enrich with increase of motor speed, and the fundamental failing of this kind of instrument is the liability of the valve to function properly over only a small range. It is liable to act irregularly at speeds above or below a certain figure, so upsetting the mixture. Again, it is only just within manufacturing possibilities to make the valve come into action gradually enough; actually it hardly ever does so, since it cannot very well open as little as a hair wide crack and float at that on a rapidly vibrating motor. Then too, if a spring is used it is subject to vibratory oscillations and should these be created by sudden changes in the suction the valve may vibrate independently of the air flow, so disturbing the constitution of the mixture. To overcome the tendency for this action to create "dead spots" or periods of weakness in mixture at certain speeds, it is often found necessary to enrich the whole range, thereby wasting fuel and increasing carbon deposit.

All kinds of devices have been tried to overcome this failing in the air valve; there are innumerable different kinds of dashpots aimed at damping out oscillations of the valve and they have met varying degrees of success, but none of them are absolute. We have not yet seen an air valve that was completely dead beat in action. Some of the most successful types are also open to the objection that they are highly susceptible to dirt or corrosion, but as a rule the more money that can be spent upon accurate work the more nearly to perfection does the valve operate.

Carbureters without Moving Parts

The second type of carbureter is most popular for very high speed motors and has given good results on power, combined with fairly good thermal efficiency. In it there is no moving part whatever and a single jet stands in a venturi choke tube, the proportions of the jet and of the choke tube being such as to suit the high speed conditions; as suction falls off with dropping motor speed a fresh supply of fuel is introduced by supplementary means. In this kind of carbureter there is usually an additional control on the main jet by so constructing the nozzle that its natural lag is overcome. The inertia of the liquid fuel causes it to lag behind a little when suction increases suddenly and to continue flowing when suction ceases abruptly. The most successful designs have utilized the air supplied to the supplemental jet for the control of the main jet; have in effect sometimes caused the main nozzle to be a tiny carbureter within itself delivering a very rich wet gas. Some of these inertia damping devices are more successful than others but it would be hard to say that any of them are absolute.

In this kind of carbureter the supplementary supply commonly consists of both gasoline and air, the former being drawn in most readily by low suction and the latter by strong motor demand. In other words, while air and fuel are drawn in mixed together, at low speeds, the air gradually displaces the gasoline as the suction increases, until at length there is only air passing up the supplemental nozzle into the intake.

The carbureter without moving parts is thus controlled by balancing the inertia of small columns of gasoline, the capillary action of small pipes, the effect of small orifices upon the speed of air flowing through them and the frictional drag on air passing through a small passage, against the varying motor suction, instead of balancing a spring or the weight of a valve against the suction. This makes clear why the air valve carbureter is easier to make and easier to adjust than the second sort, but it may also be noticed that the frictions and inertias involved in this instrument are each invariable, they are not liable to fluctuation in the way that a valve can be. Thus there is reason to believe that the air valve carbureter is essentially easy to set to suit a motor within certain limits, but that the other type should give better results if money is forthcoming for its manufacture and for expert adjustment to suit each individual engine.

Expanding Carbureters

The third kind of carbureter has usually a single jet, normally nearly closed by a taper needle, or metering pin, attached to an air valve so that, when the valve lifts to let in more air the pin is withdrawn so as to allow more fuel to pass. It is necessary to introduce a small passage through this valve so as to allow the jet, when at its minimum size, to feed direct to the intake for starting and idling, the valve only opening when a definite motor speed is reached. Carbureters with multiple jets operate on the same principle because they open up fresh jet and air orifices simultaneously, but they are bound to act in a series of jerks as successive jets are uncovered. This tendency can be reduced almost to vanishing point by using a sufficient number of jets, but there are severe mechanical difficulties in making a row of almost microscopic orifices, and it is undoubtedly the cost of sufficiently accurate manufacture that has prevented the expanding carbureter from coming more into favor.

Changes in New Carbureters

It can scarcely be said that much general advance has been made in carbureter design since 1913, and the reason for the introduction of several new models has been the demand for a horizontal type of instrument for attachment to block motors with a single intake port. No doubt the rise into favor of the vacuum feed will still more greatly encourage the development of this type of instrument, because a high carbureter mounting is a distinct advantage, since it makes for accessibility and also for simple and straight throttle connections.

With gasoline tending always towards a heavier gravity the necessity for a well warmed carbureter becomes increasingly apparent, so it is not surprising to find that several manufacturers have added a model with a water jacket. With a horizontal instrument mounted right against the cylinder block there is not the same need for warming as when a long intake manifold is used, but it seems hardly possible to have a carbureter too hot around the mixing chamber.

Changes made in the internal construction, though infrequent, and usually small where they are to be found, are noticeably in the direction of increase in the delicacy of the apparatus. Carbureters have simplified externally while growing more complicated inside, for reasons that have been sufficiently explained already.

In the following descriptions no attempt has been made to classify the types, because it would require much space to do so efficiently. Some of them are quite readily recognizable in the light of the foregoing, but a good many combine the principles of two or more of the three main divisional types. To anyone who has followed the classification on the simple lines adopted above the principle of each carbureter is made clear by the brief description and by the illustration.

Air Friction Fixed Nozzle

The feature of Air Friction carbureters is the use of a mushroom-shaped valve which floats in the venturi and out of which the fuel issues through a horizontal slit in the edge.

Model C is retained with slight improvements and a new model D with a non-adjustable nozzle added. The latter is the same in principle as the former but the flow of fuel is regulated by the size of opening in a small bushing or jet in the interior of the nozzle instead of by needle valve. This device is merely for controlling the amount of flow, the spraying of the fuel in either model being accomplished by allowing it to flow through the very thin circular opening in the mushroom valve, the walls of which openings are .015 inch apart, the circumference being 3 to 6 inches, depending on the size of the carbureter.

The fuel entering the carbureter is filtered through a fine brass screen, whence it passes through the float chamber and enters the nozzle stem, whence it passes by the adjusting needle in the old carbureter, or the fixed nozzle in the new, and from thence is distributed among four lateral openings to the two horizontal surfaces mentioned. The fuel issues from these surfaces in a circular film or mist where it is taken up by the air rushing by at right angles.

Air Valve Surrounds Nozzle

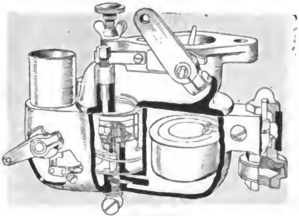
Surrounding this large circular spray nozzle is a metal air valve or sleeve, truncated at the bottom, this valve being housed in a brass liner and free to move upward. When the motor is stopped, this liner with the valve is in its adjusted position. As soon as the motor starts, the suction of the motor lifts this valve, increasing the annular opening and the flow of air.

To provide easy starting, the closing of the butterfly in the air inlet also moves the air valve down over the nozzle, reducing the annular opening to the minimum.

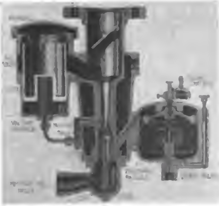
The air adjustment is controlled by a screw which should be raised about .2 inch from its closed position for first starting and regulated from that point after the motor has started.—Air Friction Carbureter Co., Dayton, O.

Browne—One Size for All Motors

The feature of the Browne carbureter is the vacuum-controlled auxiliary air valve the object of which is to maintain a constant ratio between the fuel and the air at all speeds and throttle openings. Only one size of carbureter is manufactured for all motors and the only change for different motors is to put in a new bushing which surrounds the auxiliary air valve and controls the area of the auxiliary air opening. Large motors use a bushing with more sharply outcurving surfaces than small motors. The same venturi construction is used regardless of the motor size. The throat area is small, insuring sufficient velocities to atomize the fuel at even the lowest speeds, it is stated. Friction at this point is reduced by giving the venturi a 30-degree approach and a 7-degree discharge.



Air Friction



Browne

The main air inlet is at the bottom, whence the air passes up through the venturi where it mixes with the gasoline. Additional air is supplied by the auxiliary air valve at the left, this being an aluminum piston whose position is determined by the amount of vacuum in the chamber under it. This chamber is connected with the venturi, the opening of the passage being at the same point as the spray nozzle. The result is that the vacuum acting on the fuel and on the piston valve is exactly the same, and for a definite amount of vacuum, the valve must assume a definite position; therefore, for a certain rate of fuel flow, which is determined by the vacuum, the valve must take a certain position. There is a bushing, as previously noted, with a curved surface, which surrounds the upper edge of this valve so that, as the opening of the valve increases, the area through which the auxiliary air may flow, becomes greater. The curve of this surface is so calculated that for a given position of the valve, as determined by the vacuum at the spray nozzle, the amount of air to give a correctly proportioned mixture is obtained. For a wider throttle opening the vacuum increases, the rate of fuel flow becomes greater, and the valve takes a new position. Due to the curved surface of the bushing the new area of the auxiliary valve allows enough added air to give a proper mixture, for this throttle opening.

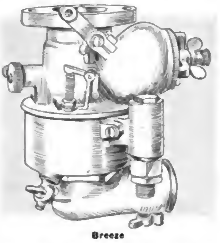
Ball Valve Stops Fluttering

Fluttering is prevented by means of a small ball which is held off of its seat slightly in the passage leading from the throat of the venturi to the air valve. When the air valve is depressed the ball offers no resistance, but when the valve attempts to close a certain resistance is interposed to prevent fluttering. This arrangement also serves another purpose since, when the throttle is closed suddenly, there is a tendency for the fuel to keep on flowing at the same rate, due to inertia. Were the air valve to close as suddenly the mixture would become too rich. The air valve is, however, retarded by the ball in the same proportion as the fuel flow is continued, thus maintaining constancy of mixture during the period. A waterjacket is fitted and the main air inlet is finished so that a hot air pipe may be attached.

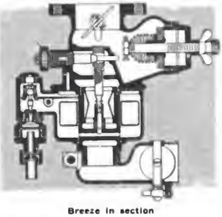
Good Accessibility

Accessibility is a feature—the carbureter may be taken entirely apart without removing it from the motor, the auxiliary valve may be lifted out after the dust cap is removed; and the float mechanism may be inspected or removed after taking off the cover to the float chamber. Dirt from the seat of the float valve may be dislodged by means of the milled head on the upper end. The fuel nozzle may be cleaned by unscrewing and withdrawing the needle valve and inserting a piece of fine wire or a hat pin. The float chamber may be drained by loosening the needle valve at the extreme right.

Priming the carbureter for starting is accomplished by pulling the lever on the top of the float chamber. This lifts the needle valve and allows gasoline to flow into the float chamber until the lever has raised sufficiently so that fuel runs down the diagonal passage into the main air passage.—Holt-Wells Co., New York City.



Breeze



Breeze in section

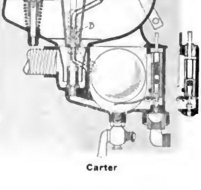
Breeze Models Simple

This is a single jet type having a large nozzle that can be adjusted by means of a vertical needle valve which fills the orifice. Instead of mounting the needle point upwards and locating the setting screw at the bottom of the carbureter in the usual way, the needle is short and hangs downward into the jet. It is suspended from a spindle which is eccentric, and this terminates in an adjusting thumb screw situated in a readily accessible position outside the mixing chamber. Turning this screw turns the eccentric and so raises or lowers the needle, which alters the effective area of the jet.

The main air is taken in at the bottom and passes up through a venturi surrounding the jet to the mixing chamber, where more air is added by a spring controlled valve, when the speed of the motor increases. Thus there are two possible adjustments, one of the fuel needle and the other the air valve spring.—Breeze Carbureter Co., Newark, N. J.

Carter Has Ball Float

The Carter is a kind of expanding carbureter since its essential feature is a vertical gasoline stand-pipe which has a series of very fine holes drilled in it in an ascending spiral. This pipe is shown at B in the illustration and the whole pipe can be unscrewed by the knurled head D. The idea of the stand-pipe nozzle is that the motor suction increasing with the speed will cause the gasoline to rise higher and higher inside the pipe, so reaching more and more of the fine holes and feeding correspondingly more freely. Air in heated state enters the pipe shown at the bottom, and passes upward; other air enters at C, where its amount is controllable by the little throttle shown, and still more air can get in through the valve on the left side, this supplementary supply passing upwards after mixing with the warmed air. Thus there is a considerable state of turbulence surrounding the spraying tube. For starting, gasoline is sucked up the passage A, from the bottom of the float chamber, and the float control has been designed with a view to keeping the level more accurately than is usual. The spherical float helps to this end and the



Carter

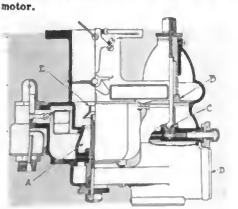
needle is so arranged that the chance of its jamming is reduced to a minimum.—Carter Carbureter Co., St. Louis, Mo.

Fritz Original in Design

The principle of the Fritz is a main jet in a choke tube A in cut, and an air valve B, which admits additional gasoline when it opens. This is done by the needle valve C, which is lifted off its seat when the air valve rises, and so allows gasoline to pass out through the little tube surrounding the needle valve. All the air enters at D, and so all air has to pass either one jet or the other. Above the main jet is the conical "hat" E, and this tends to concentrate the draught past the jet. Seen just above the main jet is a supplementary throttle which is closed for starting by a special lever and when in the position illustrated allows only a little air to pass. Putting it across the intake also opens up a passage leading to the float chamber permitting a direct spray of fuel to be inhaled. Immediately the motor is started this starting throttle is opened wide and all control is thenceforward automatic. Adjustments of a readily accessible nature are provided for all air or fuel admittance.—Fritz Carbureter Co., Norristown, Pa.

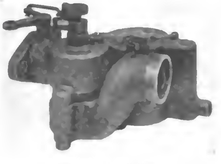
Greuter—Three in One

The feature of the Greuter carbureter is that it is really three carbureters in one, since there are three separate nozzles each in its own venturi tube. At slow speeds only one nozzle operates, then, as the throttle is opened the second one comes into play, and finally all three. As is shown in the accompanying section when the throttle is nearly closed and the motor is idling or running under a small load, the cam attached to the throttle butterfly shaft holds down the two levers which control the jet passages. When the throttle is opened beyond a certain point. one of these levers is released and the valve rises according to the suction. Still further movement of the throttle in the same direction sets free the other lever and the valve it controls is lifted more or less, depending on the suction of the motor.

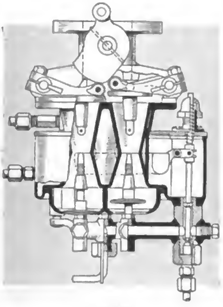


Fritz

At the bottom of each venturi tube there is what is known as a priming disk which is for the purpose of obtaining a proper mixture when the venturi tubes are coming into action. Take for example the case of the medium speed venturi; suppose it is just coming into action. The flow of air past the nozzle is very slight and not sufficient to give a good mixture. The weight of this valve slightly resists the passing of the air, thus forming a partial vacuum and assisting the production of a mixture of proper quality. As soon as the position of the throttle permits a greater quantity of air to pass through the venturi, the priming disk is sucked up against a stop collar and no longer obstructs the flow of air.—C. R. G. Mfg. Co., Long Island City, N. Y.



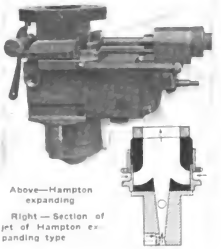
Hampton Ford type



Greuter

Hampton Makes New Models

Amongst the really new carbureters the Hampton company's products must rank prominently since they have no less than three instruments all of which are new. One is a twelve jet gasoline carbureter for which very rapid acceleration power is claimed, another is a combined kerosene and gasoline carbureter and the third is a simple gasoline carbureter for Fords.



Above—Hampton expanding

Right — Section of jet of Hampton expanding type

In the multiple-jet carbureter, each jet has its own mixing chamber and the different jets are brought into action as the throttle is opened. A section through one mixing chamber is shown herewith and the other ten are in line with this one. The gasoline jet is not shown but it is in a member which attaches at the lower left corner of the section. There is a small air port at one side of the jet through which the air passes over the jet horizontally and a rich mixture is formed. This is carried up through the mixing chamber where it is mixed first with more air which enters from the bottom and second with auxiliary air which comes in at each side of the mixing chamber. The amount of auxiliary air is controlled by the throttle. The main air jet ports and the auxiliary air ports are shown in the accompanying illustration of the complete carbureter. Fluttering of the throttle is prevented by a dash pot control.

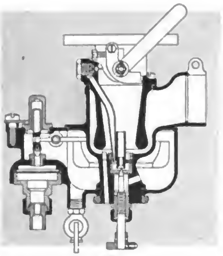
The purpose of the eleven separate carbureters is to give flexibility and maximum power. The shape of the primary air passages and the mixing chamber are so fashioned as to allow the mixture to expand, breaking the fuel into the most minute particles.

Easy starting is obtained by shutting off the auxiliary air ports, giving a very rich mixture.

There are no adjustments outside of the auxiliary air shutter which is attached to the throttle and regulates the extent to which each port is uncovered when the throttle is opened.

It is claimed that this carbureter works well on distillate and kerosene as the fuel is perfectly atomized and mixed by the primary air striking the fuel from two angles simultaneously. Each primary air opening is a small venturi in itself.

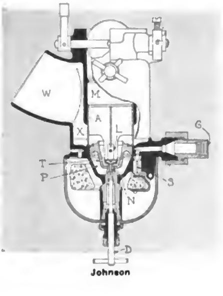
The body of the carbureter is water-jacketed, allowing the heating of the fuel and the primary air at the same time.



Holley

The combination carbureter is equipped with a dual float chamber, one for gasoline and the other for kerosene. The motor is started on gasoline and after becoming slightly warmed, a valve on the dash is turned, the kerosene float mechanism begins feeding and the gasoline is shut off. To aid in vaporization of the kerosene the mixing chamber is jacketed so that the exhaust gases from the motor may pass around it.

The outstanding feature of this carbureter is the method used to heat the kerosene thoroughly and insure its perfect vaporization. Instead of having a spray nozzle, the fuel passes from the float chamber to a cone-shaped passage which is just three or four thousandths of an inch in thickness. This is shown in the accompanying vertical section. The outside wall of this passage is heated to a high temperature by the exhaust heat and as the fuel strikes this wall it is quickly vaporized due to the thinness of the film of fuel as well as the intensity of the heat. The fuel is drawn up through this passage by the suction of the motor. As the speed of the motor increases, the air valve in the center is raised and more air is admitted. Due to the bevel on this valve the air strikes the film of fuel at right angles and this action assists in producing a thorough mixture. This valve is held closed when the motor is stopped by a helical spring at the bottom. The tension of this spring is adjustable and there is a dashpot on the air valve stem to prevent fluttering of the valve. There is also a needle valve controlling the size of passage from float to spraying passage and this has an adjustment which is interconnected with the throttle so that as the latter is opened the needle is raised.



Johnson

The Ford carbureter is a simpler design for gasoline only. It is said that it will give more power, flexibility and economy.—Hampton Kerosene Carbureter Co., New York City.

Little Change in Holley

The Holley is of the concentric float type with the fuel nozzle in the center of the most constricted portion of the venturi mixing chamber. Fuel flows upward past an adjustable needle valve into a little cup into which two tubes dip. One of these is the main jet and its lower end is nearly at the bottom of the cup, just above the needle valve point. The other terminates at a higher level and is carried up through the venturi to a point on the side of the carbureter body adjacent to the closing edge of the throttle disk.

With the throttle almost closed, which is its normal position at starting, the gasoline is sucked up through the long tube and past the plug at the top into the passage to the motor. This sends a rich mixture which has the effect of priming. After the motor is running beyond idling speed, the suction past the main nozzle draws the fuel up through it. This is atomized and mixed with the inrushing air in the usual way. This action exhausts the supply in the well at the bottom of the nozzle and the spraying of gasoline through the long tube ceases automatically, the motor getting its proper mixture through the main jet. Before the fuel reaches the float chamber it passes through a strainer disk shown in the illustration.

There is but one adjustment in the Holley, that of the needle valve in the nozzle.

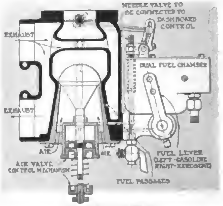
A special Holley model for Ford cars is almost identical with the standard model in design and operation, the chief differences being in the construction for giving a horizontal instead of a vertical outlet to the engine, and the needle valve is controlled from above instead of from below the main body of the carbureter.—Holley Bros. Co., Detroit, Mich.

Johnson—A New Design

The Johnson is one of the newer designs of carbureters on the market. It is made in several forms with concentric float. A special form has been brought out for Ford cars which has the motor connection horizontal, the mixing tube turning at right angles to the nozzle centerline within the body of the instrument. This has an adjustment at the top governing the height to which the sleeve can rise.

The distinguishing feature of the Johnson is the sleeve which is lifted by the suction and thus admits air through openings between the bottom of the sleeve and its seat, the amount of air varying with the height the sleeve is raised. The air supply, and therefore the mixture, is controlled automatically by the suction, which in turn, is dependent upon the throttle opening.

A section through a typical Johnson instrument of the adjustable nozzle type is shown. The carbureter consists of two compartments, the lower, the float chamber and the upper the mixing chamber. The brass sleeve A slides up and down in the mixing tube M. At its lower end this sleeve carries a small lifter plate L which extends down into the strangle tube T and over the spray nozzle N.


NEEDLE VALVE TO BE CONNECTED TO DASHBOARD CONTROL
EXHAUST
DUAL FUEL CHAMBER
EXHAUST
AIR
AIR
AIR VALVE CONTROL MECHANISM
FUEL LEVER (LEFT-GASOLINE RIGHT-KEROSENE)
FUEL PASSAGES

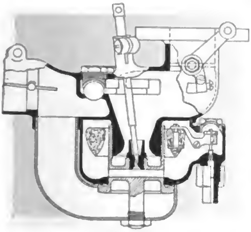
Hampton kerosene

Warm air, taken from around the exhaust pipe, enters the mixing chamber at W. It then divides and some of it finds its way down under the strangle tube T through the passage P, and picks up gasoline from the nozzle. After passing the nozzle, this jet of air strikes the lifter plate L and raises sleeve A, allowing more air to pass into the mixing tube M, above the spray nozzle. This second current of air goes through the concentric passage X and the opening made by the raising of the sleeve from its seat. It mixes with the gasoline-laden current from the spray nozzle, and the whole then goes on past the throttle valve to the motor.

As the throttle is opened and the suction on the carbureter increases, the sleeve in the mixing tube rises higher, and allows more air to enter above the nozzle, thus automatically proportioning the parts of air and gasoline in the mixture. A choker is fitted which simply moves the strangle tube around so as to open or close the ports in the carbureter body which govern the amount of air passing the nozzle. This choker connects to a dash adjustment so that the ports may be nearly closed to give a rich starting mixture. The needle D is provided with external means of adjustment so as to regulate the amount of gasoline going through the nozzle.

There are several modifications of this design, one being a fixed needle type in which case the nozzle is calibrated for the motor to which the carbureter is fitted.

Aside from its simplicity, the Johnson carbureter has several features in addition to those already mentioned. The flat lifter plate against which the fuel is sprayed has the added advantage, it is claimed, of serving to split the fuel up into minute particles, so aiding vaporization. The float needle valve is unusual, a square pin S bearing against the float and being therefore controlled directly by the latter. Its square form allows gasoline to flow by it when its point is off the seat.—Johnson Co., Detroit, Mich.


Kingston

No New Kingston

The principle of the Kingston is very simple. Gasoline collects in the cup surrounding the point of the needle valve shown in the illustration, and air enters from around this cup. On first starting the cup is emptied quickly so giving a whiff of right gas, but the cup does not fill again unless the motor speed is reduced very greatly, gasoline being drawn past the needle valve in the usual way. For the admission of extra air there are a series of bronze balls that cover holes of different sizes. As suction increases, one after another of these balls are lifted, so letting in first a little air, and as the vacuum becomes stronger, more and more air can enter. There are no springs and no wearing parts in this system of air control which gives it the desired simple character. Only one adjustment is provided, this being the needle valve that can be set from above, and there is a throttle in the air intake for accelerating the draught at starting.—Bryne Kingston & Co., Kokomo, Ind.

Krice Carbureter Simple

In the Krice carbureter, the float chamber surrounds the mixing chamber. There are no springs, no auxiliary air inlet and but one jet. The mixture is proportioned by the shape of the air passages and for slow running and starting there is a tube which supplies a very rich mixture. Instead of a nozzle the gasoline passes through an annular opening where it is sucked up by the air. The throttle is a vertical cylinder type embracing the air passage and the mixing chamber, the whole rotating and thus simultaneously varying the opening of the air intake and discharge to the manifold. The float level is adjustable by turning a nut on the shank of the needle valve.

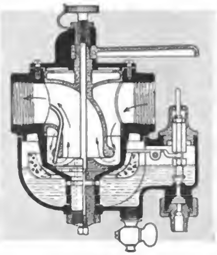
New Longuemare Horizontal Type

No valves are used in the Longuemare, in which mixture is proportioned by a combination of jets. New features include a horizontal type for motors with the cylinders cast in a block, and a braking attachment for use when the car is running down long hills. In addition to the horizontal model, a vertical model is continued and there is also a carbureter for small, high-speed motors of the motorcycle and cyclecar type.

The particular feature which distinguishes the Longuemare is an idling jet A which is superimposed upon a working jet B in conjunction with a compensator C. When either jet acts the other is ineffective and the transition from one to the other is imperceptible.

The operation is as follows: The fuel enters through a strainer E at the extreme upper right of the float chamber and passes by the needle valve which is controlled by the float. Thence it flows through the passage D by the adjustable needle valve which controls the opening into the passage F. The fuel also runs back into the reserve chamber C through the channel G. The fuel level in the chamber, is the same as that in the float chamber and in the working jet B.

There is a minute slit in the throttle shown at H, and when the throttle is closed this orifice lies just over the top of the jet. It can be seen that a small piece is beveled off the upper edge of the throttle and this allows anything that passes through H to be drawn up into J and so to the motor.

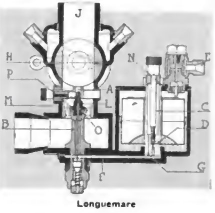

Krice

The nozzle of the idling jet L extends well into the strangling passage A, to the left of which there is a small air inlet M whose opening can be regulated by the ratchet locked thumb screw shown. Thus air can only enter the confined space around the nozzle L through M.

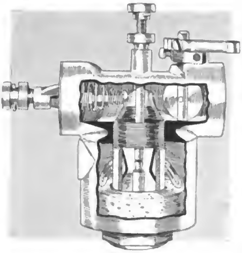
High Air Velocity When Idling

When the motor is started and run slowly in this position of the throttle it draws air with great velocity past the idling jet L and through M. The velocity past L is regulated by the thumb screw just mentioned which increases or decreases the small air by-pass M. When the throttle is opened slowly or quickly, the suction around the jet M increases rapidly but diminishes around the jet L. It is at this moment that a freer flow of fuel is always required, and to give this the compensating reserve chamber G empties into the common supply channel F. Thus the additional fuel demanded by pick up is instantly supplied. When the motor is slowed down this chamber fills to its former lever, and this reserve chamber is analogous to a storage battery floating on the line.

The natural tendency is for the mixture to become richer at higher speeds and to prevent this, when the throttle is opened the chamber C is quickly drained and exposes the orifice D to the air entering through the holes N at the top of the float chamber. This air is immediately drawn through into the channel F. Air being a lighter medium displaces the fuel passing through the channel F, and



Longuemare



Maco

retards the increasing flow from the float chamber and also aids vaporization. This saturated vapor is brought down to the proper proportion by the air entering from the main air inlet. The idling jet may be cleared of possible obstructions by a nickel steel needle operated by a push-button underneath the working jet.—The Longuemare Carbureter Co., New York City.

Maco Simple and Compact

Simplicity and compactness feature the Maco carbureter as there are but two adjustments, the gasoline for low speed and the auxiliary air for high speed. The float chamber is concentric and can be turned to any position to bring the gasoline connection to the side most convenient to the supply pipe. The spray nozzle is directly in the center of the float chamber, insuring a constant level of fuel regardless of the position of the car with respect to the horizontal.

The main air intake is at the bottom directly below the fuel nozzle. At the nozzle there is a contraction in the air passage so that the air velocity is increased and the vacuum becomes greater; these factors aiding vaporization. The auxiliary air is taken in from the side, the valve being controlled by a coil spring and the needle-valve adjustment is at the top. In adjusting the carbureter the needle valve is set to give a good low-speed mixture and then, with the spark advanced the throttle is opened wide for high speed regulation. —Gleason-Peters Air Pump Co., Brooklyn, N. Y.

No Changes in Marvel

No changes of note have been made in the Marvel. It is a double-jet type with a manually-controlled auxiliary hot air supply and a similarly controlled choker for easy starting. Two jets are used, the second jet being brought into action by the opening of the auxiliary air valve.

When the motor is idling the hinged auxiliary valve, which shuts off part of the passage, is closed thus rendering ineffective the tall jet in this part. At this time the air passes up through the small venturi surrounding the low-speed jet. As the suction of the motor increases the auxiliary valve is opened against the spring pressure and the second jet comes into action. A choke valve in the main air entrance allows a rich mixture to be obtained for starting. This device may be controlled from the dash so that when the motor is cold it may he closed when it is desired to open the throttle quickly, thus preventing a backfire.

A feature of the carbureter is an exhaust heat jacket manually operated, which aids in the vaporization of the fuel. Any degree of heat may be had.—Marvel Carbureter Co., Flint, Mich.

Master Uses Many Jets

The Master carbureter remains the same in design as heretofore. It is an eccentric float type with a rotary throttle and horizontal fuel distributer extending across the air passage.

Referring to the sectional view, the fuel distributer extending across the air passage is shown at C. This has a number of small holes drilled along its length, and the lower opening H in the rotary throttle D is so shaped as to uncover more and more of these holes as the throttle is opened. At the same time, due to a similar opening H' in the upper surface of D, an increasing amount of gas is admitted through the intake O. Thus the fuel supply is mechanically apportioned in accordance with the throttle opening. When the throttle is wide open there are no restricted passages, which is one of the points which the maker features. The air enters through the intake A and mixes with the fuel issuing from the small holes, and passes on to the engine through the openings H and H'.

The gasoline gets to the distributer through the passage P from the float chamber. A common supply tube running along the lower part of the distributer takes care of each individual distributer tube. A strainer is interposed in the passage from the float chamber. The construction of the multiple jets and of the throttle is best understood by reference to both the sectional and perspective views on opposite page.

One Jet for Idling

When the throttle is closed, there is still one distributer hole uncovered which admits sufficient fuel for slow-speed or idling. To regulate the air supply and thus control the mixture, the air damper B is placed in the air passage. This is simply a flat piece of metal arranged to swing about its base so as to shut off any part of the air. As shown, it is set for a rich mixture, whereas, if partly open, the proportion of air would be greater.

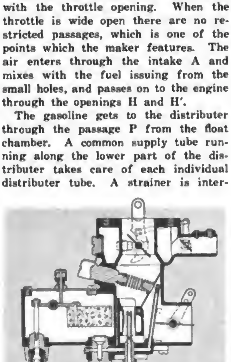
Distributers of different capacities are available for fitting to the various sizes of carbureters. Wear of the rotary throttle is minimized, for it does not touch the throttle chamber in which it operates. It has large journal bearings in the mixing chamber body. The air damper is controlled from the dash.—Master Carbureter Corp., Detroit, Mich.

M. F. Carbureter Is Floatless

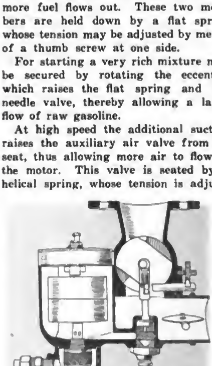
This is a carbureter of unusual design in that the float-chamber has been discarded, and it is also remarkably simple and light. The main air inlet is at the bottom and to one side. At slow speed the air rushes up through this passageway, past the spray nozzle, lifting a small disk to which is attached the needle-valve extending into the nozzle and controlling the flow of fuel. The higher the disk and needle are raised the more fuel flows out. These two members are held down by a flat spring whose tension may be adjusted by means of a thumb screw at one side.

For starting a very rich mixture may be secured by rotating the eccentric which raises the flat spring and the needle valve, thereby allowing a large flow of raw gasoline.

At high speed the additional suction raises the auxiliary air valve from its seat, thus allowing more air to flow to the motor. This valve is seated by a helical spring, whose tension is adjust-



Marvel



Parkin

able by a thumb screw.—Floatless Carbureter Co., Brooklyn, N. Y.

Newcomb Adds Water Jacket

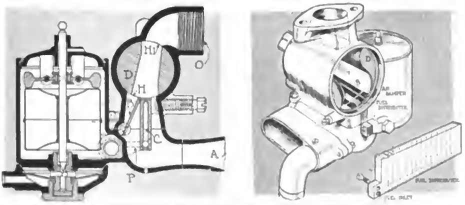
A line of water-jacketed carbureters is the new feature of the Newcomb production, all previous models having been built without water-jackets, except the .75-inch size. All water-jacketed models have been carried over with few changes, and in addition these particular models can now be procured in aluminum as well as bronze. The carbureter is called a constant-vacuum type because it automatically enlarges the effective air and fuel openings in direct proportion to each other and to the demands on the carbureter for an explosive mixture.

The metering mechanism is located in the vaporizing chamber. It consists of a hollow plunger surrounding the fuel nozzle tube, a sharply pointed needle valve is attached to the upper part of this plunger and controls the flow of the fuel. Around the bottom edge of the plunger a large number of small holes are drilled and these are arranged to register with an equal number of slots cut in the plunger tube, or cylinder, to distribute the fuel after it has issued from the main fuel-measuring orifice. The plunger is seated on the regulating collar, indicated in the illustration, when the motor is not running. The office of this collar is to withdraw the fuel needle from its closed position by raising the plunger without uncovering the air slots in the plunger chamber. The opening of the fuel port is thus given a lead with respect to the air ports, delivering a rich mixture when the plunger is raised but a trifle, as when the motor is idle.

How Air Is Proportioned

When air is drawn through the carbureter, the plunger lifts in proportion to the amount of air entering the motor. The needle in the nozzle lifts at the same time, releasing the amount of gasoline needed to correctly charge the entering air—the higher the plunger is lifted the larger the air and fuel openings. The effective areas of the air and fuel ports are at all positions so proportioned that the fuel mixture is correct for all rates of flow. As the fuel flows through the small holes it is caught by jets of air coming through the slots and is atomized thoroughly on account of the high velocity of the air. Any fuel unvaporized is gasified when it strikes the heated walls.

A dash-pot is formed between the head of the plunger and the upper end of the plunger chamber. This retards the lifting speed and allows a richer mixture when the throttle is opened suddenly—the motor may be run on a thin mixture and still pick up quickly.

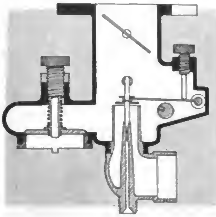


Left is view of Master in section. Right shows nozzles

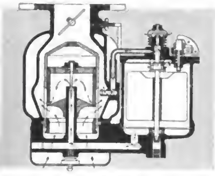
Mixture adjustment is effected by means of a pointer traversing a graduated arc etched on the top of the float chamber. This pointer adjusts the degree of vacuum above the gasoline in the float chamber and partially restrains the flow of fuel from the nozzle.

Easy Starting

For easy starting in cold weather an auxiliary fuel nozzle is provided which consists of a tube conveying gasoline from the float chamber to the small orifice just under the throttle valve. Normally, this orifice is subjected to the constant suction of the motor, whatever this may be, and the bore of this orifice is so proportioned that very little fuel flows through it to the mixing chamber under these conditions; but when it is desired to start, the throttle valve is turned backward through a slight angle bringing the orifice above the valve and subjecting it to a powerful suction.—Holtzer Cabot Electric Co., Brookline, Mass.



M. F.



Newcomb

Parkin Carbureter without Springs

This carbureter has no springs in its construction and there is but one air inlet. The mixture is controlled by a special type of throttle valve and a single large jet whose area of opening is varied by the position of the throttle.

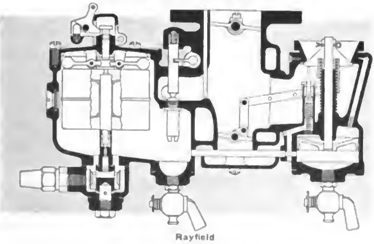
The cylindrical throttle has a double function, the upper part is the throttle proper, and the lower part is what is termed the variable-air shutter. This lower member controls the amount of air which passes the jet by varying the area of the passageway. The rotation of the throttle also controls the opening of the single jet, which is a large hole in the side of the jet tube. Over this tube is a double sleeve, the inner portion of which moves down over the jet opening as the throttle is closed. This movement is produced by an eccentric on the throttle which bears on the top of the sleeve. Easy starting is provided by means of a choke valve in the air intake and dust is prevented from entering the float chamber by means of a screen.—Light Mfg. & Fdry. Co, Pottstown, Pa.

Rayfield Makes Two Models

Rayfield carbureters are made in two types for the coming season, the difference being that one has a water-jacket. In both models the air valve adjustment has been eliminated, high and low-speed adjustments being through the control of the fuel. Both models are of the two-jet type, one jet feeding at low-speed and both at high-speed. There are three air openings, one fixed and operating in conjunction with the low-speed nozzle and the other two having automatic valves linked together and operating simultaneously.

The high-speed nozzle is controlled by a metering pin actuated by the upper automatic air valve. The stem of the valve is connected to a piston working in the dash-pot, the passage communicating with the float chamber; the dash-pot chamber has direct connection with the high-speed nozzle.

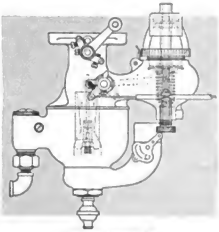
When the throttle is opened the tendency of the air valve to open suddenly and excessively, and to flutter, is checked by the dash-pot piston, which at the same time forces an extra supply of fuel into the nozzle and enriches the mixture for starting; the slow opening of the air valve helps by causing strong suction on the nozzles. These two carbureters are made in five sizes, the 1-inch being recommended for motors of 4-inch bore and either four or six cylinders.—Findeisen & Kropf Mfg. Co., Chicago, Ill.


Rayfield

Schebler Product Unchanged

The two well-known Schebler models will be continued without change for 1915. Model L has a single jet, an automatic air valve and a cam which raises the needle valve as the throttle opens, the latter being adjustable for varying the lift at different throttle openings. Model R is an improvement on the L and has a single jet, but the needle valve is inter-connected with the automatic air valve and its opening increases with that of the fuel valve. A dash-controlled eccentric acting on the needle valve and working in conjunction with a choker in the air intake gives a rich mixture for starting. Both models are suitable for four and six-cylinder motors and are equally adapted for pleasure cars or trucks. No water jackets are used, but hot air connections are furnished for a small extra charge. A dashboard, or steering column adjusting device, is obtainable for model R.

Special outfits are made for 1910-1911-1912 Flanders cars, including 1-inch Model R carbureter, manifold, steering column control, hot-air drum and tubing, gasoline connection and throttle rod, as a complete set. The makers recommend a 1-inch carbureter for a motor of from 15 to 22 horsepower; 1.25 for 22 to 25 horsepower; 1.5 for 35 to 40 horsepower and 1.75 and 2-inch carbureters for 40 to 70 horsepower.—Wheeler & Schebler Mfg. Co., Indianapolis, Ind.


Schebler Model R

Shakespeare Springless

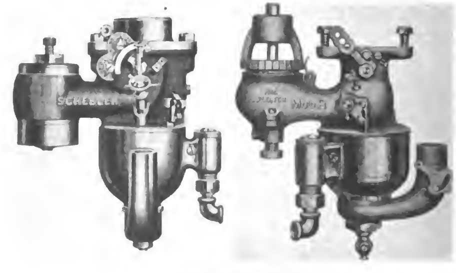
This has no springs in its construction and the gasoline and air are regulated together by means of a mushroom valve that lifts a metering pin out from the main jet nozzle as it rises. In the illustrations the valve is seen in the position it would take when the motor is not running.

The air flows in from an intake at the side of the carbureter and then down under the mixing chamber. Part of this air enters the base of the venturi tube, where it sucks up gasoline, thus forming a very rich mixture which passes out through a narrow circular passage in the valve. The thinness of this passage helps to break up the fuel and to mix it thoroughly. As the suction of the motor increases this valve A is raised, more fuel flows from the nozzle and at the same time the higher position of the valve allows more air to flow around this valve, so that at full throttle opening a large amount of air flows to the motor without passing through the venturi, but this air is mixed with the very rich mixture of gasoline and air which is produced by the air that flows through the venturi tube. Since the flow of mixture as it leaves the valve is at right angles to the passage of the auxiliary air, the two columns are thoroughly mixed when they come together, thus insuring homogeneity and perfect vaporization.—William Shakespeare, Jr., Co., Kalamazoo, Mich.

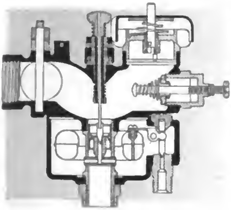
Siro Adds Starting Device

Siro carbureters are made in seven sizes, varying from .75 inch to 2 inches. Few changes have been made for the coming season, the most important being the addition of a device for easy cranking. This consists of a valve that shuts off the main air and enriches the mixture. Hot air pipes are furnished for all models. There are two auxiliary air valves and an adjustable needle valve. The mixing chamber is U-shaped, the throttle valve being at one end and a mechanically operated auxiliary air valve at the other. These valves are so arranged that when the throttle is opened the auxiliary valve opens in exact proportion to it. At the bottom of the U is an initial air tube concentric with the float chamber and in the center of it is the fuel nozzle.

The construction of the needle valve is such that it is connected with the throttle and auxiliary air valve and when the throttle is opened or closed the auxiliary air valve as well as the needle valve opens or closes proportionately.



Schebler Types L and R



Siro

The movement of the needle is effected by a cam. The float is of spun copper, made in two pieces and carefully soldered together.—Siro Carbureter Mfg. Co., Northampton, Mass.

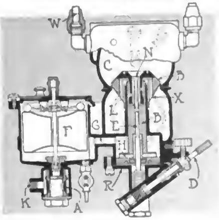
Stewart with New Dash Control

There is a new design Stewart which differs from those types which it supersedes only in some constructional details, the principle and operation being identical with that of all Stewarts. The operation depends upon a metering pin and valve, the two working in unison to automatically measure the amount of air and gasoline that enter the mixing chamber.

The main change in the new model is in the dash control D, shown in the sectional view. This is placed at an angle instead of being horizontal, and has the advantage of easy installation, doing away with the need of universal joints or flexible couplings.

With the exception of the float mechanism, the Stewart carbureter has but one moving part, the metering valve B, which may be taken apart and cleaned without disturbing the adjustment. It goes down over the taper pin E, and, when not operating, seats on the bottom R of the dash-pot. It is in its idle position in the cut.

Gasoline flows from the float chamber through the connection G and the holes H in the lower part of the metering valve into the well around the taper pin E. When the carbureter is at rest a small amount of fuel collects in this well. When the engine starts this is pulled up into the mixing chamber C, and gives a rich starting mixture. As the motor picks up a partial vacuum or suction is created above the metering valve B in the chamber C. This causes B to lift from its seat and to permit air to pass from the chamber L into chamber C. Since pin E is tapered, the more B is raised the greater the opening around E and the more fuel can flow. The height B is raised is, of course, dependent upon the suction, which in turn is in proportion to the engine speed. Therefore, as the suction varies, the height of the metering valve varies, and the volume of air and the amount of gasoline admitted to the mixing chamber must increase or decrease in the same ratio.—Detroit Lubricator Co., Detroit, Mich.



Stewart

New Type Stromberg

An entirely new design is the leading feature of the Stromberg program, this having but a single jet instead of the two nozzles customary in Stromberg practice. One of the basic ideas of the Stromberg designs is the use of a long venturi tube, the idea being that this extra length steadies the flow of air in the venturi, and prevents any disturbance in the action of the jet, which might be caused by eddy currents produced upon the opening of the air valve. Furthermore, the vortex created by the air currents swirling around the upper end of the venturi actually tends to increase the flow past the jet. Thus in the two jet horizontal model the venturi is extended well up into the main passage, and in the new type it is even longer proportionally, coming actually above the junction of the air valve chamber with the main body.

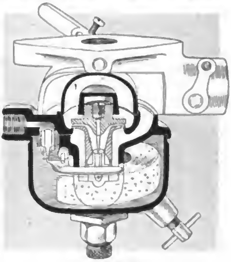
This single jet instrument operates as follows: The air valve opens downwards and in a direction opposite to the incoming air. To the upper end of the air valve spindle the piston A is attached and this piston slides smoothly in its casing, there being holes through the top so as to free the upper side of A to the atmosphere. If, owing to suction of the motor, the air pressure in C drops below atmospheric, then as the area of piston A is greater than the area of the valve proper, the atmosphere acting on A overcomes the atmospheric pressure on the valve, and the latter is opened. Air passes under the venturi and up past the jet all the time, the suction in the venturi being roughly proportional to engine speed so that more gasoline is forthcoming as the motor's demands for mixture increase.—Stromberg Motor Devices Co., Chicago, Ill.

Sunderman Is Simple

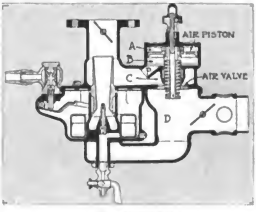
The special feature of the Sunderman is the use of a very wide mixing chamber, having a disk of finely perforated metal spread across it, this plate being of inverted saucer shape. The main air passes up a small venturi and there is a plain jet adjustable by a needle valve. The top of the venturi acts as a guide for a large mushroom valve that permits air to be taken straight into the mixing chamber when the suction is sufficiently strong, and the jet needle being attached to this valve causes the fuel supply to increase with that of the air—Sunderman Safety Carbureter Corp., Newburgh, N. Y.

Webber in One Model

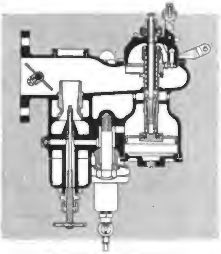
This is a vertical type and has a single jet opening into a strangling tube, surrounded by a float chamber. Directly above the nozzle is a conical valve controlling the fuel opening, a finger resting on the valve being linked to the auxiliary air valve. Normally the fuel valve is closed by a spring, but the opening of the air valve permits the fuel valve to open also. The air valve stem



Shakespeare



New Stromberg



Stromberg, horizontal type

is extended upward and carries a piston working in a cylinder to prevent fluttering. The use of an auxiliary air valve makes it possible to keep the fixed air opening of small size, so that a rich mixture for starting and low speeds is automatically secured.—Webber Mfg. Co., 66 Stanhope street, Boston, Mass.

Zenith Adds Models

In addition to its two standard models, the Zenith Carbureter Co. has added several new types for 1915, one built more particularly for the small car trade and sold at a lower price than the other models, though retaining the standard Zenith features, and a carbureter for eight-cylinder motors has also been developed.

The upright model is the standard Zenith carbureter and another is the horizontal type especially adaptable to block-cast engines which have a type of gasoline feed allowing the carbureter to be mounted high upon the side of the cylinder.

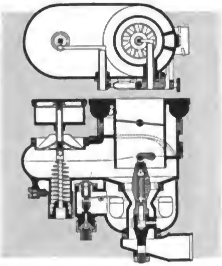
The Zenith principle is a compound compensating nozzle arrangement which is claimed to give a constant ratio of air to gasoline at all motor speeds. The main fuel jet, which is fed directly from the float chamber, is surrounded by the auxiliary jet H, giving rise to the compound construction. The outer jet connects through a small tube K to an orifice T in communication with the float chamber. The supply of fuel in this tube is constant so far as the level in the float chamber is constant, for it depends upon that level for its own height. Thus the supply of fuel given to the outer jet does not increase or diminish with the variation in the suction due to the air passing through the venturi tube.

Main Jet Size Varies

The main jet action is similar to that of any carbureter having one jet, the amount flowing through it being in proportion to the throttle opening which governs the suction. The main jet is furnished in different sizes, that size being used on any particular motor which is shown on trial to give best results.

Naturally, the greater the throttle opening the greater the tendency is to lower the fuel level in the supply chamber, with consequent decrease in the amount of gasoline passing through the outer jet. At the same time the main inner jet acts in the opposite way and gets greater supply and thus the combination serves to compensate for all speeds and give a constant ratio of fuel to air, due to the two jets acting in diametrically opposite direction.

In the Zenith carbureter design there is really a third auxiliary jet, which comes into action only for starting or for slow running. This jet is in a tube which is a part of the mixing chamber, and it opens into the passage to the motor just above the throttle valve. When the throttle is only slightly opened at times of starting, a strong suction is created at the point P, where this third nozzle enters the gas passage and this draws pure gasoline from the well at the bottom of the auxiliary tube, which mixes with the inrushing gases, enriching them as they pass to the motor. When the engine is running very slowly the suction in the venturi tube at the main jets is very low and insufficient to draw enough fuel for proper mixture. The fuel will then rise in the auxiliary tube and will finally pass through the opening at the throttle edge to sufficiently charge the gases.



Webber

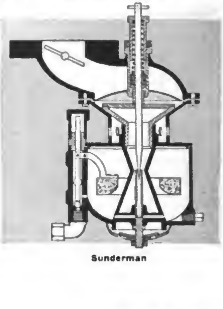
Once the proper nozzle size is determined, it will be noticed that there is no adjustment to the carbureter. For spraying the gasoline used in the starting jet air is admitted to the outer part by the adjustable screw O. This air passes down to the bottom of the jet and is drawn up to P in conjunction with the gasoline. The amount of air let in at O decides the idling speed and ease of starting. The horizontal Zenith is the same in principle as the others, only the mixing chamber is at right angles to the compound jet rather than being concentric with it.

The special duplex model Zenith for eight-cylinder motors was described fully last week, so it is only necessary to add here that it follows the ordinary Zenith principle of operation, but has two jets with the slow-running fittings and two mixing chambers. There is a single float chamber situated between the two horizontal type mixing chambers, and the two throttles are interconnected so that a single attachment to the control suffices. The compound carbureter fits snugly between the two cylinder blocks of a Vee eight motor, and the use of duplex parts reduces the task of tuning up the motor to the same simplicity as with a four cylinder.—Zenith Carbureter Co., Detroit, Mich.

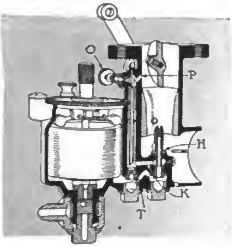
Zephyr Springless

The Zephyr carbureter is a type of instrument in which there are no moving parts. The suction is depended upon to draw the fuel through jets of predetermined size. The main features are the low and the high speed jets. In the sectional view, a form of Zephyr instrument with vertical venturi is shown. When the throttle valve T is open air passes up through the main air intake E, and the greatest suction is created at the point where the venturi reaches its smallest diameter. This is where the main jet J is located. Thus the fuel is sucked up from the float chamber through the passage X and sprayed through the atomizer M into the current of air flowing in through jet tube J. This breaks up the fuel at the point of union, and the whole mixes with the main current of air at the throat of the venturi tube.

When throttle valve T is closed the low speed jet J1 comes into action. The majority of the atomized fuel formed at M in the main jet then is drawn up through the passage Y through a hole in the main jet tube. This is sprayed



Sunderman



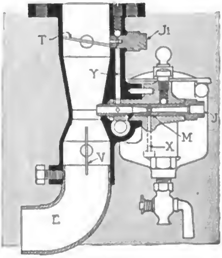
Zenith

through the slow speed jet directly into carbureter tube on the motor side of the throttle valve. This sends a rich mixture to the motor which would otherwise get only a very lean mixture, due to the small amount of air passing through the main passage and past the main nozzle through which only a small amount of fuel is issuing into the main passage.

Jet Adjustment

In order to adjust the carbureter for low and high speed running, the main jet tube J and the throttling tube J' are each provided with four jets of varying sizes which are at right angles to each other around the jet tube. Only the bottom jet, however, is operative, as it is the only one that can register with the fuel passage X or Y as the case may be. Any one of the four jets can be brought into this position over the passage, as the tubes can be rotated from their squared outer ends. Spring-engaged ball-locks seating in indentations in the tubes normally hold the tubes against rotation and also position them so that the jet desired is in register with its tube. Each of the flat faces of the squared outer end is numbered so that the adjuster can tell what one is in position. Jet tubes having different series of jets can be had thus widening the range of adjustment.

For starting, the shutter V in the main air passage can be closed. This shuts off the main air supply and a strong suction on the throttling jet sends a rich mixture to the engine. The cover for the float chamber is so attached that it may be turned to one side in order to expose the float mechanism and thus inspect the float action even when the engine is running. By removing a cotter pin which retains the float lever hinge pin in place, the whole float mechanism can be removed for cleaning or inspection, in most cases without stopping the motor, it is said. A groove cast in the inside of the fuel chamber shows the highest permissable level. Zephyrs are furnished with the venturi tube arranged either horizontally or vertically, and the design also permits of a number of positions of the float chamber with respect to the main body of the instrument.—George A. Breeze, Detroit, Mich.

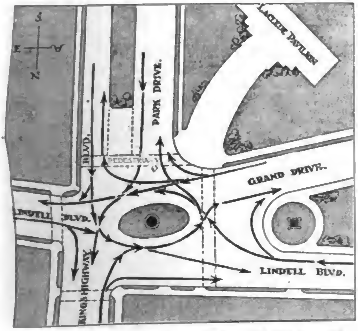


Zephyr

Rotary Traffic System in Force in St. Louis

ST. LOUIS, MO., Jan. 30—The rotary traffic system at the Lindell entrance to Forest Park has now been in effect for 2 months. The new system, which is designed to lessen the possibility of automobile accidents, is in force from 7 o'clock each morning until 6 at night.

Under the system the traffic moves in an oval around a large lamp pole on the west side of Kingshighway, a north and south street, and Lindell boulevard, an east and west lane, which heretofore has been the traffic pole. All vehicle traffic must pass to the right. A new set of traffic rules as laid down by the park commissioner follows:



Rotary traffic system used at entrance to Forest Park, St. Louis, Mo.

"Keep to the right. Drive slowly. Don't get excited and kill your engine. Pedestrians must cross at safety zone. Every vehicle must enter into the line of traffic around the circle and move in the prevailing direction. Traffic around this circle may go in double or triple lines. Northbound vehicles on Kingshighway must go to the right of the traffic officers. Westbound vehicles desiring to enter the park must keep close to the drawn circle. Through eastbound traffic on Lindell boulevard must go around the circle, as is the case with vehicles desiring to go south on Kingshighway. Vehicles wishing to go north on Kingshighway must go to the right of the traffic officers."

It is the plan of the park and street commissioners to paint white lines across the boulevards at the street intersections hence pedestrians who heretofore have cut across the park entrance in a haphazard way will be required to stay within the denoted lines. Thus the traffic of the pedestrians will be centered in a definite area so that the motorists will know where to find the pedestrians and vice versa.

The distances across the park entrances are 230 feet and 175 feet. The new plan requires pedestrians to walk only 36 feet from one safety zone to another. It also reduces the collision points where traffic lines going in opposite directions cross, from 120 to six.

The entrance to Forest Park always has been considered the most difficult traffic problem in St. Louis. Six traffic policemen formerly stood on duty here, but with the new rules three will see that the recent regulations are enforced. Signs will direct the drivers.

The AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, February 4, 1915 No. 5

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
231-241 West 39th Street, New York City

BRANCH OFFICES
Chicago—910 South Michigan Avenue Detroit—95 Fort Street, West
Boston—1035 Old South Building Cleveland—516-517 Swetland Building

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

ADVERTISING
T. B. Van Alstyne, Advertising Manager
W. I. Ralph B. Methewson Louis R. Smith
Howard L. Spohn H. H. Gill James P. Hunting
F. B. Barnett, Cleveland C. H. Gurnett, Chicago Chas. Anthony, Detroit
Guy W. Motz, Cleveland F. J. Robinson, Chicago

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Carburetion

IT would seem sufficiently easy to make a good combustible gas from gasoline and air, but the immense number of designs for carbureters shows that it is in reality quite difficult to make such gas under the conditions prevailing on an automobile. There is a greater variety of feature between carbureters than between motors, transmissions or even magnetos. The very electric generators and cranking motors show less difference in detail than can be found among any half dozen carbureters, and this is the more amazing because the carbureter is the most essential portion of the chassis. Without a carbureter the finest automobile ever constructed is merely a beautiful exhibit of workmanship; it is as useless as a steamship with no boilers. It would be rational to expect 10 years and more of earnest endeavor to bring one nearer to finality, nearer to a standardized idea, than the carbureter manufacturers have been able to do. That it has not been possible to come to agreement concerning more than a few fundamental points shows that we may still hope for a far greater carbureter efficiency. The advances made in the production of power, in the economy of gasoline consumption and in simplicity of control are very great if we look back for a decade and remember what sort of a thing the carbureter was at that time; so in anticipating better things still we do so in no carping spirit. Let us rather congratulate the men who have made the carbureter what it is today, and add that with so much of success to their credit they have established a reputation for progressiveness which the world will look to them to maintain.

Better Bodies

OUR body builders, as well as our car manufacturers, may well point with pride to the recent national shows as typifying the marked progress which has been made during the past year. As compared with the cars of 1914, those of 1915 are fitted with bodies which are at once distinctive and graceful in appearance and serviceable and sensible in construction.

While European practice is responsible for much of the improvement, there is an encouraging element of initiative and enterprise on the part of our American body designers which is apparent in many ways to one making a study of the types on the market for the current season. This is a side of our body industry which must be cultivated and developed, the war in Europe rendering the present time an excellent opportunity to surpass the foreign builders' creations both in beauty and in the perhaps more essentially American respects of comfort and utility.

A natural development of American conditions, the all-weather car, appears this year in more numerous and varied styles than ever before, the high degree of all-around usefulness of the type, combined with the reasonable price possible, rendering it exceedingly popular. The originality displayed in designing these bodies is highly commendable, while the improvement in harmony and common sense in touring car construction and in reconciling luxury of finish with durability in closed car designs entitle the body makers to the congratulations of the entire industry.

But we must not stop here. Each succeeding year must see improvement; perhaps not in such marked degree as distinguished the past year, but still constant improvement. And the car maker and the accessory manufacturer must co-operate with the body builder to work toward greater simplification, stronger construction with less weight, increased refinement, lower prices and, above all, that great ideal, beauty of line and harmony of car units, so that all shall blend into a car as nearly perfect as it is possible to construct, with no discordant note to jar its symmetry.

And we must not forget that each advance that is made in one branch of the industry will have its effect on the other branches, thus rendering progress more or less uniform and consistent from year to year.

Because of this aspect of the situation, better bodies mean better chassis and better accessory fittings, and vice versa. The progress made in body design is reflected in the chassis, and the improvement in accessory development keeps pace with other developments in the industry.

61,599 Car Owners in Canada in 1914

Increase of Nearly 100 Per Cent. Since 1912—Gain of 20,279 Over 1913—Ontario Leads with 25,258

MONTREAL, QUE., Feb. 2—A remarkable growth of automobile owners in the Dominion is apparent by the fact that in the past 2 years the number of cars owned in Canada has increased almost 100 per cent., the actual figures being, 32,276 in 1912; 41,320 in 1913 and 61,599 in 1914. The Province of Ontario is easily first in the ownership of automobiles, her total being 25,258. The Province of Quebec maintained the ratio of increase with 3,579 automobiles and sixty-five trucks in 1912, as compared with 7,025 automobiles and 299 trucks in 1914.

PROVINCE	1914	1913	1912
Alberta	4,717	3,440	2,835
British Columbia	6,523	6,354	4,666
Manitoba	6,800	4,876	3,943
New Brunswick	1,240	789	700
Nova Scotia	1,253	1,000	867
Ontario	25,258	15,255	11,939
Prince Edward Island	Motorists are restricted to 2 days in the week		
Quebec	7,025	4,076	3,579
Saskatchewan	8,783	6,513	3,742
Yukon	No returns	17	5
Total	61,599	41,320	32,276

N. Y. Registrations 169,966 in 1914

NEW YORK CITY, Jan. 29—Twenty-five per cent. more licenses were taken out in this State in 1914 than in the previous 12 months, according to official figures given out by Secretary of State F. M. Hugo. There were 169,966 registrations in 1914, as compared with 134,405 in 1913; the comparative receipts $1,529,852 and $1,275,727, an increase of $254,125.

Export Club of Detroit Formed

DETROIT, MICH., Jan. 30—Following a luncheon given at the Board of Commerce, yesterday, in honor of William C. Downs, commercial attaché of the U. S. in Melbourne, Australia, the Export Club of Detroit was formed. Many prominent business men whose specialty is the export business were present at the meeting and it was considered that Detroit's importance from the export point of view is rapidly becoming such that it will greatly benefit the manufacturers and business in having an organization which will devote all of its time to promote and further the interests of those concerns doing an export business. Among the representatives from the automobile industry present at the luncheon were John A. Olt, foreign manager of the Hudson Motor Car Co.; C. R. Cook, export manager of the Cadillac Motor Car Co.; J. L. Hibbard foreign manager of the Studebaker Corp.; H. F. Vortkamp, president of the National United Service Co.

Edison to Build Benzol Plant

PITTSBURGH, PA., Feb. 1—Thomas A. Edison will erect a by-product plant to extract benzol from coking coal at the plant of the Cambria Steel Co.

England Offers Opportunities to Makers

LONDON, ENGLAND, Jan. 15—Admirable efforts are being made by many American truck and tire making firms to firmly establish themselves in this market but it is rather poor policy for many firms to spend money on such enterprises unless they are marketing the kind of merchandise that is wanted in this country. There could not be any more opportune time to establish truck agencies or branches, but these vehicles must follow conventional European lines having the motor under a forward hood or bonnet. It is practically useless to attempt to market trucks with motors under the floor boards as this type of vehicle is not popular in England. Gasoline trucks of 3, 4 and 5-ton capacity are much in demand here at present.

Electric truck makers, who are going to attempt the British market, would be better off by opening branches than agencies. The Britisher here knows very little about electrics and is not even familiar with their good selling points. It will take some time to introduce them.

Previous to the war approximately 65 per cent. of the solid tire business was done by German firms and there is no more opportune time for American makers of tires to get established, providing they build the solid-base tire. The squat-section solid tire that has been offered by several American makers is not quite suited for London, a deeper section being preferred.

$1,000 Truck Subject of S. A. E. Discussion

NEW YORK CITY, Jan. 29—If the discussion following the paper on the possibilities for the sale of American-made motor vehicles in Europe after the war, read by A. Ludlow Clayden before the meeting of the Metropolitan Section of the Society of Automobile Engineers, can be taken as a criterion, a much greater interest will be felt in the truck field than in the passenger car line. In spite of the effort on the part of the chair to bring the discussion back to passenger cars the field of the truck occupied almost the entire part of the meeting devoted to this discussion.

The discussion brought out one fact more strongly than any other, and that is that there does not seem to be any definite idea as to what vehicle would be most suited in the way of a commercial car for all-around purposes in Great Britain and on the Continent. Many of the speakers pointed out that our American method of rating trucks would not correspond to the English method. The reason assigned for this is that the European buyer has not been educated up to the point of respecting capacity ratings. If he buys a 1-ton truck he is prone to load it to the extent of a ton and a half. Correspondingly with trucks of greater capacity he is apt to load them to a greater amount than that called for in the specifications. The result has been that makers have cut their ratings because they know that the users will not respect them, and in order to be on the safe side they are forced to give a low figure.

Another point brought up was that the English buyer of commercial vehicles does not expect the extended service required by the American buyer. In fact, to a large extent, when the sale is closed the transaction is ended, whsreas in America when the truck sale is closed the transaction has only begun, and as many of our manufacturers put it, they are selling service and not trucks.

The request of the author of the paper for a good 1-ton truck brought forth the prediction that such a vehicle would be available before long, although it seemed to be the general consensus of opinion that the identical truck wanted by the English for all-around use is not as yet being produced in this country.

The small amount of discussion on the passenger car seems to show that the principal market would be a direct replacement of a large number of cars which are being destroyed as a direct effect of the war. Another reason for a development of both the passenger car and commercial car market is in the large mortality of horses.

John R. Eustis, who spoke later on the uses of automobiles in the present war, brought up the thought that after the war there would be a large amount of used cars suddenly thrown on the market which might have a definite effect upon the purchase of the lower priced cars. Mr. Eustis gave a short lecture and showed a large number of lantern slides illustrating war automobiles of all kinds in various places.

INDIANAPOLIS, IND., Feb. 1—The eight-cylinder car will be discussed from every angle by prominent engineers in Indianapolis, February 16, at a special meeting of the Indiana Section of the Society of Automobile Engineers. The small bore, high-speed type motors will also be discussed at the meeting.

Jeffery Gets French War Order

100 Quads Worth $350,000—50 for Immediate Delivery—Balance 25 Per Week

CHICAGO, ILL., Feb. 1—The Thomas B. Jeffery Co., of Kenosha, Wis., has sold 100 of its Jeffery Quad trucks to the French Government, it was announced today, an order approximating $350,000 in value. The order specifies the delivery of fifty immediately, with the remainder to follow at the rate of twenty-five a week. The Quads will be fitted with the same style of body as used in the United States army, a box type with a bow top and a cab driver's seat.

The Jeffery company already is well represented in the European war, France having previously purchased fifty of the chain-drive type of Jeffery truck. The Canadian contingent took with it sixty of the Quads; England has bought twenty-five of them and Russia twenty-five.

More Trucks Leave for War Zone

LIMA, O., Jan. 30—The first consignment of motor trucks shipped from Lima, Ohio, for use in the European war left the Gramm factory recently, consigned to New York. The order for these trucks was received in November and the Willys-Overland Co. of Toledo booked it. That was before the reorganization of the Gramm Motor Truck company under the Geiger-Jones company of Canton.

The trucks are of the 3-4-ton type and will be included in an order of 3- and 4-ton trucks made at the Toledo and Elyria factories. All will be tested in New York before being shipped to the war zone. The Gramm trucks will be used in the distribution of supplies while the heavier trucks will be used to transport equipment. The order from the Gramm plant was for twenty-five trucks.

MILWAUKEE, WIS., Jan. 30—The Sternberg Motor Truck Co., West Allis, Milwaukee, is making final deliveries on an order for 100 Sternberg motor trucks for the allied armies of Europe. Most of the trucks are consigned to Russian ports. Each car has been given a 300-mile test with rated capacity load. An interesting feature of the tests was the fact that each truck made frequent trips from West Allis to Waukesha, Wis., where the Sternberg motors are built by the Waukesha Motor Co., carrying scrap on the out trip and finished motors on the return trip.

Briscoe Leases Cutting Plant—May Buy

DETROIT, MICH., Feb. 3—*Special Telegram*—The Briscoe Motor Co. has leased for 1 year the old Cutting plant in Jackson, Mich., with privilege of purchasing it. The Briscoe company will use this plant for motor assembling, painting and trimming and thus will give employment to about 300 more men.

INDIANAPOLIS, IND., Feb. 2—About March 1, C. C. Hanch will give up his active connection with Nordyke & Marmon Company to accept an important post in the executive organization of the Studebaker Corporation, of South Bend.

RICHMOND, IND., Feb. 1—T. H. Hill who has been treasurer and general manager of the Pilot Motor Car Co. for some time, has resigned his position and his place will be taken by George E. Seidel, president of the Pilot company. Mr. Seidel is also president of the Seidel Buggy Co.

Republic Rubber's $3,000,000 Issue Approved

YOUNGSTOWN, O., Jan. 29—Approval was voiced at the annual meeting of the stockholders of the Republic Rubber Co., this city, on a preferred stock issue of $3,000,000. Formal action will not be taken until a special meeting to be called in February.

Of the proposed issue but $2,500,000 will be required to replace stock of this character yet outstanding, which matured September 1, 1914. The remainder will be available for plant extensions contemplated as business warrants.

The former board of directors and its officers were re-elected. Members of the board are T. L. Robinson, L. T. Petersen, J. H. Kelly, A. H. Harris, M. I. Arms, John Tod, David Tod, J. G. Wick, Robert Bentley, and H. K. Wick. Officers are: President, T. L. Robinson; first vice-president and sales manager, J. H. Kelly; secretary, C. F. Garrison, and treasurer, M. I. Arms.

Mitchell Business Large—Debts Small

RACINE, WIS., Feb. 1—Reports of officers of the Mitchell-Lewis Motor Co., Racine, Wis., presented to the annual meeting, showed that during the period from August 1, 1914, to January 1, 1915, the company manufactured and sold more Mitchell cars than during any similar period in the history of the company. The report of President McClaren showed that the debt condition is lower than at any time in the company's existence; that the volume of business, number of men being engaged, number of dealers, and the financial position are larger and stronger at this time than at any time since the concern was founded in 1834. The annual election resulted as follows:

President, H. L. McClaren; first vice-president, John W. Bate; second vice-president, William T. Lewis; treasurer, Frank L. Mitchell; secretary and assistant treasurer, William H. Armstrong; comptroller, Martin J. Gillen; sales manager, Otis C. Friend. The officers enumerated here also comprise the board of directors. Mr. McClaren also occupies the position of general manager and Mr. Bate that of chief engineer and factory superintendent.

Automobile Securities Quotations

NEW YORK CITY, Feb. 2—Although the general tone of the market for the past week was slightly weaker than for the preceding 7 days, a number of the stocks showed substantial gains. Kelly-Springfield continued its upward trend by going 4 points higher on the common and 7 on the second preferred. Increased manufacturing activity and in orders received was probably largely responsible for the four point increase of Case preferred. General Motors continued strong, the common gaining 3 points and the preferred 2. Maxwell common and first preferred gained 1-2 and 1 point, respectively, while the second preferred lost 3-4 point. Other stocks which were lower than last week are: Reo, Car and Truck, each 1-2 point; Studebaker common 1-2 and preferred 2 and U. S. Rubber common 1 and preferred 2. Oils were weak, Texas being 2 lower than last week and Vacuum 4. Stewart-Warner common lost 3 points, but the preferred gained 2.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	200	..	250	..	..
Ajax-Grieb Rubber Co. pfd	98	101	100	..	..
Aluminum Castings pfd	97	100	95	100	..
J. I. Case pfd	..	..	79	81	+4
Chalmers Motor Co. com	..	92	..	96	..
Chalmers Motor Co. pfd	93	94½	90	93½	..
Electric Storage Battery Co	..	..	..	..	..
Firestone Tire & Rubber Co. com	246	252	370	375	..
Firestone Tire & Rubber Co. pfd	105	107	109	111½	..
General Motors Co. com	63	65	93	95	+3
General Motors Co. pfd	86	88	95	97	+2
B. F. Goodrich Co. com	25	26	30¾	31	+ ¾
B. F. Goodrich Co. pfd	89	91	96	97½	..
Goodyear Tire & Rubber Co. com	220	230	193	196	—1
Goodyear Tire & Rubber Co. pfd	100	102	101¾	102½	— ¼
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	..	..	..
International Motor Co. pfd	..	15	..	..	..
Kelly-Springfield Tire Co. com	59	60	97	100	+4
Kelly-Springfield Tire Co. 1st pfd	126	128	82	83	..
Kelly-Springfield Tire Co. 2d pfd	..	..	112	116	+7
Maxwell Motor Co. com	4½	5	17	17½	+ ½
Maxwell Motor Co. 1st pfd	26½	27½	54	56	+1
Maxwell Motor Co. 2d pfd	8	8½	20¾	21¼	— ¾
Miller Rubber Co. com	..	..	158	165	..
Miller Rubber Co. pfd	124	130	101	103	..
Packard Motor Car Co. com	..	..	..	100	..
Packard Motor Car Co. pfd	95	99	93	..	..
Peerless Motor Car Co. com	15	25	13	20	—2
Peerless Motor Car Co. pfd	75	80	..	55	..
Portage Rubber Co. com	..	40	30	36	..
Portage Rubber Co. pfd	..	90	80	85	..
*Reo Motor Truck Co	7	7½	11½	12	— ½
*Reo Motor Car Co	16	16½	24½	25	— ½
Splitdorf Electric Co. pfd	40	50	69	71	..
Stewart-Warner Speed. Corp. com	52	54	48	50	—3
Stewart-Warner Speed. Corp. pfd	96½	..	101	103	+2
Studebaker Corporation com	27	28	41½	42¼	— ½
Studebaker Corporation pfd	82	85	92	93½	—2
Swinehart Tire & Rubber Co	69	71	69	71	..
Texas Company	..	..	131	135	—2
U. S. Rubber Co. com	59½	60	56	57	—1
U. S. Rubber Co. pfd	102	102½	102	104	—2
Vacuum Oil Co	213	216	195	198	—4
White Company pfd	105	110	108	110	..
Willys-Overland Co. com	62	64	90	91	—1¼
Willys-Overland Co. pfd	91	95	93	95	..

---

*Par value $10; all others $100 par value.

Market Reports for the Week

NEW YORK CITY, Feb. 3—Unusual changes occurred in the metal markets in this week's market reports. Tin went up $2.88 per 100 pounds, closing at $37.88. Sales at this price are scarce. Lead went up $0.12 1-2 per 100 pounds. This metal was quiet and less firm. Antimony closed at $0.17 at a gain of $0.01 and both electrolytic and Lake coppers went up in prices, the former 1-2 cent and the latter 3-8 cent. A small demand in electrolytic is reported. According to London cables the supply of standard copper available in Great Britain and France, including supplies afloat at the beginning of February, were 35,500 tons; deliveries during the last fortnight having been 300 tons more than supplies. Fine Up-River Para rubber dropped to $0.59, after a fluctuating week. There were no changes in the oil and lubricants markets.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.16	..	.17	.17	.17	.17	+.01
Beams & Channels, 100 lbs.	1.21	1.21	1.21	1.21	1.21	1.21	......
Bessemer Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Copper, Elec., lb.	.14⅛	.14⅝	.14½	.14½	.14⅝	.14⅝	+.00½
Copper, Lake, lb.	.14⅜	.14⅜	.14⅝	.14⅝	.14¾	.14¾	+.00⅜
Cottonseed Oil, bbl	6.91	6.95	7.00	7.00	7.07	7.15	+.24
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	3.67½	3.67½	3.80	3.80	3.80	3.80	+.12½
Linseed Oil	.60	.60	.60	.60	.60	.60	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.55	.55	.55	.55	.55	.55	......
Petroleum, bbl., Pa., crude	1.50	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.71	.71	.71	.71	.71	.71	......
Rubber, Fine Up-River, Para	.62	.62	.61	.60	.59	.59	—.03
Silk, raw, Ital.	..	3.90	..	..	3.90	3.90	......
Silk, raw, Japan	..	3.45	..	..	3.45	3.45	......
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	35.00	36.00	37.00	37.25	38.00	37.88	+2.88
Tire Scrap	.05	.05	.05	.05	.05	.05	......

Goodrich and Fisk Cut Tire Prices—Others May Follow Soon

AKRON, O., Feb. 1—The B. F. Goodrich Co. has adopted a new method for quoting dealers' prices and at the same time has made a reduction in prices to the consumer. The new method of quoting eliminates the percentage basis and gives straight prices to both the dealer and consumer. That no percentage scheme has been followed will be evident from the prices on the new tire sizes which have been built up from cost, thus allowing each tire size to stand by itself without depending on a more popular size for its profit. The table of old and new prices for plain tread tires follows:

PLAIN TREAD SIZE	OLD	NEW	REDUCTION
30 x 3	$11.70	$9.00	$2.70
30 x 3 1-2	15.75	11.60	4.15
32 x 3 1-2	16.75	13.35	3.40
34 x 4	24.35	19.05	5.30
36 x 4 1-2	35.00	27.35	7.65
37 x 5	41.95	32.30	9.65

Although formal announcement of other price cuts have not been made by many other makers, as yet, it is expected that some of the other big makers will join in the downward revision. This is evident by the fact that the Fisk Rubber Co. has already sent announcements to the trade covering new price lists for consumers and preferred trade, taking effect on February 1. The cut in price is said to be due to the lower cost of crude rubber resulting from the increased supplies from the Far East since the raising of the embargo. That the readjustment of prices is complete is shown by the following list of prices on Fisk Q. D. clincher tires:

PLAIN TREAD SIZE	OLD	NEW	REDUCTION
30 x 3 1-2	$16.60	$11.60	$5.00
32 x 3 1-2	17.65	13.35	4.30
34 x 4	25.65	19.40	6.25
36 x 4 1-2	36.85	27.35	9.50
37 x 5	44.15	32.30	11.85

United States, Braender, Thermoid, Ajax, Kelly-Springfield, McGraw and Knight have not as yet decided upon any price change. Ten days ago the Republic company lowered its prices 10 to 12 per cent. to the consumer on casings.

Goodrich 1914 Profits $5,440,000

Total Undivided Profits Now $3,177,400—Quick Assets Show Gain of $2,950,000

AKRON, O., Jan. 29—The B. F. Goodrich Co., this city, earned in 1914, 5.65 per cent. on its $60,000,000 common stock, compared with 0.83 per cent. in 1913 on the same stock. The net profits for 1914, ended December 31, approximated $5,440,000. This amount added to the surplus on December 31, 1913, $705,900, brought the total undivided profits up to $3,177,400, after deducting the four quarterly dividends of 1 3-4 per cent. on the preferred stock outstanding, together with a provision of $900,000, July 1, 1914, for the redemption of preferred stock, as called for by the articles of incorporation.

The report states that the company's financial position was materially strengthened during the past year, the amount of quick assets over current liabilities on December 31 last showing a gain over the previous year of approximately $2,950,000. The contingent liability in respect of bankers' loans made on behalf of the Société Française—B. F. Goodrich, and which existed at December 31, 1913, has been entirely liquidated. The company has on hand cash to the amount of $4,175,000 and has no bills payable outstanding. The current assets amount to approximately $20,300,000 and the current liabilities to $1,470,000. The company has no bonded debt.

At the regular quarterly meeting of the directors held on January 27 there was retired, subject to the approval of the stockholders at their annual meeting on March 10, 11,000 shares of preferred stock, which, together with 9,000 shares appropriated at the July meeting of the board, makes a total retirement of 20,000 shares.

The company holds 20,587 shares of preferred in its treasury, paying dividends on them. In the hands of the public there will remain of the original $30,000,000 preferred issue $25,941,300 after the retirements up to July 1 this year. The company is very evidently reducing its outstanding shares, so that these shall be more in line with year in, year out earnings.

In connection with the dividend policy of the company the report states that, although a dividend of 3 1-2 per cent. was declared on the preferred stock, 1 3-4 per cent. payable April 1, and 1 3-4 per cent. payable July 1, at a recent meeting, no action was taken or contemplated in the near future regarding dividends on the common stock.

The preliminary statement of the company for 1914 is compared as follows:

	1914	1913	Changes	
Cash on hand	$4,175,000	$723,053	Inc.	$3,451,947
Bills payable	......	2,799,736	Dec.	2,799,736
Current assets	*20,300,000	723,053	Inc.	19,576,947
Current liabilities	*1,470,000	3,505,974	Dec.	2,035,974
Net profits	*5,440,000	2,599,747	Inc.	2,840,253
Div. on pfd. stock	2,048,500	2,100,000	Dec.	51,500
Balance	3,391,500	499,747	Inc.	2,891,753
P. C. common stock	5.65	0.83	Inc.	4.82
Com. stock dividend	....	600,000	Dec.	600,000
Pfd. stock redemp.	900,000	....	Inc.	900,000
Previous surplus	705,982	802,235	Dec.	100,253
Final surplus	3,177,483	705,982	Inc.	2,471,501

*Approximately.

Fisk 1914 Profits Increase $336,204

CHICOPEE FALLS, MASS., Jan. 29—The fiscal report of the Fisk Rubber Co., this city, which ended October 31, 1914, shows an increase in net profits of $336,204 over 1913, the net profits for 1914 being $942,204. The surplus for 1914 shows an increase of $229,725, the 1913 surplus being $285,833 and the 1914 surplus being $350,000. The 1913 surplus includes a $42,777 dividend on the preferred stock of the Fisk Rubber Co. of Delaware. Out of the net profits made in the fiscal year 1914 there were retired on December 31, 2,250 shares of first preferred stock. Statement follows:

	1914	1913	Increase
Net profits	$942,204	$606,000	$336,204
Inventory reserve	160,000	117,688	42,312
Balance	$782,204	$488,312	$293,892
Preferred dividends	350,000	285,833	64,167
Surplus for year	$432,204	$202,479	$229,725

Dewar Trophy for Coke-Burning Bus

Automatic Stoker Replaces Kerosene Burner on Standard Type of Steam Omnibus

LONDON, ENG., Feb. 1—A motor omnibus run by steam generated from coke is the latest novelty in this city. The Royal Automobile Club has awarded to the National Steam Car Co., the Dewar Challenge Trophy for the most meritorious achievement of the year in automobile engineering.

Instead of having a furnace fed with paraffin, the new omnibus automatically stokes itself with coke. The bunkers are inside the bonnet and surround the boiler. Thus not only is the coke kept dry and warm, but also it acts as lagging to the boiler and prevents loss of heat.

It is a small vertical boiler, with the furnace underneath; and mechanical feeders, which may be likened to the fingers of a hand, pass the coke downward to the fire. An ingenious device prevents clinkering. The bunkers, which can be easily replenished, hold sufficient coke for a run of 50 to 60 miles.

On a 100-mile trial trip to Brighton and back a lorry weighing with its load 6 1-2 tons used 446 pounds of coke in 109 1-2 miles and ran 87 3-4 miles before it was necessary to stop for water. The average speed was 12 miles an hour, and the cost for fuel is less than one-third that of an omnibus using paraffin for steam generating.

Manchester, Eng., Show for April 16

MANCHESTER, ENG., Feb. 1—The North of England Motor Shows, Ltd., will conduct an automobile show in this city on April 16 to 24. The show will be held at the Manchester Ice Palace and will include automobiles, commercial vehicles and accessories.

English Efficiency Test of Cord Tires Shows Fuel and Power Economy

LONDON, ENG., Jan. 27—Some interesting tests have just been carried out on the Brooklands race track, to make comparisons between the behavior of tires made with the well-known system of interlaced cords instead of canvas lining and tires of other makes.

The tests consisted of gasoline consumption tests of a car fitted first with Palmer tires and secondly with ordinary canvas covers. In each case the tires had been inflated to 60 pounds front and 72 pounds back. The weight of the car was 2 tons 4 cwt. and the size of the tires was 34 by 4 1-2 inches. With the car shod with ordinary canvas covers the gasoline consumption worked out at 18 miles, 897 yards to the gallon, while with the Palmer tires fitted the mileage improved to 20 miles 782 yards.

Then speed tests were held under similar conditions as regards the wheels. The throttle was fixed at a point which provided a speed as close as possible to 30 miles an hour, and with the ordinary tires 31.68 miles were covered in the hour, and with the Palmer 33.89 miles. This test having been concluded, a coasting test was made, which produced some exceedingly striking results. The car was released on a gradient of 1 in 12 over a distance of 120 feet, and from a standing start with ordinary tires fitted coasted 1,118 feet, attaining a maximum of 21½ miles an hour, whilst when running on Palmer cord tires it coasted 1,746 feet, attaining a maximum of 24½ miles an hour.

Marvel-Equipped Oakland Makes 23.7 M. P. G.

CHICAGO, ILL., Jan. 28—In a blinding wind, and on one of the coldest days of the year, an Oakland 37 roadster with a Marvel carbureter, yesterday made an official economy run on Chicago's boulevards, and accomplished 23.7 miles on 1 gallon of gasoline. The economy test was held under the sanction of the American Automobile Association, the test being supervised by Darwin S. Hatch of *Motor Age*, representing the Contest Board of the A. A. A.

The car was driven by Al. Meisner of the Chicago Oakland branch, and with him rode E. A. Turner of the Chicago Automobile Club, as observer. The gasoline and oil used was supplied by the Texas Oil Co., and according to the official report the fuel was 61.25 Baumé gravity at 36 F. This would be 63.65 Baumé at 60 degrees F. The gallon measure was stamped correct by the city sealer of Chicago, and speedometer was checked for accuracy.

The Oakland that made the best mileage was a model 37 four-cylinder car of 3 1-2 by 5 inches, bore and stroke, and was fitted with a Marvel carbureter, Delco electric system, Stewart vacuum fuel feed, and Goodyear 33 by 4-inch tires. The roadster, according to the officially balanced scales, weighed 2,875 pounds with its load, and 2,510 pounds empty.

Federal Cuts Price—Adds 3 1-2 Tonner

DETROIT, MICH., Jan. 29—A feature of the 3-days convention of the dealers of the Federal Motor Truck Co., which was held last week, was the decision to lower the price of the 1 1-2 ton worm-drive Federal from $1,900 to $1,800 and the addition of a 3 1-2 ton worm-drive chassis to sell at $2,800. The various discussions among dealers and factory men also brought about some minor constructional changes.

G. M. Truck Holds Convention

PONTIAC, MICH., Feb. 1—A 3-days convention of the district sales managers of the General Motors Truck Co., started today. According to all present, and they came from all parts of the United States, the automobile truck business outlook is decidedly encouraging.

150 Cadillac Men in Session

DETROIT, MICH., Feb. 2—More than 150 Cadillac dealers were present this morning in the convention hall of the Hotel Ponchartrain, when the annual convention of the Cadillac Motor Car Co.'s sales organization was opened. During the 3-day convention all matters relating to the welfare of the business from every angle will be discussed between the dealers and chiefs of the various departments of the Cadillac company. There will be entertainments and a big banquet.

Associated Garages of America Formed

CHICAGO, ILL., Feb. 1—The Associated Garages of America, the national association of garagemen, was organized in this city, January 27. Robert Bland, of Evanston, Ill., former president of the Garage Owners Assn. of Illinois, was made president. F. A. Beane, president of the Detroit garagemen, was named treasurer. W. L. Rudd was made vice-president.

CLEVELAND, O., Jan. 30—Erecting a factory under a tent: The Willard Storage Battery Co. is building a plant 300 by 100 by 30 feet beneath a 5,000 square yard spread of canvas, and it is to be finished in 3 weeks. Under the big tent there are 570 workmen and building is going on 24 hours a day. Steam pipes laid against the brick walls assist in quick drying. The building was started on January 10 and is to be finished February 1. This is the third building to be erected on the new 10-acre site of the company, and it is planned to have fourteen by the first of January, 1916.

Claims Floating Spider Infringes

Kardo Suit Against Former Reo Representative Is Heard—Decision Expected in 10 Days

CLEVELAND, O., Jan. 30—That the Reo Motor Car Co., in adopting in its bevel gear drive a compensating mechanism termed a floating spider, infringed on patent No. 792,690, issued to Alanson P. Brush, of Detroit, is the allegation of the Kardo Co., substituting for the American Ball Bearing Co. in action against Henry J. Adams, former representative of the Reo factory and dealing locally as the Reo Motor Sales Co.

Judge John H. Clarke heard testimony and arguments of the attorneys, opening the case last Friday. This final hearing follows that of the American Ball Bearing Co. against Edward B. Finsh, representing the Chalmers Motor Co. In the Chalmers case Judge Clarke will be unable to render an opinion for a week or 10 days. He has found it necessary to review the legal citations and to study the history of the case.

Direct evidence was heard in the Reo case Friday and Saturday, and rebuttal testimony was given Monday and Tuesday. Witnesses Monday were Charles E. Duryea, H. T. Thomas, chief engineer of the Reo company; Walter C. Baker, Fred C. Dorn, treasurer of the American Ball Bearing Co.; Phillip Dorn, with the American Ball Bearing Co., and Donald C. Carpenter, professor of mechanical arts in Cornell University.

The Kardo Co. "fell heir" to the suit against the Reo representative when it took over the patents of the American Ball Bearing Co. The bill of complaint was filed June 25, 1913, and the case was transferred to The Kardo Co., October 3, 1914.

The mechanism in question has to do with light, quiet running operation of an automobile, and the complaint alleges the compensating gear arrangement is the same as that for which Mr. Brush received a patent which he assigned to the American Ball Bearing Co. Prior art testimony was introduced by the defense.

To familiarize himself with all the conditions that have arisen in these automobile patent suits Judge Clarke questioned Walter C. Baker concerning the organisation and aims of The Kardo Co. Mr. Baker explained that patents of the Peerless Motor Car Co., the Packard Motor Car Co., The American Ball Bearing Co. and the Baker Motor Vehicle Co. were so similar that each had been threatening the other with legal action. As a means for the solution of all the dissension and better control of the patents which each organisation held the Kardo Co. was formed.

Judge Clarke expects to close the Reo case Wednesday or Thursday, and it will be 2 weeks before he can render an opinion, it is believed.

Counter Charges Made in Ritz Suit

NEW YORK CITY, Feb. 1—The Driggs-Seabury Ordnance Corp., Sharon, Pa., has filed its answer in the suit of the Ritz Cycle Car Co., of this city, which recently asked for $50,000 damages, alleging that the Driggs-Seabury corporation failed to carry out its part of an agreement entered into April 8, 1914. In its answer the Driggs-Seabury corporation denies that the Ritz Cycle Car Co. has been irreparably injured by any of its acts and asks for the dismissal of the bill of complaint for lack of jurisdiction inasmuch as the Driggs-Seabury Ordinance Corp. has no designated agent in the state of New York or in the southern district of New York. The agreement in question, it alleges, was entered into at Sharon, Pa.

The answer goes on to charge that the Ritz company did not furnish workmanlike drawings, plans and specifications of the car in accordance with the agreement in sufficient time to permit the manufacture of the cars in the time specified. It also alleges that payment was refused on the two notes for $2,500 each, given by the Ritz company to cover, among other things, the necessary dies, jigs, tools, etc., for the manufacture of the car. The answer claims that the agreement provided that in the event of its cancellation the Ritz company should assist the Driggs-Seabury corporation in marketing any cars left on its hands. It alleges that the Driggs-Seabury corporation spent $2,337.17 in building a car at the order of the Ritz Cycle Car Co., for which it has never been paid. With protest fees on the two unpaid notes and accrued interest the Driggs-Seabury corporation claims the Ritz Cycle Car Co. owes it $7,339.72. It asks dismissal of the bill of complaint, denial of the Ritz company's application for injunction, with costs in favor of the Driggs-Seabury corporation and for a judgment against the Ritz Cycle Car Co. of $7,339.72 with interest. The suit is in the U. S. district court for the southern district of New York.

Charges Infringement of Bumper Patent

NEW YORK CITY, Feb. 1—Suit has been brought against the Charles Weiland Co. of this city by Allan L. McGregor, Chicago, Ill., charging infringement of his patent No. 1,088,832 covering a bumper construction. McGregor asks for an injunction and damages. The suit is in the U. S. district court for the southern district of New York.

Temporary Injunction in Horn Suit

NEW YORK CITY, Feb. 3—Judge Lacombe has granted a temporary injunction in favor of Lovell-McConnell Mfg. Co., in its suit against the Heinze Electric Co., in which it charged unfair competition, alleging that a large motor-operated horn made by the Heinze company is an imitation in appearance of the right-angle design of the type L Klaxon. It will be remembered that this matter came up during the New York automobile show. The suit is in the U. S. district court for the southern district of New York.

Partin-Palmer Maker May Reorganize

CHICAGO, ILL., Feb. 1—Three creditors whose claims aggregate $700 have made application to adjudge bankrupt the American Mfg. Co., builder of Partin-Palmer cars. The American Mfg. Co. is a Chicago concern very closely allied with the Partin Mfg. Co., the latter being practically the sales organization for Partin-Palmer cars. The liabilities of the American company amount to more than $125,000, and the assets, in the form of car parts, etc., to about $15,000. The firm is of the opinion that a reorganization will straighten matters out and under such conditions there would be little difficulty it is stated in paying all the debts of the company. The Partin Mfg. Co. only recently announced a new model, the 25, and has for some time been marketing the 38. Both cars are four-passenger types.

Elections of 1915 Officers

FINDLAY, O., Jan. 28—At the annual meeting of the stockholders of the Adams Brothers Co., Dr. N. L. MacLachlan was elected president; Murray Irwin, vice-president and general manager; G. M. Carter, secretary; B. B. Bigelow, treasurer. These officers and E. C. Edwards, W. F. Hosler, W. A. Hollington, and J. G. Kwiss were elected directors. F. E. Liddle, formerly of Jackson, Mich., has been appointed factory superintendent.

RACINE, WIS., Jan. 26—At the annual meeting of the stockholders of the L-P-C Motor Co., William Mitchell Lewis was elected president; J. M. Cram, vice-president; F. S. Gordon, secretary; and G. B. Wilson, treasurer. These officers and Rene M. Petard were elected directors for the current year.

The capital stock of the company was increased from $250,000 to $350,000. It was announced at the meeting that during the first nine months of operation since the company was started, 380 cars were made and sold and that the business outlook is most satisfactory.

FINDLAY, O., Jan. 26—The following officers were elected for the current year at the annual meeting of the stockholders of the Grant Motor Co.: David A. Shaw, president; George D. Grant and George S. Salzman, vice-presidents; George S. Waite, secretary and sales manager. The board of directors consists of these officers and E. A. Dorsey, J. M. Howe, Roger R. Hall and Charles A. Grant.

KENOSHA, WIS., Jan. 30—At the annual meeting of the Badger Brass Mfg. Co., Kenosha, Wis., manufacturing Solar lamps, Gordon Yule was elected a director to fill the vacancy caused by the death of his father, William L. Yule. Officers were re-elected as follows: President, George A. Yule; vice-president, William H. Yule; secretary, L. J. Keck; treasurer, Richard H. Welles.

TOLEDO, O., Feb. 1—At the annual meeting of the stockholders of the American Metal Wheel Co., Henry Streetman was elected president; F. H. Steel, vice-president; J. C. McKisson, secretary-treasurer; C. W. Bennett, general manager. These officers and Ira C. Taber, J. C. Anderson and Joseph Roth, form the board of directors.

Speedway Men Confer—Chicago Sanction

New York Speedway To Become a Reality

CHICAGO, ILL., Jan. 29—Chairman Richard Kennerdell of the contest board of the American Automobile Assn. was the guest of honor at a luncheon given yesterday at the Chicago Automobile Club by *Motor Age* which was also attended by representatives of the leading speedways and by representatives of concerns interested in racing. At this luncheon a get-together spirit was displayed and the speedway people became acquainted with each other for the first time. Plans were discussed, each track told of its progress on the season's plans and the car makers' representatives outlined what their respective companies intend doing this season.

As a result of this luncheon the promoters have a fair idea of what support they may look for from the manufacturers and at the same time Chairman Kennerdell was able to straighten out several disputes as to dates. Probably one of the most significant facts connected with the luncheon was the statement made by J. G. Vincent, chief engineer of the Packard company, who was present, who told the racing folk that while he could not speak officially for the Packard company, still he would say that if Packard did not race this year he, himself, would have one or two cars in the big events.

For the Maxwell company Ray Harroun stated there would be seven Maxwell racing cars in the big events this year, four of them of the new 300-inch class and the remaining three the same ones the company campaigned last year. Five of these will be raced by the company direct and the other two turned over to E. A. Moross for the dirt track campaign. Harroun has four drivers signed at the present time, including Barney Oldfield, Billy Carlson, Harry Grant and Ed. Rickenbacher.

The Stutz company was represented by its sales manager, H. W. Anderson. There will be six Stutzes raced this year, three of them of the 300-inch type and the others the ones campaigned last year. The Stutz team consists of Earl Cooper, Gil Anderson and Howard Wilcox, the last named being the most recent addition to the team.

George Dickson, general manager of the National company, also was among those present. Dickson states that his company will not race this year, but that this does not mean that the big blue cars never will be seen in speed contests again. He urged those present to support the American Automobile Association, pointing out the strong need of a national organization at this, the most crucial time of the sport.

Representing the tracks were T. E. Myers, of the Indianapolis speedway; F. E. Edwards, of the Chicago speedway; Felix McShayne, of the Omaha speedway; E. R. Schultz, of the Sioux City speedway; F. W. Jencks, of the Elgin Automobile Rotaries Assn.; J. E. Callender, chairman of the contest board of the Chicago Automobile Club; and E. P. Robinson, of Galesburg. E. C. Patterson, backer of Ralph de Palma, represented the owners.

From the reports handed in by the speedway managers it looks as if both the newcomers, Omaha and Chicago, will be in position to race this summer according to schedule, as work on their respective plants is progressing nicely. Omaha and Sioux City are still in doubt as to their exact dates, the matter being held up until Tacoma can be heard from.

Considerable enthusiasm was aroused by the receipt of a telegram from J. C. Nichols, representing the New York speedway, who stated that all the necessary money has been raised, the land secured and contracts are being let, so it is hoped to have the track done by fall so that a big meet can be held some time in September.

Following the luncheon Chairman Kennerdell and Clifford Ireland, a western member of the A. A. A. contest board, who also was present at the affair, visited the new Chicago speedway in company with Contest Director F. E. Edwards. Both were satisfied as to the progress being made and issued the necessary sanction for the 500-mile race, which is scheduled to be run June 19.

19 Entries to Date for Exposition Races

NEW YORK CITY, Feb. 1—The following are the entries as received to date by W. L. Hughson, chairman of the racing committee of the Panama-Pacific International Exposition, which will hold the Vanderbilt Cup and Grand Prix races on February 22 and February 27, respectively:

Car	Driver	Owner
Stutz	Anderson	Stutz M. C. Co.
Stutz	Cooper	Cooper.
Duesenberg	O'Donnell	F. S. Duesenberg.
Stutz	Wilcox	Stutz M. C. Co.
Duesenberg	Alley	F. S. Duesenberg.
Peugeot		Peugeot Auto Import Co.
Peugeot		Peugeot Auto Import Co.
Delage	Newhouse	W. E. Wilson.
Tahis	Gable	Fred. Robinson.
Mercer	Pullen	Mercer Automobile Co.
Mercer		Mercer Automobile Co.
Mercer		Mercer Automobile Co.
Marmon	Cadwell	A. A. Cadwell.
Marmon	D'Alene	W. D'Alene.
Simplex	Disbrow	Simplex Auto Co.
Chevrolet	Le Cain	Chevrolet Motor Co.
Maxwell	Oldfield	Maxwell Motor Corp.
Maxwell	Carlson	Maxwell Motor Corp.
Maxwell	Rickenbacher	Maxwell Motor Corp.

Three Porter-Knights for Indianapolis

NEW YORK CITY, Feb. 1—The Finley Robertson Porter Co., Port Jefferson, L. I., will be represented at the Indianapolis 500-mile race in May by at least three cars, according to Finley R. Porter, president of the company. As announced in THE AUTOMOBILE last week, it is the intention of the company to compete in all important events of the year. Mr. Porter states that the announcement of the intended move of the company to Indianapolis was a misunderstanding, as the factory will continue to be located at Port Jefferson.

As described last week the Knight motor, which will be used in the F. R. P. car, will be a 3 3-4 by 6 1-8-inch, four-cylinder type, capable of 3,500 r.p.m. The piston displacement which was given as 207 cubic inches, is 270 and the wheels are 32 by 4 instead of 34 by 4, giving a lower car. The Knight type motor was adopted by the company in its plan for developing a high-speed small car as the most suitable high speed construction inasmuch as the trouble often experienced in positively opening and closing valves is so well guarded against in this motor. The chassis of the car will be of high carbon chrome vanadium steel throughout.

Sunbeam Engineer and Driver for Indianapolis

INDIANAPOLIS, IND., Jan. 30—Louis Coatalen and Dario Resta the chief engineer and the leading race driver identified with the Sunbeam company will drive their cars in the 500-mile race at Indianapolis, May 30. Mr. Coatalen by birth a Frenchman, is British by naturalization and has been resident in England for many years. Connected with the Humber company he produced a car in 1904 which was a big advance on any previous Humber model and earned for the engineer considerable fame. Joining the Sunbeam concern a few years later his facility for efficient motor production, neat design and up-to-date factory management soon became apparent so that Sunbeam stands today amongst the foremost of British automobile firms in quantity of output and easily first in the racing field.

Coatalen has done a good amount of driving on both road and track, but has not taken a steersman's part in racing lately, his genius for organization proving more valuable in the pits than at the wheel, and the credit for the Sunbeam success is largely due to the perfect management of the tire changing, fuel replenishment, etc. Resta is one of the favorites with the British racing public, as he has a dogged determination that carries him through difficulties.

LOUIS COATALEN,
Sunbeam engineer

The Week in the Industry

Motor Men in New Roles

Sevier Jones Sales Manager—The Jones Motor Car Co., Wichita, Kan., which was recently organized to make the Jones six-cylinder cars, has started operation in its new plant at 210 West Douglas avenue, with a force of thirty to forty men for the present. V. T. Sevier, formerly of the Farmers and Bankers' Life Insurance Co., has been appointed sales manager; E. E. Stroup, his assistant; Charles H. Smith, advertising manager.

Chamberlin Mgr.—D. W. Chamberlin has been appointed manager of the Cleveland, O., branch of the Kelly-Springfield Tire Co.

Thompson Velie Truck Sales Mgr.—Capt. M. S. Thompson has been appointed manager of the truck sales and service department of the Velie Motor Car Co., Cleveland, O.

Cairns Leaves Parish and Bingham—William Cairns is no longer in the employ and capacity of general manager and sales representative of the Parish & Bingham Co., Cleveland, O.

Halligan Heads Chalmers U. C. Dept.—Fred Halligan, formerly with the Boston Locomobile company, is now in charge of the used car department of the Chalmers Motor Co., of Boston, Massachusetts.

Collins Sales Mgr.—B. W. Collins has become sales manager of the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. He was formerly with the Lozier Motor Co., Detroit, as assistant to the president.

Faust Buffalo Mgr.—A branch has been opened in Buffalo, N. Y., under the management of H. C. Faust at 20 Goodrich street, by the H. C. Faust Co., Philadelphia, Pa., manufacturer of the Panther spark plugs.

Smith Resigns—E. D. Smith, until recently manager of the car order department of the Chalmers Motor Co., Detroit, Mich., has resigned to become manager of the Detroit branch of the Reed Self-Adjusting Weather Strip Co., Wichita, Kan. Offices have been secured at 805 Chamber of Commerce Bldg.

Talbot Succeeds Holihan—R. Talbot, vice-president of the National Bank of Commerce, Detroit, Mich., has been named president of the Holihan Mfg. Co., Detroit, succeeding J. A. Holihan. William Christian has been appointed manager of the company, which will continue to make automobile radiators and other metal specialties for the automobile industry.

Poyer Assistant Sales Mgr.—C. E. Poyer has been appointed assistant general sales manager of the Edison Storage Battery Co. Mr. Poyer has been with the Edison interests for about 4 years, having served first on the personal engineering staff of Mr. Edison in the development of special application of the alkaline battery, and later as assistant advertising manager. For the last 2 years he has been manager of the house lighting department.

Garage and Dealers' Field

Pullman Agency in Australia—J. J. Hughes, Sydney, Australia, will handle the Pullman car.

Toledo Peerless Tire Moves—The Peerless Tire & Rubber Co., Toledo, O., will move shortly into its new and larger quarters at 713 Jefferson avenue.

Newark Chevrolet Moves—The Chevrolet Motor Co., New York City, has leased the two-story building at 307-309 Central avenue, Newark, N. J., to be occupied by February 1.

Wille Piston Co. Dissolved—The Wille Piston Co., 1534 Fulton street, Brooklyn, N. Y., has been dissolved. The business will be continued by P. A. Wille under the name of the Wille Piston Works.

St. Louis Ford Adding—An addition is being built to the St. Louis, Mo., branch of the Ford Motor Car Co. The new building, a one-story structure, 40 feet by 50 feet, will be used as a storage room for parts.

In New Salesrooms—The Williams Motor Car Co., agent for the Dodge Brothers car at Springfield, Mass., has moved into its new salesroom in the building at the corner of Worthington and Chestnut streets.

Buick In New Home—The Buick agency in Providence, R. I., is located in its new home at 37 Chestnut street, where it has the entire building for a salesroom and service station near the main arteries of travel.

Detroit Co. Moves—The Barton Auto Top Co., formerly at 65 East Fort St., is now located in its new quarters at 863 Woodward avenue, Detroit, Mich., where it will continue the manufacture of slip covers, dust hoods, automobile curtains and automobile tops.

Kelly-Springfield Tire Agency Moves—The Kelly-Springfield Tire & Rubber Co., San Francisco, Cal., which recently enlarged its branch and appointed W. H. Bell as district manager, with headquarters in this city, on February 1 occupied its new quarters on Van Ness avenue.

Marketing K. and M. Piston Ring—A new type of piston rings, known as the "K. and M. Conform," is now being made by the Modern Electric Motor & Machine Co., Indianapolis, Ind., and marketed by the Superior Auto Parts Co. L. J. Eby is sales manager of the concern.

Artificial Leather Co. Moves—The Du Pont Fabrikoid Co., Wilmington, Del., has moved its office from 621 Broadway, New York City, to 90 West street. The latter address is only temporary, until it can get into its new and permanent quarters in the new Equitable Bldg., 120 Broadway.

To Distribute Johnson Shock Absorbers—A new store and service station will immediately be opened by the Triple Action Spring Co. in San Francisco for the distribution of the Johnson shock absorbers for the entire state of California. It is expected that in the near future agencies will be opened in Los Angeles, Oakland, Berkeley, Sacramento, San José, Santa Barbara and Pasadena.

New Company at Providence, R. I.—The Guaranty Used Motor Car Co. has been formed at Providence, R. I., to rebuild and market second hand cars. C. P. Walker, formerly with the Jackson agency in Boston, is at the head of the new concern and it has leased the two-story building on Atwell's avenue formerly used by the White Co. for a service station.

Will Handle Accessories—A partnership has been formed between J. Wetzel and Charles M. Hall, of Detroit, Mich., who was formerly manager of the Parish Mfg. Co., Detroit. They will handle automobile accessories. The automobile accessory business conducted by McLean & Freeman, at 1575 Woodward avenue, has been taken over by E. M. Morris, formerly assistant secretary of the Northern Motor Car Co., also assistant sales manager of the E-M-F Co., and at one time general manager of the Great Western Auto Co., Peru, Ind.

New Service Plan—The Van Sicklen Co., Aurora, Ill., manufacturer of the Van Sicklen speedmeter, has a new plan for service to the owners of cars equipped with its instruments. The car manufacturers adopting the speedmeter as standard equipment furnish a list of their representatives to whom a letter is addressed describing the proposed plan, stating that upon receipt of information regarding the probable number of cars the dealer will sell during the season, the Van Sicklen Co. will send to the dealer a service package containing the parts he is liable to need based on the number of cars handled.

Recent Changes In Kansas City—The Scarritt Motor Car Co., Stearns distributer, Kansas City, Mo., has incorporated. The company was formerly known as the White Motors Co. The company has the distribution for Stearns cars in Kansas, western Missouri and northern Oklahoma. The Kansas City Auto Parts Co., Kansas City, will open around February 15 to handle a complete stock of automobile supplies and accessories. G. V. Nelson is manager. The Kansas City White Co. has been organized with headquarters at 928 East Fifteenth street to handle the White car and truck. John Toole is manager.

Recent Indianapolis Changes—The following changes have taken place in the Indianapolis, Ind., trade: J. M. Ward, for 2 years factory representative for the United States Tire and Rubber Co., has been made manager of the company's local sales branch. The election of Tom L. Marshall as treasurer of the Marion Motor Co. is announced. H. W. Martz, who has been distributor for the Maxwell, has become distributor for the Briscoe and has opened new quarters at 646 North Meridian street. A large store for the sale of tires and accessories has been opened at 213 South Illinois street by G. F. Kreitlein, who has had several years' experience in the business.

Factory Miscellany

LARGE War Order on Milling Machines—The Kearney & Treeker Co., Milwaukee, Wis., a large manufacturer of milling machines, started shipments January 29 on an order for 120 Milwaukee milling machines contracted for by the French government for use in its arsenals, armament factories and motor car manufacturing and repair shops. It will require more than 6 weeks to complete the delivery.

Duesenberg Bros. Open Plant—Duesenberg Bros., St. Paul, Minn., have opened their new motor building plant.

Stewart & Clark Adds—The Stewart & Clark Mfg. Co., manufacturers of automobile supplies, 1828 Diversey boulevard, Chicago, Ill., will construct a six-story addition to cost $75,000.

May Build Automobiles—W. A. Williams, of the Independence Motor Car Co., Lima, O., is reported to be planning the establishment of a new plant for the manufacture of automobiles.

Elyria Plant for Overland Parts—The plant recently used for the manufacture of the Willys Utility and Garford trucks at Elyria, O., will be employed in the manufacture of Overland parts.

Regal to Enlarge Berlin Plant—The Regal Automobile Co., Detroit, Mich., will construct a large addition to its plant at Berlin, Ont., in the spring. It is in the market for machinery.

To Manufacture Spring Wheels—W. B. Rosenburg, Corbin, Mont., and W. A. Black, Livingston, Mont., plan to establish a factory in Seattle, Wash., for the manufacture of spring wheels for automobiles.

Branch Factory for Fair-Anderson—The Fair-Anderson Co., Chicago, Ill., contemplates the establishment of a branch factory for the manufacture of automobile tires. The estimated cost is $125,000.

New Plant for Calgary—The Ingram-Hatch Motor Corp., 2 Stone street, New York City, is planning to build a plant at Calgary, Alta., for the manufacture of automobiles and motor trucks operated by oil engines.

De Mooy Bros. Add—De Mooy Bros., 1931 East 55th street, Cleveland, O., are making arrangements for the construction of an automobile plant in connection with their present plant. The estimated cost is $6,000.

Falls Rubber Buys Wire Plant—The Falls Rubber Co., Cuyahoga Falls, O., has purchased the old plant of the wire mill company on East Broad street, which will be converted into a modern plant for the manufacture of tires.

To Manufacture Trucks—The Chester County Motor Co., Coatesville, Pa., has increased its capital stock to $500,000 and plans the construction of a factory for the manufacture of commercial trucks. J. Edwin Brinton is president.

Montana Co. Manufacturing Spring Wheels—The Montana Improved Spring Wheel Co., Livingston, Mont., is preparing plans for the construction of a plant to manufacture spring wheels for automobiles. The plant will employ about 300 men.

Hartford Tire Pump Adds—The Hartford Tire Pump Co., Hartford, Wis., is installing additional equipment, including a large oxy-acetylene welding and cutting apparatus for its own uses, but will do custom work for motorists needing welding repairs.

Mercer Automobile Club Formed—The Mercer Automobile Co., Trenton, N. J., foremen and members of the office force have formed the Mercer Automobile Club, the object of which is to hold an occasional get-together meeting for the promotion of greater co-operation.

Manufactures Anti-Freezing Liquid—The Can't Freezit Chemical Co. is the name of a new concern located at 187½ South High street, Columbus, O., which manufactures a liquid to be used in radiators to prevent freezing. A great deal is claimed for the preparation.

Fire Damages Canton Plant—Fire of unknown origin destroyed the administration building of the Cleveland Axle Co., Canton, O., and the Cleveland-Canton Spring Co., January 24. The remainder of the factory was saved. The blaze started under the stairway of the building.

Jiffy Jack for Grand Rapids—The Jiffy Jack Co. is Grand Rapids' latest addition to the automobile accessory manufacturing industry. H. E. Hosken is prime mover in the enterprise. The company makes jacks for raising automobiles, four jacks being the complement, two being used on each axle.

Columbus Concern Makes Motors—The Ohio Engine Co., Columbus, O., recently incorporated with a capital of $25,000, will manufacture small motors for the farm trade. M. H. Joy, manager of the Ohio Engine Sales Co., is the promoter of the new concern, which will establish a plant in Sandusky.

Peckham Looking for Plant—G. G. Peckham, formerly proprietor of the Peckham Motor Car Co., Dayton, O., who has been in the automobile business in Toledo for several months, has returned to that city and is looking for a site upon which to construct an automobile plant. Toledo capital is interested in the project.

Magnus Co. in Brass Casting Business—The Magnus Co., Detroit, Mich., has been organized to take over the business of the National Fulton Brass Mfg. Co., and will continue the brass casting and foundry business of that concern. The capital stock of the new concern is $100,000 and about 150 men are employed.

Will Manufacture Bodies—The Ohio Carriage Mfg. Co., Columbus, O., which purchased the old plant of the Barndt-Johnson Body and Top Co. on South High street has installed complete machinery for the manufacture of automobile bodies. The company will make bodies for all makes of cars but will specialize on bodies for Ford cars.

Newcastle Rubber Co. Formed—The formation of a new corporation for the manufacture of automobile tires and inner tubes with a capitalization of $500,000 has been made known with the granting at Harrisburg, Pa., of a charter to the Newcastle Rubber Co., Newcastle, Pa. The organization has erected a factory measuring 80 by 340 ft. and the plant will start operations April 1.

Will Start Work on Remy Plant—Construction on the new plant of the Remy Electric Co., which is to move to Detroit, Mich., from Anderson, Ind., will be started in the near future when ground will be broken for the two-story 50 by 150 engineering building. This is to be the first of various buildings which will be erected on Mt. Elliott and the Boulevard. The building will cost about $100,000.

Kelly Truck Addition—The Kelly Motor Truck Co., Springfield, O., will start construction this week on a new addition to be 50 by 260 feet of reinforced concrete. One new addition was completed a little over a week ago and is now being used by the company, and with the second addition the company will have more than a third more working space than when the extensions were started.

Foundry Production Increased 600 Per Cent.—Although the Lansing Foundry Co., Lansing, Mich., has been in business less than 12 months, its production has increased 600 per cent., it is claimed, and made it necessary to increase the working force until it now is 102 men. The officers of the present year are: J. H. Moore, president; Ray Potter, vice-president; C. D. McCormick, secretary and office manager; M. C. Knight, treasurer and factory manager.

To Manufacture $500 Cars in Los Angeles—Another automobile factory for the Pacific Coast became a reality when it was announced recently that the Silent Engine Co. had purchased a large tract of land in the Los Angeles harbor section for the erection of an automobile building and assembling plant. The specifications of the new car are not known as yet, but it has been announced that the company would build a touring car, roadster and light truck which will retail on the Pacific Coast for about $500.

To Manufacture Aluminum Castings—To better designate the nature of the business under the new policy of devoting its entire attention to aluminum foundry business, the Western Iron Works, Manitowoc, Wis., has changed its name to Grimm Aluminum Castings Co. The entire plant is being overhauled and some new equipment installed and in the future only aluminum castings will be produced. A campaign for business among motor car and motor manufacturers will be undertaken at once. Roland Grimm is president and general manager.

New Body Building Concern—The building of metal bodies has been started at Worcester, Mass., by George Demers & Son, long in the blacksmith, carriage building and automobile repairing business at 98 Union street. The company has secured N. Allard, for 14 years one of the expert body builders at the Knox factory at Springfield, Mass., and who later worked for the Springfield Metal Body Co., to take charge of the work. Special machinery has been ordered and the company will go into the business on a good sized scale.

Hupp Starts Work on Four Buildings—The Hupp Motor Car Co., Detroit, Mich., has started work on four new buildings, consisting of a new office building two stories high 1,800 by 300 feet; an engineering building, 200 by 200; a testing laboratory 350 by 200 and a top and body building 1,500 by 300. At least $150,000 will thus be spent and the work was started at this time instead of in the spring in order to give work to many unemployed. The men employed in the erection work are in the direct employ of the Hupp company.

To Mfg. Only Automobile Tires—Consistent with the policy announced recently, the Hartford Rubber Works plant, Hartford, Conn., of the United States Tire company is to manufacture pneumatic automobile tires only. The bicycle tire department has been closed down and the equipment removed to Indianapolis. Additional apparatus for the production of automobile tires is now being installed. The steam kettle room on the west side of the factory is being enlarged. At the present time the factory is said to be working to capacity.

To Market 4-Wheel Drive Tractor—The Utility Steel Tractor Co., organized recently at Antigo, Wis., with $25,000 capital, is preparing to market a light four-wheel drive tractor designed by N. C. Woodin, formerly chief engineer of the International Hoist Co., of Antigo. The company is negotiating witb several commercial associations in Wisconsin and Illinois for a site for the proposed foundry and machine shop group it intends to erect during the course of the present year. D. S. Stewart is president; Mr. Woodin, vice-president, and F. A. Hecker, secretary-treasurer.

Homer's Tractor on Market—The Homer Motors Co., with offices at 1119 Van Nuys Building, Los Angeles, Cal., is manufacturing the Homer high-grade motor tractor weighing 4 tons, which sells fully equipped at $3,000. Its other product is the Homer light delivery automobile, capacity 1,000 pounds, 20 horsepower and selling for $600. The company is financed entirely by Los Angeles capital and under the management of J. E. Meyer, president; Dr. J. E. Coweles, vice-pres.; G. W. Bishop, secretary; Geo. F. Thompson, treasurer; J. P. Barker, the inventor, and David Macdonald(directors.

Indiana Plants Busy—There is a very pronounced renewal of activity in the motor car industry of the State with the beginning of the new year. Conditions are not yet normal, but they promise to be so before long. At Kokomo today the plants of the Haynes Automobile Co. and Apperson Brothers Automobile Co. put their full forces at work. Similar reports are being received from other parts of the State. In Indianapolis the Lyons-Atlas Co. is preparing to double its working force. Other plants are taking on additional employees gradually. The Capitol Body Co. is moving into the old No. 2 plant of the American Motors Co. in South Meridian street, Indianapolis, and will increase its force from 125 to 275 employees.

Another Tire Works for Trenton—Another tire manufacturing concern has located in Trenton, N. J., at Mulberry street and New York avenue. The property at this address, formerly occupied by the American Lamp & Brass Co., has been purchased by the Mecca Tire Co., of Philadelphia, and is being remodeled and improved for tire manufacturing purposes. This property covers about 3 acres and contains six brick buildings, each 30 by 90 feet, five of them 2½ stories high and one 3½ stories. These will be equipped with the necessary modern machinery to turn out from 250 to 300 tires per day, and give employment to about the same number of workmen. G. E. Knowles, of Carteret, at one time employed by the Thermoid Rubber Co., and later connected with the Chester Rubber Tire & Tube Co., of Chester, W. Va., will be general manager of the new concern, whose officers are: Charles Buckley, president; William Fullerton, treasurer; W. J. Cassidy, secretary. The plant will not be ready for operation before March 1.

The Automobile Calendar

Jan. 30-Feb. 6	Columbus, O., Show, Memorial Hall, Columbus Auto Club and Columbus Auto Trades Assn.
Jan. 30-Feb. 6	Minneapolis, Minn., Show, National Guard Armory, Minneapolis Automobile Trade Assn.
Feb	Portland, Ore., Show: Portland Auto Trade Assn.
Feb	Battle Creek, Mich., Show, Rathbun & Kraft Bldg.
Feb	Toledo, O., Show, Toledo Auto Show Co.
Feb. 1-6	Louisville, Ky., Show, Louisville Auto Dealers' Assn., First Regiment Armory.
Feb. 2-7	Kalamazoo, Mich., Show, Armory.
Feb. 3-6	Geneva, N. Y., Show.
Feb 4-6	Marinette, Wis., and Menominee, Mich., Show, Armory, Marinette, Twin City Auto. Assn. of Marinette.
Feb. 8-11	Peoria, Ill., Show, Coliseum.
Feb. 8-13	Salem, Mass., Show, North Street Skating Rink, C. O'Shea.
Feb. 8-13	Toledo, O., Show, Terminal Bldg., Toledo Auto Shows Co., H. W. Blevins.
Feb. 8-14	Kansas City, Mo., Show.
Feb. 8-14	Troy, N. Y., Show, Troy Auto. Dealers' Assn.
Feb. 8-15	Wilmington, Del., Show, Hotel duPont.
Feb. 9-12	Eau Claire, Wis., Eau Claire Auto Dealers' Assn.
Feb. 9-12	Peoria, Ill, Show, Peoria Auto & Motor Cycle Dealers.
Feb. 10-13	Davenport, Ia., Show.
Feb. 15	Fort Wayne, Ind., Show, Fort Wayne Auto Trade Assn.
Feb. 15-20	Grand Rapids, Mich., Show, Klingman Furniture Exposition Bldg., Grand Rapids *Herald;* C. L. Merriman.
Feb 15-20	Omaha, Neb., Show, Auditorium, C. G. Powell
Feb. 15-20	Bridgeport, Conn., Show, State Armory; B. B. Sterber.
Feb 16-18	Bloomington, Ill., Show, Deere Bldg.
Feb. 18-20	Racine, Wis., Show, Lakeside Auditorium, Racine Auto Show Assn.
Feb. 22	Newark, N. J., Light Car Club of N. J., Hillclimb at Teaneck.
Feb. 22	San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds, Promoter, Panama-Pacific Exposition Co.
Feb. 22-25	Allentown, Pa., Show.
Feb. 22-27	Duluth, Minn., Show, Auditorium.
Feb. 22-27	New Haven, Conn., Show, Second Regiment Armory; W. N. Lindsay.
Feb. 22-28	South Bethlehem, Pa., Show, Coliseum; J. L. Elliott.
Feb. 23-27	York, Pa., Show, Coliseum Hall.
Feb. 23-27	Syracuse, N. Y., Show, Arena, Syracuse Motor Vehicle Trade Assn.
Feb. 23-27	Syracuse, N. Y., Show, Armory, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27	Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 24-27	Freeport, Ill., Show, Freeport Automobile Show Co.
Feb. 25	New York City, S. A. E., Metropolitan Sec. Meeting; Report of Research Committee on Kerosene Carbureters. Research Com. Report on Non-Electric Continuous-Torque Transmission.
Feb. 27	San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 1-5	Wilkesbarre, Pa., Show, Vehicle Trades Assn.
Mar	Benton Harbor, Mich., Show, St. Joseph and Benton Harbor, St. Joseph Garage, St. Joseph.
Mar 3	Albany, N. Y., Associated Garages of America, General Convention.
Mar. 4-6	Springfield, Mass., Show; J. H. Graham.
Mar. 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13	New York City, Made in the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13	Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13	Canton, O., Show, Auditorium, Stark Co. Auto Show and Electrical Exposition.
Mar. 8-13	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 8-13	Utica, N. Y., Utica Automobile Trade Assn.
Mar. 13-20	Harrisburg, Pa., Show Arena, Harrisburg Dealers' Assn.
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
Mar. 22-27	Bangor, Me., Show, Bangor Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., Two-mile Track Meet.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
June 25	Sioux City, Ia., Track Meet.
July 4-5	Tacoma, Wash., Road Race.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S., 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.

Automobile Agencies Recently Established

PASSENGER CARS

Ohio

Thurston	Krit	Thurston Auto Garage
Tiffin	Oldsmobile	C. L. Filer & Co.
Urbana	Ford	Frank Ganson, Jr.
Zanesville	Jeffery	Central Garage Co.
Zanesville	Detroit Electric	Central Garage Co.

Oklahoma

Okmulgee	Oldsmobile	Lamberson & McBrayer Bros.
Telsa	Sphinx	F. F. Hannon

Oregon

Portland	Dodge	Covey Motor Car Co.

Pennsylvania

Allentown	Moon	W. F. Rabenold
Ashland	Oldsmobile	J. B. Young
Freeport	Oldsmobile	E. H. Wallace
Huntingdon	Oldsmobile	Port's Garage
Jeanette	Oldsmobile	J. G. Waddell
Lock Haven	Oldsmobile	J. S. Waite & Co.
Mt. Morris	Oldsmobile	Mt. Morris Motor Co.
New Philadelphia	King	Moffitt & Kneuss
Pen Argyl	Saxon	Ackerman Bros.
Philadelphia	Marion	Fanning Motor Car Co.
Philadelphia	Jeffery	Sterling Motor Car Co.
Pittsburg	King	King Motor Sales Co.
Pittsburg	Scripps-Booth	L. G. Martin & Son
Scranton	Scripps-Booth	O. D. De Witt
Sharon	King	Monarch Hardware
Virginville	Oldsmobile	M. W. Smith
Waynesburg	Oldsmobile	Mt. Morris Motor Co.
Wilkes-Barre	Scripps-Booth	D. & H. Automobile Co.
Wilkes-Barre	Oldsmobile	H. M. Ransom

Rhode Island

Providence	Briscoe	Spencer-Wilke Co.
Providence	Saxon	Foster-Smith Co.
Providence	Scripps-Booth	Wallace L. Wilcox & Co.
Providence	Peerless	J. W. Breese

South Dakota

Yankton	King	E. W. Crane

Tennessee

Chattanooga	Franklin	J. H. Alday

Texas

El Paso	Franklin	The Oakland Auto Co.
Houston	Saxon	J. M. McDade Auto Co.
Menard	Oldsmobile	J. A. Bevans
Pampa	Oldsmobile	D. B. Stribling
Vernon	Saxon	A. B. Swartwood

Utah

Ogden	Oldsmobile	L. P. Wright

Vermont

Rutland	Saxon	Rutland Mach. & Auto Co.

Virginia

Pulaski	Oldsmobile	Pulaski Motor Car Co.

Washington

Almira	Dodge	J. T. Callanan
Bellingham	Oldsmobile	Bay City Motor Car Co.
Blueston	Paige-Detroit	C. W. Gilstrap
Centralia	Buick	R. N. Berlin
Colfax	Dodge	Colfax Garage
Columbia	Cadillac	Wood & Lane
Colville	Dodge	M. E. McCauley
Deer Park	Dodge	W. M. Critzer
Garfield	Dodge	Garfield Hardware Co.
Hoquiam	Buick	George Rhines
Lincoln	Studebaker	Eastman Motor Car Co.
Oakesdale	Dodge	Linville Bros.
Ritzville	Dodge	J. Friesloger
Rosalia	Dodge	Rosalia Auto Co.
Seattle	Jeffery	F. H. Bardshar
Spokane	Franklin	Franklin Auto Sales Co.
Spokane	Studebaker	Eastman Motor Car Co.
Tacoma	Ford	Sullivan & Volk
Tacoma	Maxwell	Tacoma Motor Car Co.
Walla Walla	Cadillac	Wood & Lane
Waverly	Dodge	C. K. Thayer
Wilbur	Dodge	Enterprise Garage

Wisconsin

Appleton	King	H. E. Griffin Auto Co.
Beloit	Argo	J. W. Menhall Auto Co.
Bloomington	Allen	Knapp & Hillary
Cuba City	Apperson-R.C.H.	Hein Brothers
DePere	Hupmobile	Ray Marcott Co.
Dorand	Franklin	J. P. Unswer
Edmund	Glide	Daniel Lee
Elmwood	King	Rice & Webb Motor Co.
Ft. Atkinson	Glide	Vance & Roos
Galesville	Oldsmobile	A. J. Olsen
Glenwood City	Overland	Glenwood Auto Co.
Howard's Grove	Partin-Palmer	Frome-Kaiser Auto & Impl. Co.
Kilbourn City	Apperson-R.C.H.	O. E. DeWitt
La Crosse	Durant-Dort	La Crosse Auto Co.
Lancaster	Glide	W. A. Jerrett
Milwaukee	Oakland	Dewitt-Schank Motor Sales Co
Milwaukee	Monroe	Frint Motor Car Co.
Milwaukee	Argo	Milwaukee Cycle S. & Sales Co.
Milwaukee	Allen	Dieman Motor Co.
Milwaukee	Moon	Durbin & Thomas
Milwaukee	Grant	Diener-Nelson Co.
Monroe	Buick	Geiger, Fasser & Lynch
Monroe	Ford	Geiger, Fasser & Lynch
Monroe	Hudson	Geiger, Fasser & Lynch
Monroe	Reo	Geiger, Fasser & Lynch
Neenah	Scripps-Booth	J. L. Densenbrenner
New London	Apperson	W. F. Block
New London	New R.C.H	W. F. Block
Richland Center	Ford	E. A. Prouty
Stoughton	Apperson-R.C.H	Trace Christenson
Tigerton	Overland	C. A. Roepke
Tigerton	Studebaker	C. A. Roepke
Tigerton	Maxwell	C. A. Roepke
Tigerton	Ford	C. A. Roepke
Watertown	Glide	F. G. Buruff Motor Car Co.
West Bend	Dodge	Meyer Bros.

COMMERCIAL

Alabama

Dothan	Koehler	W. L. Brown

California

Oakland	Signal	Osen & Hunter Auto Co.

Canada

Vancouver	Signal	H. J. Tucker

Georgia

Albany	Koehler	Anderson & Ivey

Iowa

Council Bluffs	Koehler	Marion Auto Co.

Kentucky

Harrodsburg	Koehler	Ingrams Garage
Louisville	Koehler	Strube's Garage
Louisville	Signal Truck	Louisville Motor Co.

Massachusetts

Boston	Atterbury	L. M. Harmon
Boston	Denby	Denby Motor Car Co.
Boston	Mais	Myer Abrams Company
Worcester	Vim	Franklin Square Garage

Michigan

Battle Creek	Signal	B. N. Beedon
Detroit	Signal	The Moritz-Mullin Co.
St. Joseph	Signal	Burkhard Bros.
Wayne	Signal	The Moritz-Mullen Co.

Missouri

St. Louis	Kissel	Colonial Motor Car Co.

Montana

Butte	Signal	Inter-Mountain Auto Truck Co.

New Jersey

Cape May Court House	Koehler	Dis Auto Co.
Hightstown	Koehler	Thomas Peppler & Son

New York

Buffalo	Signal	A. J. Sanderson

Ohio

Cleveland	Signal	Curtis Bros.
Columbus	Vim	The Brasher Motor Car Co.

Pennsylvania

Chambersburg	Koehler	J. A. Schaal
Houtzdale	Koehler	H. J. Wagner
Philadelphia	Signal	Interboro Motor Truck Co.
Pittsburg	Signal	Stewart Motor Truck Co.
Steelton	Koehler	W. F. Maginnis

Rhode Island

Providence	Koehler	Capitol Motor Car Co.

Tennessee

Clarksville	Koehler	Clarksville Auto & Repair Co.

Washington

Seattle	Signal	Waterhouse-Sands Motors Co
Spokane	Signal Truck	Arthur Hertz

Recent Incorporations in the Automobile Field

New York

NEW YORK—Hecht's Magneto Exchange; capital, $5,000; ignition products and other motor car accessories. Incorporators: Alex. B. Hecht, Emil M. Lowy and Leo L. Lowy, all of 854 Intervale avenue.

NEW YORK—International Tri-Ricksha Co.; capital, $500,000; to operate a motor livery, taxicabs, rickshaws, etc. Incorporators: John P. Mahan, 331 Arlington avenue, Jersey City, N. J.; Archibald McClintock, 182 W. 82d street; Francis Kaley, 47 Bay 22d street.

NEW YORK—K-T Lever Spring Co.; capital, $50,000; to manufacture springs for motor cars, carriages, shock absorbers, etc. Incorporators: W. F. Cornell, T. Johnson and S. Gross, all of New York City.

NEW YORK—Lever Spring Co.; capital, $50,000; to manufacture motor car devices. Incorporators: Emil Koeb and William Koeb, both of 271 W. 87th street; William F. Cornell, 20 Exchange place.

NEW YORK—Magneto Parts Co.; capital, $30,000; electrical and other accessories for motor cars. Incorporators: Emil M. Lowy, Leo L. Lowy and Alex. S. Hecht, all of 854 Intervale avenue.

NEW YORK—Practical Repair Co.; capital, $5,000; motor car repair business. Incorporators: Johann Kahrs and Albert Boehm, both of 320 E. 16th street; Ela Probaksa, 542 E. 79th street.

NEW YORK—Safety Signal Co.; capital, $200,000; to manufacture devices for motor cars, rubber goods, etc. Incorporators: Arthur W. Dennen and Stanley C. Fowler, both of 19 Cedar street; Rebecca Hilliker, 80 Maiden lane.

NEW YORK—Self-Propelled Car Co.; capital, $500. Incorporators: M. E. Harby, Huntington; Emy Clauss, 1016 Washington street, Hoboken, N. J.; Eva De Trannites, 170 W. 98th street.

NEW YORK—Speedograph Sales Corporation; capital, $150,000; to manufacture instruments for recording speed of vehicles, etc. Incorporators: V. V. Lebedjeff, A. B. White and J. W. Bondy, all of 11 Broadway.

NEW YORK—Tire-Seal Co.; capital, $500; to manufacture puncture fillers, tire supplies, etc. Incorporators: George A. Orr and Joseph L. Stiebel, both of Kansas City, Mo.; Morton Wollman, 1 W. 70th street.

ROCHESTER—Rochester Case Sales Co.; capital, $10,000; general motor vehicle business. Incorporators: George H. Parker, 295 Plymouth avenue; William F. Hill, 22 Shepard street; Frank L. Elliott, 60 Plymouth avenue.

SALAMANCA—Salamanca Garage; capital, $6,000; to operate a garage. Incorporators: Robert N. Forbes, Frank J. Eaton and Charles E. Congdon, all of Salamanca.

SYRACUSE—James Tool & Machine Co.; capital, $500; to conduct a motor car repair business and machine shop. Incorporators: Frank P. Davis, Jessie M. Whiteside and Eliza Davis, all of Syracuse.

TARRYTOWN—Tarrytown Garage; capital, $5,000; to operate a garage. Incorporators: C. F. Offenhauser, Mary J. Keith and A. R. Keith, all of Tarrytown.

TROY—Patnaud's Garage; capital, $1,000; to operate a garage. Incorporators: David Patnaud, 154 Ninth street; Harry Benjamin, 686 Third avenue, North Troy; Albert B. Wolf, 5 State street.

Ohio

AKRON—Star Rubber Co.; capital, $1,000; to manufacture rubber goods. Incorporators: George W. Carmichael, J. W. Miller, D. B. Duff, W. E. Wright and W. M. Dabney.

CINCINNATI—Non-pneumatic Suspension Tire Co.; capital, $10,000; to manufacture tires, etc. Incorporators: Anthony Schemel, George Webotitts, E. H. Goosmann, G. W. Mackenbach and H. Serkowich.

CLEVELAND—Humphrey-Kennard Co.; capital, $10,000; to deal in tires for motor cars, etc. Incorporators: J. R. Humphreys, F. C. Waite, C. A. Colvin, E. G. Hoag and L. M. Sewell.

CLEVELAND—Penn Square Tire Reclaiming Co.; capital, $10,000; to manufacture and repair tires. Incorporators: H. L. Heller, O. A. Erb, J. F. Krajewski, I. Grauer and Nathan Herstauer.

YOUNGSTOWN—Auto Truck and Drayage Co.; capital, $10,000. Incorporators: N. L. Norris, J. W. Parkin, C. E. Norris, Evan Butler, E. H. Evans.

Oklahoma

CORDELL—Cordell Ford Co.; capital, $4,000; deal in automobiles. Incorporators: G. C. Naden, M. E. Naden, C. R. Lewis.

TULSA—Tulsa Automobile Assn.; to carry on an automobile club. Incorporators: J. L. Gillespie, C. S. Avery, O. R. Howard, J. A. Hull, L. N. Ewing, Fred Shaw.

Tennessee

JOHNSON—Ward's Garage; capital, $5,000; to conduct a garage, buy, sell and operate motor cars. Incorporators: Charles D. Vance, O. P. Ward, P. M. Ward, Charles Bayless and David Miller.

Vermont

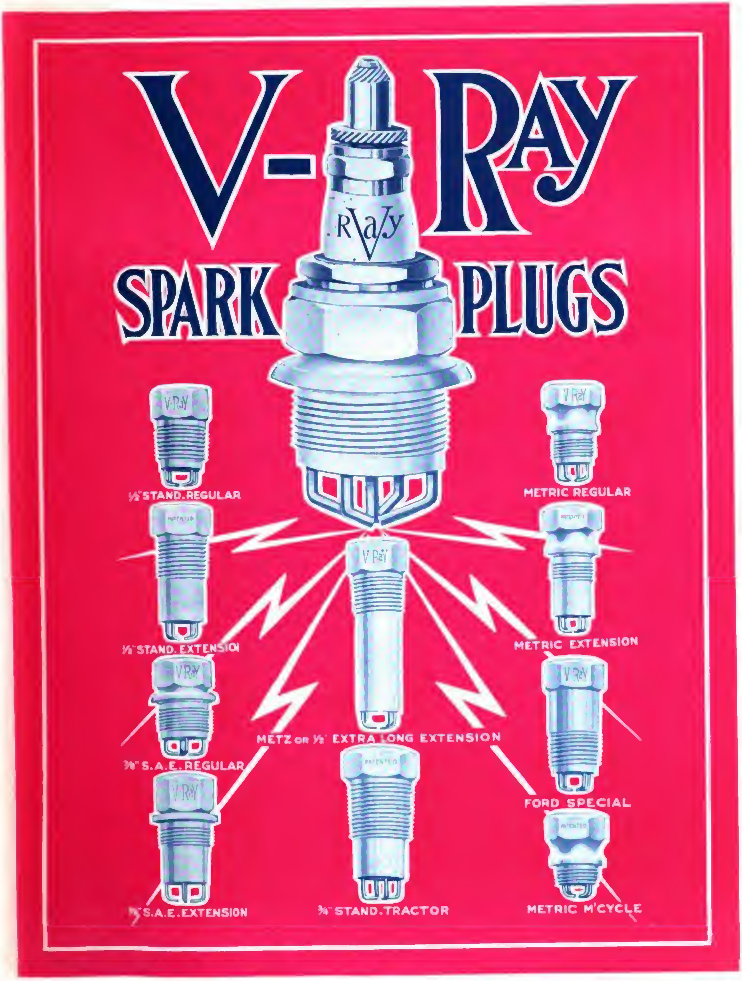
BARRE—Brown Motor Car Co.; capital, $50,000. Incorporators: N. D. Graves and others.

Virginia

NORFOLK—H. H. Johnson Co.; capital, $3,000 to $5,000; to deal in motor cars. Incorporators: J. T. Nicholson, Jr., and H. H. Johnson, both of Norfolk, and others.

NORFOLK—Norfolk-Buick Motor Car Co.; capital, $15,000; to deal in motor cars. Incorporators: George F. Edwards, Victor de Murguiondo and H. C. Sherritt, all of Norfolk.

RICHMOND—Dominion Motor Co.; capital, $10,000; to deal in motor cars. Incorporators: John E. Swartwout and W. J. Miller, both of Richmond, and others.


V-RAY
SPARK PLUGS
RVaY
½" STAND. REGULAR
METRIC REGULAR
½" STAND. EXTENSION
METRIC EXTENSION
⅞" S.A.E. REGULAR
METZ OR ½" EXTRA LONG EXTENSION
FORD SPECIAL
⅞" S.A.E. EXTENSION
⅞" STAND. TRACTOR
METRIC M'CYCLE

A Favorable Impression

The forerunner of every sale is the creation of a favorable impression.

The real important function which good advertising is constantly performing is the creation of a favorable impression.

A good and sufficient reason, isn't it, why advertising has come to hold so steadfast a place in every up-to-date merchandising plan?

The problem has resolved itself then to the question of how to create the most favorable impression on the greatest number of possible customers.

The Class Journal Company's four papers—

THE AUTOMOBILE — MOTOR WORLD
MOTOR AGE — MOTOR PRINT

with a combined circulation of over 100,000
potential purchasers of your product

constitute a medium for reaching the maximum number of possible buyers of your product—They present the dual advantage of economy and no waste.

The Service Department of The Class Journal Company, with its staff of experienced copy specialists and high class artists, is able to present your sales story in the most pleasing and persuasive way, and thus create the most favorable impressio

Scores of manufacturers have put th [illegible] dvertising campaigns into our hands.

Let us demonstrate what we can do for you.

THE CLASS JOURNAL COMPANY

239 West 39th Street, New York

Members of the A. B. C.

The AUTOMOBILE

FEBRUARY 11, 1915
10¢ A COPY

The stamp of quality in motor car construction is no longer the dollar sign. Owners of the highest priced cars as well as prospective owners who insist on quality at low cost find in the Pathfinder the best that automobile design
can produce, an
within modest re
with the detachab
carefully designe

sible to tell where the touring body ends and the limousine top begins, one chassis affords the luxury of a superbly equipped car for winter service, with the cool comfort of a touring car for summer. The change
other is made
difficulty.

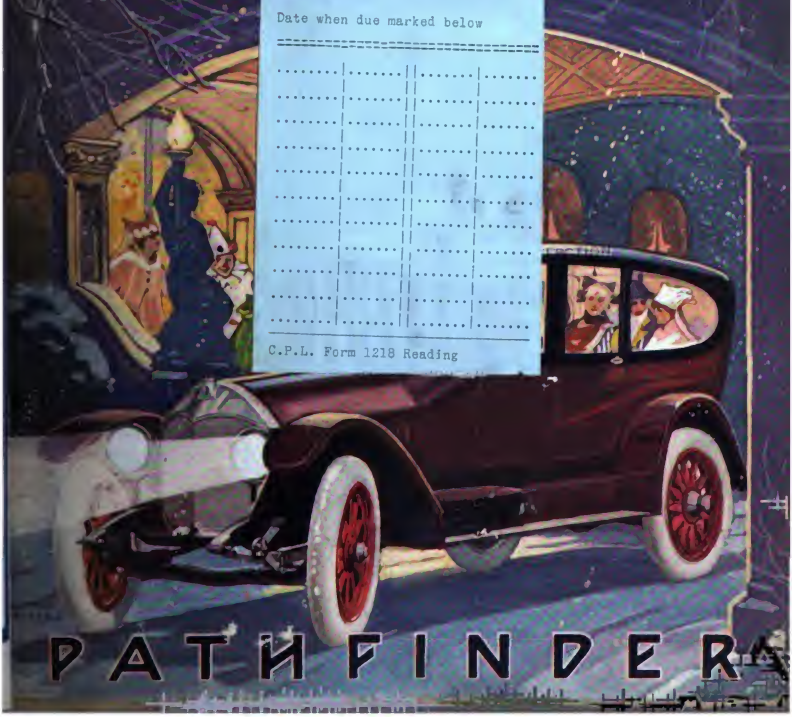
turing Co.
NAPOLIS, IND.

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading



FAKES

VERSUS

A-C EFFICIENCY

Freakish spark plug construction is intended, primarily, to appeal to the motorist, like quack patent medicines appeal to the chronic invalid. It is mostly a catch-penny scheme and rarely receives the endorsement of a practical engineer.

AC-TITAN plugs typify the infinite and painstaking degree of accuracy which has made our product the unqualified choice of most of the leading authorities on gas engine combustion.

Improvements in basic design of spark plugs are few and far between, but there are many freakish styles and shapes constantly appearing for which most everything is claimed and nothing proven.

Lack of space prevents our describing in detail the many "catch-penny" arguments advanced by unscrupulous plug manufacturers to stampede the entire industry into the thought that they have accomplished over night that which has taken responsible, dependable manufacturers years to achieve.

What we want to emphasize is the fact that when a new plug is brought out, or a design is changed, extravagant claims are made regarding features of this kind but very seldom is an improvement made to the basic design of the plug: an improvement which will increase efficiency and make the plugs gas tight under all conditions.

AC-TITAN and CICO plugs embody these improvements. Their use insures a smooth running motor at all speeds, eliminates pre-ignition and affords the highest degree of efficiency attained in spark plug construction.

CHAMPION IGNITION CO.

FLINT · MICHIGAN · U · S · A ·

Vol. XXXII New York—Thursday, February 11, 1915—Chicago No. 6

The AUTOMOBILE

Engine Balance and Vibration

What Causes Vibration—Different Motor Types Compared from Vibration Viewpoint—Designing a Vibrationless Eight-Cylinder Motor

By A. Ludlow Clayden

VIBRATION would cause the engineer but little concern if the human frame were less susceptible to it, but the whole sensory system of man is designed to appreciate vibrations of the smallest character. Sight, sound and touch are all vibratory and even taste and smell may possibly be due to electrical waves that are vibrations of a less concrete kind. Thus it is not surprising that any change for the better in the smoothness of a motor is appreciated very quickly by the passengers in the car to which it belongs, and it is likely to be a long time before automobile makers can safely feel that the last word on vibration has been said.

Why Engines Vibrate

Reciprocating engines vibrate because the connecting-rods are only a little longer than the stroke, because parts of the shafts and bearings bend under the loads put upon them, and because the turning effort, in a gas or oil engine, fluctuates with each explosion. Mathematical analyses are apt to take only one or other of these things into account to the neglect of the rest, so much that has been written on the subject loses practical value. For instance the two-cylinder, 90-degree V engine is nearly ideal from the point of view of reciprocating balance, but it has an irregular torque; so the horizontally opposed two-cylinder motor which is inferior in mathematical balance is yet far pleasanter to sit behind.

Similarly, crankshaft deflections under load often spoil the balance of the six-cylinder motor that, theoretically, is almost perfect, and an engine that has no other faults in the balance line can be rendered most unpleasant by a lack of homogeneity in the iron of which the flywheel is composed. Care in design and accuracy in manufacture enter into the matter almost equally, neither being of much use without the other, but properly to understand the whole question we must consider mathematical balance first, though there is no need to go deeply into figures or formulas.

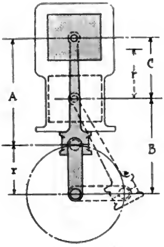
Reciprocating Balance

Fig. 1 shows a crank, connecting-rod, piston and cylinder in diagram. When the piston is at the top of its stroke the center of the wristpin is above the center of the crankpin by a distance equal to the length of the connecting-rod—A in Fig. 1. Now, imagine the position where the crankpin is half way round, at mid-stroke that is. Here the connecting-rod makes an angle with the vertical and the centers of wristpin and crankpin are thus no longer so far apart if we measure the *vertical* distance as B, Fig. 1. This means that the piston on the down stroke comes nearer to the center of the crankshaft faster than it would if the connecting-rod was not obliged to incline to the vertical. In other words the shorter the connecting-rod, the more it is tilted and the more the piston is accelerated by that tilting. A piston on the down stroke covers *more* than half its travel during the first *quarter* turn of the crank and *less* than half during the *second* quarter turn of the crank. On the upstroke it is easy to see that things are reversed, the third quarter turn of the crank causing less than half the piston travel in the upward direction, and the last quarter turn more than half the upward piston movement. This all means that the pistons on the commencement of the down stroke in a four-cylinder engine are moving faster than the other pair of pistons that are simultaneously on the upstroke.

Energy, Weight and Speed

Now the energy stored up in a moving mass depends upon its weight and speed, so in the four-cylinder engine we have equal weights of pistons and at mid-stroke they balance, but at any other points in the stroke where their speeds of movement are not the same, there is more energy stored in one pair than in the other. Follow the argument a little further. Looking at Fig. 2 suppose the right hand pair of pistons are on the first half of the down stroke, then it is they that are moving faster and the extra energy of motion is thus on the right side. After half stroke the left side pistons are moving faster than the right side pair and so the extra energy has shifted across to the other side too.

Since the pistons during the upper half of the crank circle move faster than in the lower half, a greater effort is required to arrest and reverse the direction of the piston at the top



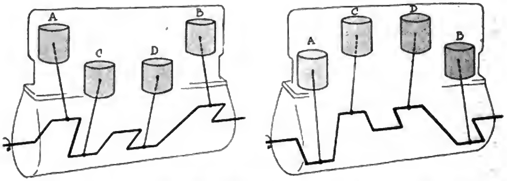


Fig. 1—Left—Piston moves more than half stroke during first quarter turn of crank. Since connecting rod is fixed length distance, B must be less than distance A, or C, the piston travel, is greater than r, the crank radius (half stroke) A + r = B + C, but B is less than A, so C is more than r. Fig. 2—Right—In left view upper pistons are on first half of down stroke, and so moving faster than lower pair of pistons that are on first half of upward stroke. In right hand view the rising pair are moving faster than the falling pair

dead center than at the bottom center. Now, as two pistons in a four-cylinder motor arrive at the top at the same instant as another two reach the bottom and, as the effort of stopping the top pair is greater than the effort of stopping the bottom pair it is obvious that there is some force left over, so to speak, and this will be an upward pull in the direction of the center line of the cylinders. Since each pair of pistons reach the top once in each revolution, this force appears twice each revolution and it is therefore called an unbalanced force of the *second* order of magnitude.*

There is another way of explaining the unbalanced force in a four-cylinder motor which will be useful later, and this is to imagine a common center of gravity for all the pistons together. We know that all bodies have a center of gravity, or a point where we can imagine all their weight to be concentrated. Turning to diagram Fig. 3, suppose that the weight of each piston is concentrated at one of the four black dots, then these four can be combined and represented by the single big black dot in the center. If we use graphical mechanics to find the position of this dot for a variety of piston positions, we shall find that it moves up and down the vertical center line of the engine as the crank revolves, making two oscillations for each turn of the shaft. Thus we can picture the unbalanced force as equal to the whole mass of all four pistons concentrated at the common center of gravity, and moving up and down a short distance very rapidly.

The effect of this unbalanced force in a four-cylinder engine is to lift the whole motor upwards twice each revolution, the weight and the fixing in the frame resisting the tendency.

Owing to the nature of the reciprocating engine there are often forces of higher orders that operate at various higher multiples of crankshaft speed, but any unbalanced forces above the second order of magnitude is usually so small as to be completely negligible in the small engines that are used on automobiles.

Eight-Cylinder Engine

An eight-cylinder V engine can be regarded as two blocks of four cylinders and the unbalanced forces will therefore tend to oscillate the motor as a whole along both the center line of the right block and that of the left block. Now, a mass cannot move in more than one direction at once, so the effect of the two separate unbalanced forces in the eight-cylinder motor is expressed by compounding them, and the resultant can be shown to be a separate force greater than either of the other two, but less than their sum; and oscillating transversely on a horizontal line drawn through the mass center of the motor. This is only true when the cylinders are at 90 degrees because they then make equal angles of 45 degrees with both the vertical and the horizontal. See Fig. 4. Other angles will produce an unbalanced force that tends to make the whole engine describe a small elliptical movement, the degree of the angle determining the relative depth and breadth of the ellipse. When the cylinders are at 60 degrees the "ellipse" is a circle.

Summing up therefore. The four-cylinder motor acts as though there was a small loose weight inside it vibrating up and down in a central vertical line.

The 90 degree eight acts as if a slightly heavier weight were vibrating it transversely.

The 60 degree eight acts as if a free weight was revolving round inside at twice the crankshaft speed.

The Six-Cylinder

It is less easy to explain the action of the forces in a six. It is perhaps most simple to imagine two pistons at the top of the stroke and therefore just undergoing reversal in direction of movement. Instead of these two being balanced by another pair at the bottom of the stroke, as in the four, they are balanced by *four* other pistons, two rising and two falling. These four pistons are none of them near a dead point, but are rather closer to the mid-stroke positions of maximum speed. Thus, instead of there being an instant when all the pistons are changing direction of motion together as they do in the four; when two are stationary another two are decelerating and yet another two are accelerating. The effect of removing the sudden change that is found in the four is to remove the unbalanced force altogether.

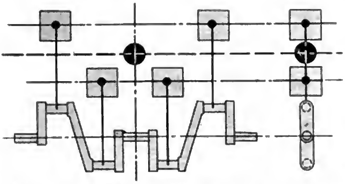


Fig. 3—Centers of gravity of each piston shown by small black dots act as though they had a common center of gravity indicated by large dot. The unbalanced force in a four-cylinder motor is measured by the total piston weight and by the amount of the slight distance the big black dot moves up and down during one crank revolution

if we plot the common center of gravity of all the pistons, as shown in diagram Fig. 3, for the four-cylinder motor, we shall find—on trying different crank positions—that the common center of gravity does not move in any direction, and thus the six-cylinder motor is balanced completely.

---

*Note—Primary balance does not enter into the problem of simple multi-cylinder engines balancing, except in one case, and its nature will be touched upon in the proper place.

Plunging Action

So far we have considered the balance of an engine solely from the end aspect, but if we regard the engine from the side there are other forces at work called couples. Take the diagram Fig. 5 which shows a four cylinder motor with the pistons at dead point. The outer pair are at the top and the inner pair at the bottom, so if we cut the engine in two by a vertical line and think of the forces acting on half the crank shaft we see then on each side there are two forces pulling upwards at the extreme right and left ends on the shaft, and there are two other forces pulling down near the middle of the shaft. If we forget the unbalanced force and suppose that an equal pull is needed to reverse the motion of a piston at the top and bottom of the stroke then we have four equal forces acting in the directions of the arrows A, B, C, D. Now this means that there is an attempt being made to pull the two halves of the shaft into the positions shown in Fig. 6, and when the pistons have made a half revolution the tendency is still to bend the shaft the same way, but the stresses on the bearings which prevent such whipping are now reversed in direction. In a two-cylinder engine this action produces a "couple" which tries to rock the whole motor and is damped out by the frame of the car, the springs and ultimately the wheels; its effect is to constantly throw a little extra weight first on the front and then on the rear axle.

In the four cylinder engine there are two of these couples in opposite directions so that they cancel out if the crank is stiff enough to resist the bending stress. This tendency to bend explains why the crankshaft of a two bearing pattern has to be so very stiff, since it gets no support at the point where bending is greatest, namely at the center.

A six-cylinder engine and a three-cylinder have equally good balance as viewed from the end, but there is a couple in the three-cylinder similar to that in the two. So the six-cylinder crank has to enable two opposing couples to counteract each other by reason of its intrinsic stiffness just as a four-cylinder crank has to do.

An Eight with Perfect Balance

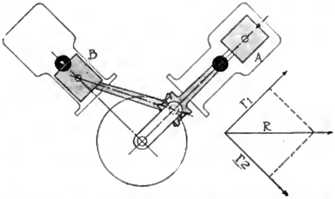
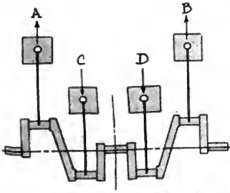


Fig. 4—A is at top of stroke, so force due to common mass of all pistons on right side is acting upward along center line of right cylinder block. B is at half stroke, so force due to four left pistons is acting down left center line. If F_1 F_2 in diagram of forces represent the unbalanced forces in amount and in direction, it is obvious that R is their resultant and acts horizontally

The only objection that can seriously be urged against the eight as made at present is that it has a distinct unbalanced force, as has been shown already. There is a modification that is perfectly practical which would overcome this objection almost completely at a slight increase in cost of manufacture, and it seems curious that this has not been brought up during recent discussions on the subject. In the ordinary eight the unbalanced force acts along a horizontal line transverse to the motor and it is greater than the vertical unbalanced force in a four-cylinder engine. Both in the four and in the eight the unbalanced force is of the second order, that is to say it acts at twice crankshaft speed.

Now there are two ways of regarding the eight; we have adopted the scheme of considering two fours and showing that the resultant of their unbalanced forces produces the horizontal vibration aforesaid. We can, however, consider an eight as made up of four two-cylinder 90 degree motors, one behind the other, and if we adopt this plan the result appears differently although it is actually the same. The two-cylinder 90 degree V motor has an unbalanced force of the *first* order, that is at crankshaft speed, unless it is fitted with a balance weight as a counterpoise to the pistons. In a single cylinder motor it is impossible completely to overcome the primary unbalance by a single balance weight on the crank though it may be reduced greatly, but it is possible to reduce the magnitude of the force. In a 90 degree two-cylinder the primary force is completely balanced by fitting the crank with a suitable counterpoise, and when such an engine has the primary balance thereby rendered perfect there is left unbalanced only the secondary horizontal force which is just a quarter of the similar force in an eight with similar cylinder dimensions.

If instead of regarding the unbalance of the eight as made up of the sum of the two unbalanced forces of two four-cylinder motors we think of it as produced by each V-pair of cylinders considered separately, we have suggested to us the possibility of arranging these four forces so as to counteract each other. In the ordinary eight each of the



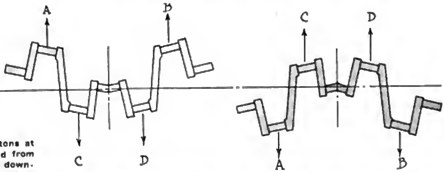


Fig. 5—Left—Diagram showing forces on pistons at dead center. The two outer are being arrested from traveling upward and the two lower stopped in downward movement, all at the same instant. Fig. 6—Right—Shows the bending action on the crankshaft caused by the forces shown in Fig. 5, and the similar position for the opposite dead center. Incidentaly explains the need for stiff crankshafts and for rigid center bearings

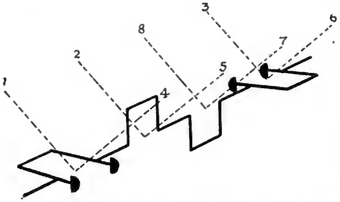


Fig. 7—With a shaft having the pairs of cranks at 90 degrees an eight-cylinder motor is in almost perfect balance, provided that a pair of balance masses are added. Of course, the firing order requires to be different, and the diagram shows a possible order which would give perfectly regular torque

four acts in the same direction as the other three at the same instant, but if we could make two cylinder pairs act one way while the other two acted in the opposite direction, the forces would neutralize each other.

Now, the secondary unbalanced force acts at twice the speed of crankshaft revolution, so if we are to balance the forces due to the four separate transverse pairs of cylinders we shall have to change the order of the cycle so as to retard two of the pairs by a time equal to *one quarter* of a crankshaft turn, since the unbalanced force reverses its direction completely during one *half* turn of the crank.

Take the first pair of cylinders, therefore, and it is easy to see that, if the unbalanced force due to them is to be balanced by that due to the second pair, their respective cranks must be at 90 degrees instead of 180 degrees as is usual. When this is done then the four cylinders forming the front half of the motor are balanced completely except for a transverse couple of small amount. Setting the rearmost pairs of cylinders similarly will balance them with respect to each other and will also cancel the couple, so leaving no unbalanced force at all of either first or second magnitude.

Actually there is a small unbalanced force acting at four times crankshaft speed, but this is only *one hundredth* of the force in an ordinary eight with all cranks in the same plane.

With such a motor as the one suggested the same even torque is obtainable by altering the sequence of firing. A possible order of firing is shown in Fig. 7.

The drawback to this type of motor being the balance masses necessary, it may be added that they have advantages on all types of engine for reasons that have nothing to do with the balance of reciprocating parts. Next week we shall consider vibration in the motor arising from causes other than the balance of the pistons and connecting-rods, and the matter of balanced cranks will be explained therein.

(To be concluded)

Recent Court Decisions—Pedestrian Loses

By George F. Kaiser

ALTHOUGH holding that all parts of a public highway are open to foot passengers and automobiles and that pedestrians are not obliged to look back, while the motorists are required to use every reasonable precaution to insure their safety, it was decided in California lately that a woman could not recover for her injuries when she rushed from a place of safety to one of danger, in terror at the sudden approach of an automobile.

The court held that a $2,000 judgment which she had received was improper, although women are liable to become panic stricken at the sudden approach of a car.—*Raymond vs. Hill,* 143 *Pacific* (*California*) 743.

Girl Not Negligent

That a young girl seven years old, crossing a street at a jog trot, was not guilty of negligence, if she was run down and injured at a place and hour where automobiles might be expected to move at a moderate speed, was recently decided in Massachusetts.

The Court held that, as the automobile was moving at from 15-20 miles an hour, and no horn was sounded, it was significant that the motorist was negligent, in view of the close proximity of a school house and the actual presence of children nearby.—*Trips vs. Taft,* 106 *N. E.* 578.

Owner Liable, Though Not in Car

Another severe case, holding an automobile owner responsible for injuries when his car is driven by a third party, was recently decided in Massachusetts.

A motorist was entertaining two men and two women as guests at his summer cottage. The women asked for an automobile ride but the owner refused and (the words of the learned court) they then "kept teasing" him and did "quite a little coaxing" until finally he said: "Well, you can go if you want to, but do not be gone long," and took the key from his pocket with which to unlock the switch and threw it down. One of the men guests had a chauffeur's license and knew how to operate the car. He took the women out and, through carelessness, injured another person who sued the owner.

The owner testified that he did not want them to go; that he knew his guest would drive and thought they would go just a little way and come back, but denied that the guest was acting as his agent in taking the women out.

The court held, however, that although if the defendant had merely loaned his car, or permitted it for use, in which he had no interest, he would not be liable; still, as the women were his guests, and he told them to return, the relation of host and guest existed during the ride and it must be presumed that the driver had implied authority to act as the owner's agent, and the owner must therefore stand responsible for the injuries caused by him.—*Campbell vs. Arnold,* 106 N. E. (*Massachusetts*), 599.

Owner Not Responsible

A motor truck owner was not responsible in damages merely because of its ownership of the truck.

In New York it was recently decided that a motor truck owner, having hired out its truck to another concern, was relieved from responsibility for injuries occurring through the negligence of the chauffeur in charge of the truck. The company owning the motor truck had made an agreement with another company by which the latter was to hire a truck, employ a chauffeur and have complete control over him. The first company, however, was to pay the chauffeur's salary.

While driving negligently a person was injured and sued the truck owner. The court said that the company renting the truck was the proper party to be sued, as it gave the chaffeur his orders and assumed complete control over him and the mere fact that the owner paid his wages, alone, did not make it responsible for the chauffeur's carelessness.—*Diamond vs. Sternberg,* 149 *N. Y. S.* (*New York*) 1,000.

Capacity of Eight-Cylinder Motors in Cubic Inches

Calculated for Bores Between 2½ and 5 Inches, with Strokes from 2½ to 6½ Inches

BORE—INCHES

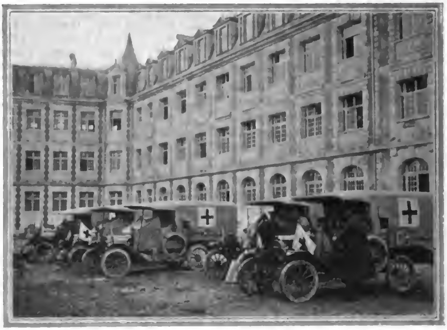
STROKE—INCHES

	2 1-2	2 9-16	2 5-8	2 11-16	2 3-4	2 13-16	2 7-8	2 15-16	3	3 1-16	3 1-8	3 3-16	3 1-4	3 5-16	3 3-8	3 7-16	3 1-2	3 9-16	3 5-8	3 11-16	3 3-4
2 1-2	98.2	103.1	108.2	113.4	118.8	124.2	129.8	135.5													
2 5-8	103.1	108.3	113.6	119.1	124.7	130.4	136.3	142.3													
2 3-4	108.0	113.4	119.0	124.8	130.6	136.7	142.8	149.1													
2 7-8	112.9	118.6	124.5	130.4	136.6	142.9	149.3	155.9													
3	117.8	123.6	129.9	136.1	142.5	149.1	155.8	162.6	169.6	176.8	184.1	191.5	199.1	206.8	214.7	222.7	230.9				
3 1-8	122.7	128.9	135.3	141.8	148.5	155.3	162.3	169.4	176.7	184.1	191.7	199.5	207.4	215.4	223.6	232.0	240.5				
3 1-4	127.6	134.1	140.7	147.5	154.4	161.5	168.8	176.2	183.8	191.5	199.4	207.5	215.7	224.0	232.6	241.3	250.1				
3 3-8	132.5	139.2	146.1	153.1	160.3	167.7	175.3	183.0	190.8	198.9	207.2	215.4	224.0	232.7	241.5	250.6	259.7				
3 1-2	137.4	144.4	151.5	158.8	166.3	173.9	181.8	189.7	197.9	206.2	214.7	223.4	232.3	241.3	250.5	259.8	269.4	279.1	288.9	299.0	309.2
3 5-8	142.3	149.5	156.9	164.5	172.2	180.1	188.2	196.5	205.0	213.6	222.4	231.4	240.6	249.9	259.4	269.1	279.0	289.1	299.3	309.7	320.3
3 3-4	147.2	154.7	162.3	170.1	178.2	186.4	194.7	203.3	212.0	221.0	230.1	239.4	248.8	258.5	268.4	278.4	288.6	299.0	309.6	320.4	331.3
3 7-8	152.2	159.8	167.7	175.8	184.1	192.6	201.2	210.1	219.1	228.3	237.7	247.4	257.1	267.1	277.3	287.6	298.2	309.0	319.9	331.0	342.3
4	157.1	165.0	173.2	181.5	190.0	198.8	207.7	216.8	226.2	235.7	245.4	255.3	265.4	275.8	286.3	296.8	307.9	318.9	330.2	341.7	353.4
4 1-8	161.9	170.2	178.6	187.2	196.0	205.0	214.2	223.6	233.2	243.1	253.1	263.3	273.7	284.4	295.2	306.2	317.5	328.9	340.5	352.4	364.4
4 1-4	166.9	175.3	184.0	192.8	201.9	211.2	220.7	230.4	240.3	250.4	260.8	271.3	282.0	293.0	304.2	315.5	327.1	338.9	350.9	363.1	375.5
4 3-8	171.8	180.5	189.4	198.5	207.9	217.4	227.2	237.2	247.4	257.8	268.4	279.3	290.3	301.6	313.1	324.7	336.7	348.9	361.2	373.7	386.5
4 1-2	176.7	185.6	194.8	204.2	213.8	223.6	233.7	243.9	254.4	265.2	276.1	287.3	298.6	310.2	322.0	334.6	346.3	358.8	371.5	384.4	397.6
4 5-8	181.6	190.8	200.2	209.9	219.7	229.8	240.2	250.7	261.5	272.5	283.8	295.2	306.9	318.8	331.0	343.3	356.0	368.8	381.8	395.1	408.6
4 3-4	186.5	195.9	205.6	215.5	225.7	236.1	246.7	257.5	268.6	279.9	291.4	303.2	315.2	327.5	339.9	352.6	365.6	378.8	392.1	405.8	419.7
4 7-8	191.4	201.1	211.0	221.2	231.6	242.3	253.2	264.3	275.7	287.3	299.1	311.2	323.5	336.1	348.9	361.8	375.2	388.7	402.5	416.5	430.7
5	196.3	206.3	216.5	226.9	237.6	248.5	259.7	271.1	282.7	294.6	306.8	319.2	331.8	344.7	357.8	371.1	384.8	398.7	412.8	427.1	441.7
5 1-8	201.2	211.4	221.8	232.5	243.5	254.7	266.1	277.8	289.8	302.0	314.4	327.2	340.1	353.3	366.8	380.4	394.4	408.7	423.1	437.9	452.8
5 1-4	206.1	216.6	227.3	238.2	249.4	260.9	272.6	284.6	296.9	309.4	322.1	335.1	348.4	361.9	375.7	389.7	404.1	418.6	433.4	448.5	463.8
5 3-8	211.1	221.7	232.7	243.9	255.4	267.1	279.1	291.4	303.9	316.7	329.8	343.1	356.7	370.6	384.7	399.0	413.7	428.6	443.7	459.2	474.9
5 1-2	215.9	226.9	238.1	249.6	261.3	273.3	285.6	298.2	311.0	324.1	337.5	351.1	365.0	379.2	393.6	408.2	423.3	438.6	454.1	469.9	485.9
5 5-8	220.8	232.2	243.5	255.2	267.3	279.5	292.1	304.9	318.1	331.5	345.1	359.1	373.3	387.8	402.6	417.5	432.9	448.5	464.4	480.5	497.0
5 3-4	225.8	237.2	248.9	260.9	273.2	285.8	298.6	311.7	325.1	338.8	352.8	367.1	381.6	396.4	411.5	426.6	442.6	458.5	474.7	491.2	508.0
5 7-8	230.7	242.4	254.3	266.6	279.1	292.0	305.1	318.5	332.2	346.2	360.5	375.0	389.9	405.0	420.5	436.1	452.2	468.5	485.0	501.9	519.0
6	235.6	247.5	259.6	272.3	285.1	298.2	311.6	325.3	339.3	353.6	368.1	383.0	398.2	413.6	429.4	445.4	461.8	478.4	495.3	512.6	530.1
6 1-8	240.5	252.7	265.2	277.9	291.0	304.4	318.1	332.1	346.3	360.9	375.8	391.0	406.5	422.3	438.4	454.7	471.4	488.4	505.7	523.3	541.1
6 1-4	245.4	257.8	270.6	283.6	296.9	310.6	324.6	338.8	353.4	368.3	383.5	399.0	414.8	430.9	447.3	463.9	481.0	498.4	516.0	533.9	552.2
6 3-8	250.3	263.0	276.0	289.3	302.9	316.8	331.1	345.6	360.5	375.6	391.1	406.9	423.1	439.5	456.2	473.2	490.7	508.3	526.3	544.6	563.2
6 1-2	255.2	268.2	281.4	294.9	308.8	323.0	337.6	352.4	367.5	383.0	398.8	414.9	431.4	448.1	465.2	482.5	500.3	518.3	536.6	555.3	574.3

	3 13-16	3 7-8	3 15-16	4	4 1-16	4 1-8	4 3-16	4 1-4	4 5-16	4 3-8	4 7-16	4 1-2	4 9-16	4 5-8	4 11-16	4 3-4	4 13-16	4 7-8	4 15-16	5
3 1-2	319.6	330.2	340.9																	
3 5-8	331.0	342.0	353.1																	
3 3-4	342.5	353.8	365.3																	
3 7-8	353.9	365.6	377.5																	
4	365.3	377.4	389.6	402.1	414.8	427.6	440.7	453.9	467.4	481.0	494.9									
4 1-8	376.7	389.1	401.8	414.7	427.7	441.0	454.5	468.1	482.0	496.1	510.3									
4 1-4	388.1	400.9	414.0	427.2	440.7	454.4	468.2	482.3	496.6	511.1	525.8									
4 3-8	399.5	412.7	426.2	439.8	453.7	467.7	482.0	496.5	511.2	526.1	541.3									
4 1-2	411.6	424.5	438.4	452.4	466.6	481.1	495.8	510.7	525.8	541.2	556.7	572.5	588.5	604.8	621.2	637.9	654.8	671.9	689.2	706.8
4 5-8	422.4	436.3	450.5	464.9	479.6	494.4	509.5	524.8	540.4	556.2	572.2	588.4	604.9	621.6	638.5	655.6	673.0	690.6	708.4	726.5
4 3-4	433.8	448.1	462.7	477.5	492.5	507.8	523.3	539.0	555.0	571.2	587.7	604.3	621.2	638.4	655.7	673.3	691.2	709.3	727.6	746.1
4 7-8	445.2	459.9	474.9	490.1	505.5	521.2	537.1	553.2	569.6	586.3	603.1	620.2	637.6	655.2	673.0	691.1	709.4	727.9	746.7	765.7
5	456.6	471.7	487.1	502.6	518.4	534.5	550.9	567.4	584.2	601.3	618.6	636.1	653.9	672.0	690.3	708.8	727.6	746.6	765.9	785.4
5 1-8	468.0	483.5	499.2	515.2	531.4	547.9	564.6	581.6	598.8	616.3	634.0	652.0	670.3	688.8	707.5	726.5	745.8	765.2	785.0	805.0
5 1-4	479.5	495.3	511.4	527.8	544.4	561.3	578.4	595.8	613.4	631.4	649.5	667.9	686.6	705.6	724.8	744.2	763.9	783.9	804.2	824.7
5 3-8	490.9	507.1	523.6	540.3	557.3	574.6	592.2	610.0	628.0	646.4	665.0	683.9	703.0	722.4	742.0	761.9	782.2	802.6	823.3	844.3
5 1-2	502.3	518.9	535.8	552.9	570.3	588.0	605.9	624.2	642.6	661.4	680.4	699.8	719.3	739.2	759.3	779.7	800.3	821.2	842.4	863.9
5 5-8	513.7	530.7	547.9	565.5	583.3	601.4	619.7	638.4	657.3	676.5	695.9	715.7	735.7	756.0	776.5	797.4	818.5	839.9	861.6	883.5
5 3-4	525.1	542.5	560.1	578.0	596.2	614.7	633.5	652.5	671.9	691.5	711.4	731.6	752.0	772.8	793.8	815.1	836.7	858.6	880.7	903.2
5 7-8	536.5	554.3	572.3	590.6	609.2	628.1	647.3	666.7	686.5	706.5	726.9	747.5	768.4	789.6	811.1	832.8	854.9	877.2	899.9	922.8
6	547.9	566.0	584.5	603.1	622.3	641.5	661.0	680.9	701.1	721.6	742.4	763.4	784.7	806.4	828.3	850.5	873.1	895.9	919.0	942.5
6 1-8	559.4	577.8	596.7	615.7	635.1	654.8	674.8	695.1	715.7	736.6	757.8	779.3	801.1	823.2	845.6	868.3	891.3	914.6	938.2	962.1
6 1-4	570.8	589.6	608.8	628.3	648.1	668.2	688.6	709.3	730.3	751.6	773.3	795.2	817.4	840.0	862.8	886.0	909.5	933.2	957.3	981.7
6 3-8	582.2	601.4	621.0	640.8	661.0	681.5	702.4	723.5	744.9	766.7	788.7	811.1	833.8	856.8	880.1	903.7	927.7	951.9	976.5	1,001.3
6 1-2	593.6	613.2	633.2	653.4	674.0	694.9	716.1	737.7	759.5	781.7	804.2	827.0	850.1	873.6	897.3	921.4	945.9	970.6	995.6	1,021.0

American Ambulances in the Field

Equipment of American Hospital in Paris Over 100 Cars—Compactness and Practicability Feature Body Design—Work Is Quick and Efficient



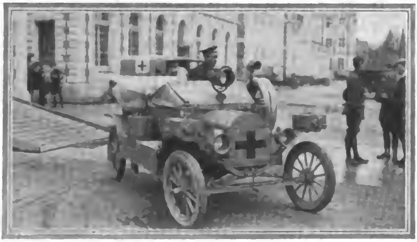
Ford ambulances attached to American hospital, Paris. These are some of the earliest machines, having had 3 months' active service on the battlefields in France and Belgium

WHEN the war trumpet had sent national institutions tottering, when the railroads and highroads were monopolized by men going forth to fight, when American tourists were struggling to escape from a country in which their dollars and their check books had become so much trash, when all Europe was shrieking or benumbed at the pestilence which was about to fall upon it—at that moment a group of American citizens in Paris rolled up their sleeves and prepared for the grim work they saw just ahead of them.

The modern and scientifically equipped American Hospital at Neuilly formed the nucleus and an almost completed high school building in the same suburb of Paris provided the necessary extension for an army hospital. As quickly as if the dinner bell had sounded, the men in that high school building had dropped their tools to take up rifle, lance or machine gun. But for them there was no after-dinner return. Their work was not sufficiently advanced to make the building fit for the youth of France, but it was in such a condition that the bare halls could be quickly transformed into wards and offices. With plenty of hard work, American goodwill, and the necessary financial backing, the unfinished Lycée Pasteur, abandoned by its workmen transformed into soldiers, was in a few days a military hospital with accommodation for 900 men.

A civil hospital might exist without automobiles; to a military establishment they are as necessary as the steam to a steam engine, the clients to a store, the water to a mill. During the moments when nations are switching over from peace to war, automobiles are valuable and scarce. The American Hospital committee discovered its first automobiles at the Paris branch of the Ford company. But they were not ambulances, and to make them into such the Ford company employed the cases in which the automobiles had been brought from America, and even tore up some of the flooring of their cinema theater.

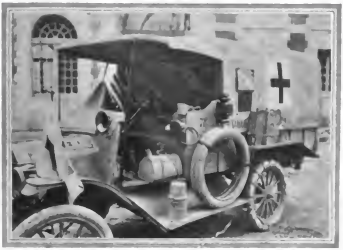
From that hasty beginning a wonderful organization has sprung up. It would be more correct to say has been built up, for automobile organizations, whether they be ambulances or factories can only be brought into being by persistent and conscientious work. At the present moment there are attached to the American Hospital in Paris, about 100 automobile ambulances. Fords predominate; their companions are English Daimlers and "Jumbo," an eight-cylinder De Dion Bouton with a horsevan body—but instead of racehorses it carries wounded soldiers.



Section commander's car attached to American ambulance. Note reserve gasoline cans on front fenders and top of tool box

Nearly All Volunteers

A staff had to be got together. America supplied it before it was asked for. The list of names in the office of the Captain of Ambulances is worth looking over. Alphabetical classification puts at the head an ex-governor of Porto Rico; he is followed by an ex-assistant secretary of the treasury, the son of a well-known cotton king; ex-army officers, Harvard men. The paid workers might be counted on the fingers of one hand; the men who are driving automobiles as well as those who are sweeping wards, washing wounds, and preparing bandages come from homes of luxury and an environment of wealth.



Detailed fittings of one of American ambulances. Shoes and generator on running board, spare gasoline and kerosene on fender, sterilized water bottle at driver's feet, spare tubes in locker at driver's elbow

Tommy Atkins, who has done much to increase the world's vocabulary since this war began, has hit upon a happy expression. The British soldier was wounded; he was making his way to the rear as best he could, when a Ford from the American Hospital came dancing down the greasy, granite paved, mud bordered highway. It jumped off the paving stones into the mud bath, and from the mud bath back to the paving stones; it slipped past convoys and worked its way past wrecked machines; finally it pulled up in front of the Britisher. "Blime if that ain't another of them bloomin' bleedin' jumpin' bedsteads," remarked Tommy as they lifted him aboard. And "jumping bedsteads," with as many adjectives as imagination can supply, the Fords have remained until this day.

How these machines were brought up to a state of perfection is a story of some interest to automobilists. Before it can be told some explanation must be given of the work the cars have to do and how they do it. Although the hospital is a private institution, the entire organization is under military control. Every automobile carries a military number and every driver is almost as much under military control as the Englishman who has taken the King's shilling, or the conscript owing allegiance to France. In the earlier stages of the war, particularly when Paris was threatened, the ambulances made out and home trips from the hospital to the battlefield. They picked men up where they had fallen and brought them direct to the hospital in the suburbs of Paris. Now that is changed. The firing line is some distance away and the automobiles are sent out in sections and squads, to remain in the field for any period from 3 weeks to 3 months, to work under army directions, while at the same time maintaining their individual organization. The work is varied. It may be taxicab service in some town 50 miles from the battle line; it may be picking up wounded practically on the battlefield and carrying them to the field hospitals; it may be the removal of sick and wounded men from the field hospitals to the base hospitals or to the hospital trains some miles back.

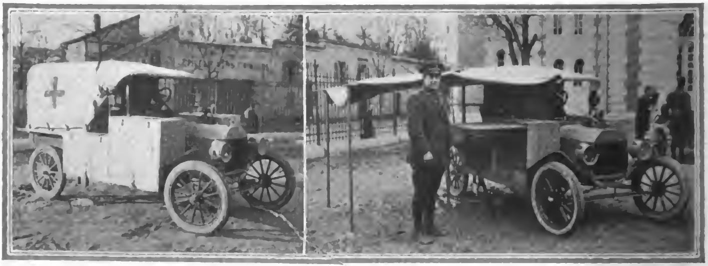
Many Emergency Calls

The work is as exacting as it is varied. At any moment the hurry up call may come, and when it comes men and machines must be ready to start off for a run which may be from 50 to 250 miles, and for service which may last a few minutes or a few hours. It is not infrequent for men and machines to be kept going continuously for 18 hours without the motors being stopped.

A squad consists of five ambulances, a supply car and a touring car. A section is made up of two squads, or twelve vehicles, ten of them being ambulances and two respectively a supply car and a touring car. In the majority of cases the ambulances work in sections, for these are absolutely self contained, carrying with them all necessary parts to meet every possible emergency, and requiring nothing more in the way of outside supplies than gasoline and oil to keep them running indefinitely.

Each ambulance is built to receive a couple of army type stretchers, or to carry four wounded men sitting, thus making, with the driver and attendant, a maximum load of six men. It is a rule to carry four orderlies for six ambulances. Owing to the small dimensions of the vehicle it has not been an easy matter to fit up the Fords in a satisfactory manner. The body is of wood and canvas, with the canvas fastened down permanently all round except at the rear. Here there is a hinged tail board with canvas curtains above it fastened by turnscrews. There is a considerable amount of overhang, and the army stretchers are a little longer than the body. Thus four holes have been cut in the tailboard and canvas bags fitted over these. This allows the ends of the stretchers to project, but prevents cold air entering. When men are sitting on the transverse benches hooked to the side panels, they have a tendency to get to the rear, in order to look out, thus upsetting the balance of the car. This is overcome by fitting a mica window on each side forward; the men move

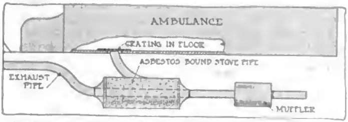
Left—The English Daimler attached to an American hospital, Paris, taking on gasoline. Right—Jumbo—An eight-cylinder De Dion Bouton which formerly carried race horses. Fitted as an ambulance it can move eighteen men at a time



Left—Ford store and workshop ready for the road. Right—Ford repair car fixed up for service

upwards to look out of this and in doing so evenly distribute the load.

As soon as the cold weather set in, the French army asked for heated ambulances. The American Hospital tried to meet the want, and after some experimenting produced a simple heating apparatus of such efficacy that the Ford was dubbed by French soldiers "L'Hotel du Courant d'Air—Chauffage Central" (Drafty Hotel—Central Heating). Mr. McFadden, one of the voluntary workers who tackled this job, fitted a stovepipe around the exhaust pipe, closed up the ends, bound it with sheet asbestos, and carried a lead from the stovepipe through the floor level with the heads of the men lying in the ambulance. The opening is covered with a grating. This arrangement will raise the temperature of the ambulance 17 degrees in half an hour. It supplies pure hot air, and has the advantage of costing but $4.



Ingenious method of heating Ford ambulances. Section of asbestos-bound stovepipe with closed ends is fitted around the exhaust pipe and a lead carries the heat to a grating in the floor of the ambulance

How two wounded men are carried in one of the American ambulances

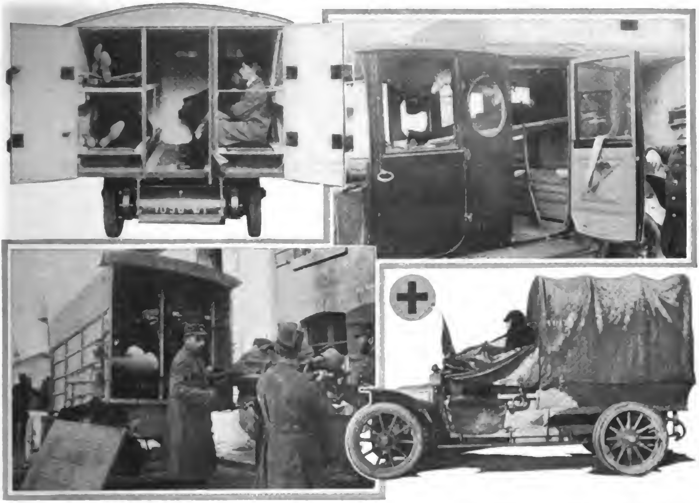
One of the objections to the Ford was the use of odd size tires. The ambulance people finally discarded the 3-inch tires on front wheels in favor of 3 1-2; they thus avoid carrying two size tubes and casings, an important matter when every ounce of weight has to be considered; they obtain better tire service, and according to some of the drivers the cars are easier to steer. The lighting outfit had to be simplified; there were originally too many bends in the pipes and no provision for drawing off water. Electric lighting was tried and abandoned, the experience of the ambulance people being that it is unsuitable. Further, the British army authorities refuse to allow any car to be in service at the front with electric lighting only. If electric lighting exists, it must be supplemented by gas. Each car carries two spare casings, either on the left hand running board or on the roof extension above the driver's head. Spare tubes are contained in a box at the driver's elbow. The gasoline supply for each car is 35 liters, or 7.7 gallons, in tank, and 30 liters, or 6.6 gallons, in reserve. This reserve supply is contained in 6 cans, 3 on each rear fender, in addition a small supply of kerosene is carried for side lamps and a reserve of 2 gallons of lubricating oil. This reserve supply must always be maintained. In this way the ambulances are ready to respond to every call for a distance of not less than 250 miles without any outside supplies being needed. Under the canvas apron which replaces the glass windscreen, every driver has a bottle containing sterilized water, and a military kitchen with all eating utensils.

Cars Marvels of Compactness

The touring car and supply car which travel with every section are marvels of ingenuity. All jimcrack ideas have been driven out by the stern realities of war, and the touring car can handle all the kit and food of the men in its section, while the supply car has enough spares to build a complete Ford car. The problems in the supply car were to have the load distributed so that the weight should be carried with the least possible strain, to make every spare accessible, and also to render control of the stock eas y. This car carries a radiator, cylinder casting, set of pistons, rear axle, spare wheel, steering levers, and a stock of small parts usually only to be found in an automobile store. The general arrangement, for which Fred B. Bate is responsible, is shown in the illustrations. Boxes for spare parts are built all around the car in such a way as to get the load well centered and as low as possible. The body is of wood and canvas, with the canvas sides capable of being extended and held up by props so as to form a convenient workshop. Within the body are shelves receiving metal boxes for such articles as bolts, nuts, gaskets, nails, screws, spark plugs, etc. Every cupboard is numbered and a list maintained of every article in each cupboard. As a note is made of every part given out to drivers, the keeper of the supplies knows exactly what stock he has in hand and can supply any part at a moment's notice.

It will be asked what are the mechanical troubles which develop with this type of machine. They are surprisingly small. Spark plugs give a lot of trouble; under the heavy going brake bands fail more frequently than in normal service. But this is about all. The accurately kept list of spares supplied to a section of 12 cars which had been at the front for eight consecutive weeks showed nothing more important than a set of steering levers (damaged in a collision) hub caps, gaskets, spark plugs, switch keys, headlight burners, tail lamps and brake bands.

The war has reached such a stage that it is necessary to keep very few ambulances at the hospital in Paris. The Captain of Ambulances is striving to keep his whole fleet in the field, under the direction of the military authorities. When a section comes back—it may be after a couple of months' constant service,—it is repaired, overhauled, given fresh supplies and sent back into the field.



Upper left—British army ambulance designed by J. J. Mann, of the Daimler company, which can carry six men lying or two lying and three sitting. Upper right—This Sizaire-Berwick carries two stretchers, thus providing comfortable sleeping accommodations for the driver and his mechanic. Lower left—Bringing in wounded French soldiers by motor ambulance. Lower right—Two-cylinder Renault Paris taxicab converted into an ambulance for service in the French army

Convoy of British Red Cross automobiles in France ready for use at a moment's notice

Northwest Farmers Offer Big Car Market

Great Minneapolis Distributing Show for Tremendous Territory of 316,134 Square Miles Closes—25,000 Cars Sold Last Year in This Region —50 Per Cent. Increase Is Expected for 1915

MINNEAPOLIS, MINN., Feb. 6—When the eighth annual automobile show closed here tonight, after running for a week, all exhibitors united in declaring it the best show ever held in the Twin Cities. It was the best show because its attendance was 25 per cent. above that of any previous show held here. The dealers were present in greater numbers than ever before, in fact, over 4,000 dealers were present from this territory which includes the states of Minnesota, North Dakota, South Dakota, the eastern half of Montana and the northwestern counties in Wisconsin.

The Minneapolis show is not a retail show for this city and St. Paul, but a great distributing show for the Northwest section of the country. The dealers came in to place specifications for shipments of cars to the territory and generally bring with them hundreds of prospects who want to look over all the different makes of cars before finally selecting. As a result of the show the Minneapolis distributors have orders on many car load shipments, and in addition many retail sales are made, but yet it is not in any sense a retail show, although the Twin City citizens attend in large numbers, the paid attendance alone for the week exceeding 40,000. To this you can add the tens of thousands who get tickets from dealers, which bring the attendance figures well up. Twin City dealers of small cars selling under $1,000 do not expect to make many retail sales, but do get names of many prospects.

Show week is the second biggest week of the year for the Twin Cities, the fall fair week in the fall bringing greater crowds to the city, but the money spent in show week is greater. Minneapolis and St. Paul are the great buying cities for the territory, in fact, they are familiarly known as the gateway to the Northwest.

As an automobile show the Minneapolis exhibit is one of no mean proportions. The National Guard Armory and Annex affords 50,000 square feet of floorspace. The armory has a square floor space with a narrow gallery for accessories in three sides, and the annex of slightly greater area is to one side and is reached by a short passageway of 50 feet. Here are cars, trucks, tractors, electrics and accessories.

All told fifty-eight different makes of gasoline passenger cars were exhibited, five makes of electrics, seven makes of gasoline trucks, three makes of gasoline farm tractors, and fifty-two accessories. The totals of vehicles exhibited were:

Gasoline passenger cars	163
Electric passenger cars	12
Gasoline trucks	13
Gasoline farm tractors	4
Total	193

The display of cars compared favorably with that in New York and Chicago, many of the exhibits from these shows being sent bodily to the Twin Cities. The chassis display was heavy, there being twenty-eight, some of the high-priced makers such as Packard, Reo had two, a four and a six, Cadillac, Overland, Jeffery, Chandler, Studebaker, Dodge, Velie, Maxwell, Hupp, Chalmers, Dort and many others had cut-away chassis, a few of which had constant crowds listening to the demonstrators' talks.

The display of electrics was particularly good—Minneapolis is a good electric center, there being five makers represented, Detroit, Rauch & Lang, Ohio, Milburn and Chicago. All vehicles were closed types, excepting the Detroit cabriolet or roadster style, a vehicle well suited for all-year-around use.

Closed Cars Neglected

Minneapolis and St. Paul, with a combined population of 535,000 are each year becoming a better closed car market, and berlines, sedans, and coupés are coming into their own, slowly but surely. Few of the makers have given the distributors here the assistance they deserve, as the number of closed cars shown is lamentably small. In the gasoline field they totaled eleven, made up of four berlines, four sedans and three coupés. In contrast with these figures were thirty-four roadsters and 118 touring cars. The limousine cannot be considered, in short, it is not here. The Twin City family prefers the berline with its removable windows or partition between the driver's compartment and the passenger compartment, so that the owner can drive if so inclined. Locomobile, Winton and Packard showed berlines, Overland, Cadillac, Franklin and Stutz had sedans, and Overland, Cadillac and Scripps-Booth showed coupés. The local dealer and distributor does not want to buy a berline or sedan from his factory for this show as the selling season is nearly over and he would have to carry it over for the fall of 1915. On the other hand a larger display of closed styles by the makers would serve to accelerate their introduction. Closed cars sell best here from October 1 to December 1 and the orders are generally placed late in the spring and the early summer. There is much talk of local body builders taking up the manufacture of closed types. In other words, the trend of special closed bodies is moving westward from New York to Chicago. All week in spite of the worst snowstorm of the season and in spite of temperature close to zero, at times, and in spite of more snow than this city is accustomed to, automobiles were out every day and every night in full force. One night 150 cars were lined up in the open square in front of the Armory, notwithstanding a blinding snowstorm and the next night nearly as many were counted under one of the clear, frosty nights for which the territory is renowned. The great majority of touring cars were fixed up with tops and side curtains, in fact, you do not see a touring car here without top or side curtains up. The hoods are well bundled up with padded jackets and blankets. Looking at these cars and considering the push-ahead spirit of this territory one is very forcibly impressed with the field here for closed types.

Minneapolis distributors placed many new agencies during the week, particularly those handling new cars. Thus W. E. Wheeler of the Northwestern Automobile Co., handling Saxon and Chandler, arranged for forty or more agencies in the territory. Milton Brice, of Brice Automobile Co., selling the Grant, appointed fifty to sixty new dealers. The La Crosse Implement Co. appointed thirty-five to forty new Dort agencies. The Pathfinder Motor Car Co., which is extending itself in this territory, appointed ten new dealers. These examples are typical of the value of the show for cars that are relatively new, whereas old-established makers add few new agencies during show week. Although many distributors placed few, if any, new agencies, yet their dealers from the territory attended in good numbers so that at least 50 per cent. of all dealers were present at the show. Overland has 150 dealers of whom 120 were in attendance; Studebaker had 225 at its dealers' dinner. Of the sixty-five Paige dealers, thirty-five were at the show; Mitchell had 110 of whom thirty-five were here; of the 100 old Grant dealers, seventy-five were in the city; Reo has 140 selling agencies in the territory and ninety attended the show; of 250 selling Saxon and Chandler, 125 were here; Franklin has twenty dealers of whom ten attended; Pathfinder reported the same figures; and with such leaders as Ford and Buick the representation of agents was particularly high.

The Territory

Minneapolis and geography are always closely associated just like New York and money, Chicago and stockyard, Washington and senators. Minneapolis is the flour city of the Union, but in the automobile industry the geography aspect of the city crowds out the flour phase. You get into a new range of distance here as compared with New York or Boston. Here area is the dominating feature.

The Minneapolis territory, when considered, is almost stupifying. Roughly it embraces more or less of five states, all Minnesota, North Dakota and South Dakota, the eastern half of Montana and a little northwestern corner of Wisconsin. This area looks big on the map but it is when you get it in figures that you start to comprehend its proportions. In area, the territory is one-eleventh of our country, including Alaska. It totals 316,000 square miles of country. Little New England, with its six states, has but 66,424 square miles. You could practically put five such areas into the territory that the Twin City automobile distributor has for his selling zone. No wonder out here they talk distributor, not dealer; but let us get a little more tangible grasp on the Twin City selling territory. This Minneapolis territory is almost equal in area to that of the following thirteen states: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Maryland, Pennsylvania, Ohio, Indiana and Illinois. Is there any wonder that out here is a robust spirit?

The great territory is exactly one-half larger in area than either Germany or France. You could lose twenty-eight little Belgiums in it. It is over twice as large as Japan. Note the table of comparative areas herewith.

In the population chart the figures are not so formidable but they are increasing very fast each year. The population of the whole Minneapolis territory is nearly 4,000,000 as compared with 6,552,681 in New England in 1910, but car buying is not in proportion to population. In other words, the number of cars owned for each 100 population is much higher in Minneapolis territory than in the New England zone. When you think of cars out here you think of farmers. They are the great big, overwhelming, dominating factor out here. They own the territory and Minneapolis and St. Paul are mere necessary excrescences. Going through the show and talking to exhibitors you get almost calloused to such expressions as: "I sell 75 per cent. of my cars to farmers, or 90 per cent. of our sales are with farmers." This is the farmers' country. There are 384,000 of them in the state of Minnesota and of these not 10 per cent. own cars. One-half the annual output of the country could be sold in this state alone for a year or two. To this you must add the two Dakotas and the east half of Montana.

The Farmer

The farmer has more money today than he has ever had before. What is the answer? Minnesota and the two Dakotas have this year produced 280,000,000 bushels of wheat and the farmer has sold it at an average of 50 cents per bushel ahead of any previous year. This means $140,000,000 additional going to the farmers in these three states. The state of Minnesota alone has a wheat crop of 90,000,000 bushels, meaning $45,000,000 additional more than the farmer looked for.

From this additional wheat money of $140,000,000 the implement man and the automobile dealer are going to benefit most. They come first with wheat selling here today at $1.54 per bushel, the farmer is getting $1.37 per bushel at the grain elevator. On August he was getting 95 cents per bushel and the price has been rising steadily ever since.

No wonder 90 per cent. of the cars are owned by the farmers. During 1914 the number of cars in Minnesota increased 50 per cent. November 1, 1914, there were 64,185 cars registered in the state. A year previous there were 42,664 cars registered. *The Farmer*, of St. Paul in a recent analysis of the cars sold in Minnesota last year, says that 63 per cent. of the 21,521 cars sold went to people whose postoffices are in towns of less than 3,000 population. This is another way of saying that these cars were sold to farmers. In North and South Dakota the same is true, only more so. The farmer is the big buyer. He is brawn and sinew of the industry in this great distributing zone. Farmers in this zone are divided into two classes: the grain farmer and the dairy or mixed farmer. The first grows only grain, wheat, oats, etc. He is found in western Minnesota and in the Dakotas. The dairy farmer grows grain but has many cattle, sheep and swine and depends upon a variety of sources of income. He gets money in each month for the sale of cream, he sells stock and sells grain. He is found in Wisconsin and generally in eastern Minnesota. He is invading a few of the Eastern counties in the Dakotas. His money comes in off and on during the entire year. Contrast this farmer with the one who grows grain only. He sells his grain in the fall and gets his money in once a year, and who if his grain fails has no other source of income. Place yourself as a dealer selling to such, selling 90 per cent. of your output to them. Begin with the basic assumption that you must do business on a credit basis. You must sell for a little cash and take notes at 3, 6, 9 and 12 months for the balance. That is how cars are sold to these farmers. The dealer gets as much cash as he can and takes notes for the balance. In Minnesota, notes in the mixed or dairy farmer territory are for short periods, 3 or 6 months, and carry interest at 6 or 8 per cent. In the grain farming sections the notes often run for 9 or 12 months and carry 10 per cent. interest. The dealer takes these notes to his banker, who gives the dealer their face value in cash. When the notes are due the banker notifies the dealer who in turn notifies the farmer and makes collection, so that often the farmer does not know the bank has held the note. Farmers prefer to do this in preference to going to the bank for a loan, as often the banks aim to discourage the farmer from buying a car. These farmers have been buying on credit since they settled in the territory and you cannot do business with them at present on any other basis than credit.

Minneapolis Territory

	Area Square Miles
Minnesota	84,682
South Dakota	77,615
North Dakota	70,837
Half of Montana	73,496
Wisconsin (part)	10,000
Total	316,134

Want Touring Cars

The farmers want touring cars, not roadsters. They all have families, hence a rational five-passenger car; and they want power, as many roads are heavy, and hills steep. As a result, horsepower is a greater selling factor in this territory than in New England or the East with its improved roads. This explains why several makers of small cars building only runabouts a year ago have brought out touring cars, thus referring to such as Saxon, Grant, Metz, etc. In the Dakotas the farmer is buying a two-wheel trailer carrying a box 3 by 8 feet. He attaches this to a cross-bar fitted above the rear spring and on this trailer he can carry a load of 1,500 pounds at a speed of 22 miles per hour. In general the farmer wants a tonneau type, so he can carry his produce to market, bring home his flour, groceries and binder twine; in short, his automobile has entirely replaced his horse vehicle on the road except for taking grain to the elevator.

These farmers do not take the best care of their cars. Some are not washed from January to December, as in the alkaline sections in South Dakota and Montana the body finish is soon ruined, black suffering quickest.

13 Other States

	Area Square Miles
Maine	33.040
New Hampshire	9.341
Vermont	9.564
Massachusetts	8,266
Rhode Island	1,248
Connecticut	4.965
New York	49.204
New Jersey	8.224
Maryland	12,327
Pennsylvania	45,126
Ohio	41,040
Indiana	36 354
Illinois	56,665
Total	315,364

Buy on Credit

Farmers who buy cars on credit expect to buy accessories, tires, gasoline and oil and also get repairs on credit. This is another big dealer's problem. In the dairy country with cream checks coming in once a month the dealer gets his money with reasonable regularity, but in some of the grain sections in Dakota, Montana and western Minnesota there is pay only once a year and that if crops are good. Often the dealer carries the account for 6 months and then takes a note for 6 or 9 months with 10 per cent. interest. But heroic efforts are being made to get repairs and accessories on a cash basis. In Montana, F. E. Doran in Lewistown, a town of 6,000 population, started on a cash basis last August and now all the dealers in the town have followed suit. He has issued coupon books with $25 worth of coupons which he sells for $22.50 or 10 per cent. discount. These are sold for cash. The coupons are good as payment for everything except tires and paying for a new car. In the first month he sold seventy books and now the farmers are well pleased. Before making the change Mr. Doran had printed posters placarded all through his territory and he advertised the fact that dealers in South Dakota and other parts of Montana are now adopting this new cash scheme. The dealer in the West calculates that it costs 10 per cent. to make collections, and the discount of 10 per cent. allowed on the coupons is very attractive to the farmer. The coupon books are the same size as a conventional blank check book. The coupons are in $1.50, 25, 10 and 5 cent denominations.

The war has not seriously affected this section. August 1, when war was declared, there was a lull which continued for nearly a month, but since then business has been above normal because of the unprecedented wheat market.

European Countries

	Area Square Miles
German Empire	208.780
France	207.054
Belgium	11.373
Japan	147,655
Russia	8,647,657
China	2,169,200

Double Oiling System in Duesenberg

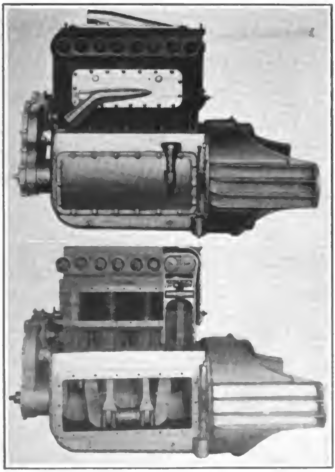
Duplex Oil Pump Replaces Single Type, Keeping Oil Always Cool

THE Duesenberg Motor Co., St. Paul, Minn., which has made a creditable showing for its engines in speed contests the past few seasons, is to continue them as a type for high speed cars in four-cylinder designs ranging in size from 4 by 6 inches to 4 3-8 by 6 inches.

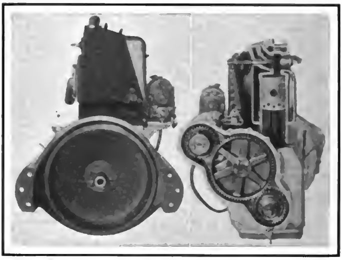
The general design and construction of these motors is the same as used the past two seasons in the concern's racing cars, with the exception that a double oiling system is now employed, a duplex oil pump being fitted in place of the former single type. It is the duty of one of these pumps to send the oil to the bearings and reservoir at the bottom of the motor, keeping the level here constant at all times. The other pump is used for taking away the overflow from the motor and returning this surplus to the main oil tank. It is pointed out that the new system has the advantage of keeping the motor supplied with cool oil at all times and avoids the possibility of overfilling the crankcase with lubricant.

Valves Are Horizontally Set

The distinctive features of the Duesenberg design are that the intake and exhaust valves are all set horizontally in the cylinder head, and the valves are operated by vertically-positioned rocker arms, one for each valve. The lower ends of these rockers bear on the cams, and the upper directly against the valve rods. With this construction, the valves, as in valve-in-head engines of the usual form, open directly into the cylinder heads without pockets. The valve construction is clearly seen in the end sectional view, and a plate goes over the valve rockers and valves, inclosing them effectively against dust and dirt, and also quieting them.



Duesenberg has two-bearing crank and very light pistons



Showing method of valve operation

Opposite to the valves are plugs in the center of which are the spark plugs, which make a simple head. The exhaust passages go directly upward to individual openings, while the passages to the intakes are cored within the cylinder casting, and the carbureter attaches by a single flange.

The motor uses a two-bearing crankshaft, and special magnalium racing pistons of light construction and having large oil holes in the lower part below the wristpins. The drive for the camshaft, water pump and magneto is by spiral gears, housed at the front.

The smaller motor—4 by 6—uses the same crankshaft and bearings as the larger size and also has the same valve area; therefore, the motor is capable of higher speeds than the larger type.

Both motors are furnished with rear supports to take the Brown-Lipe or other standard gearsets. On any installation, however, the three-point suspension principle is retained, the front end of the motor resting in a cradle lined with leather, thereby making for wear reduction and the lessening of vibration.

Flexible Leather Shaft Couplings Replace Metallic Type

IT is practically impossible to make a metal universal that will not chatter after a certain amount of wear has taken place and this fact has lately led to the use of joints in which the flexibility is given by the material. Used first for magneto couplings, leather was tried as long ago as 1911 for the propeller shaft on Isotta-Fraschini cars, and has been continued ever since, it is also used on all the Daimler passenger buses for the shaft drive.

Though few manufacturers have had the courage to follow this example, leather has been adopted widely for clutch coupling on chassis with separate gearboxes, and it is now the favorite material for coupling small parts such as magnetos, water pumps or even generators.

The original Isotta-Fraschini joint was as shown in A, Fig. 1, there being a disk of leather held at its circumference by a ring and driving through a smaller concentric ring. This stresses the leather more than the other type B which is the common form. An advantage of the leather for drive shaft coupling is that it is cheap and easy to renew if it should eventually fail and on bus service it is claimed that renewal of the leather every 30,000 miles or so is less costly than the re-bushing and lubrication necessary with metal universals.

Usually where leather disks are employed, the two shaft ends to be joined are fitted with a form of cross piece with provision for bolts at the extremities. In assembling, the two shafts are arranged with the cross pieces at right angles, and thus the leather ring interposed between them is bolted first to one and then the other. This obviously gives enough flexibility for the desired purpose.

The National Shows, where so many different cars are assembled in a small space, afford excellent opportunities for comparing the different types and modifications of couplings as well as other features. The sketches herewith depict some of the couplings on view at Chicago, no attempt having been made to show them all—simply a representative array taken at random.

Either an oak leather or a good grade of rawhide is best for the purpose in the majority of cases. It must be tough enough to take the drive without wearing the bolt holes so as to give no play there as, in time, this would tend to tear the holes in the leather sufficiently to cause trouble.

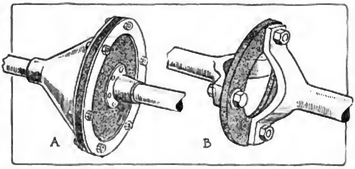
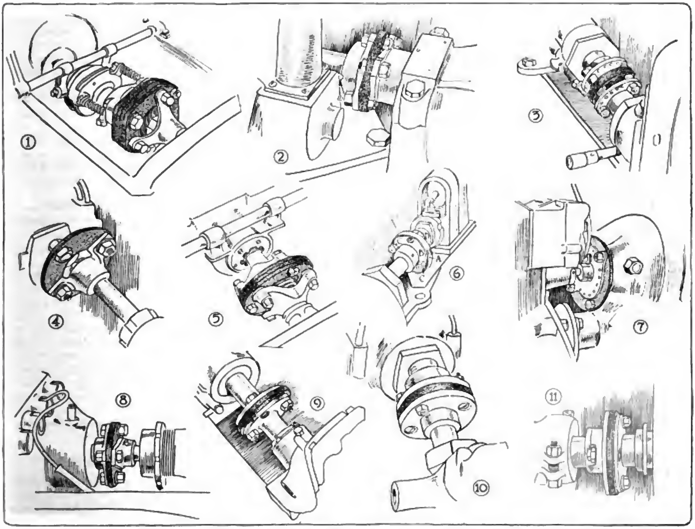
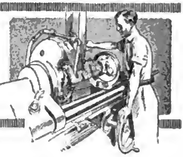


Fig. 1—A—Isotta-Fraschini coupling; the original design in which a real disk is used driven at its outer edge and driving through the center flange. B—The modern style using a ring of leather



1—Daimler form of coupling on Jeffery between clutch and gearbox; oak leather rings with corrugated steel washers mounted between them on the clamping bolts to prevent friction between leathers when joint is deformed by clutch withdrawal. 2—Pathfinder coupling with four arms to each flange and alternate bolting to leather disk. 3—Jeffery magneto coupling with differential holes in flanges bolted to leather to allow for fine magneto timing. 4—Standard form of coupling with leather ring between right angle flanges, provision being made for end play. 5—Willys-Knight clutch coupling with triple rawhide disks stiffened against end play of clutch throwout by spring support for leather. 6—National magneto coupling with leather inclosed for protection. Leather is attached to flanges A and B by bolts at right angles and the cupped edge of A overlaps the edge of B. 7—Modification of right angle flange coupling on Case. 8—Standard form of coupling as seen on Pierce-Arrow. 9—10—Kisselkar and Paige, respectively, are couplings with leather bolted to flanges. Bolt heads are free of holes in flanges and fair protection is given to leather. 11—Pratt coupling of similar type to 9 and 10, but in this case the bolt heads stand up in the holes in the flanges so that if the leather should fail contact will be made and drive maintained

The Rostrum



Communications

¶ The editor of the Rostrum is anxious to secure from car users and others, communications dealing with the overcoming of difficulties, in making repairs and in the numberless other phases of every-day automobiling. This department is mutual and is a common ground upon which an interchange of ideas and opinions can be made as freely as in the clubroom.

¶ The ingenuity of the motorist who has his own garage and enjoys working upon his car is originally responsible for many of the improvements made by manufacturers. In fact, it is known that every maker is more than anxious to learn the opinions of the users of cars and is more than anxious to benefit from the experience gained by the mass of automobilists.

Why Have Sleds Narrow Treads?

EDITOR THE AUTOMOBILE:—I presume almost everyone knows that sleds used in the winter in this latitude have a 38-inch tread, while wagons, buggies and automobiles have a 54-inch tread. I would like very much to know why a sled for winter use should have a 38-inch instead of a 54-inch tread. If sleds were built with a 54-inch tread they would be a mutual help in keeping the roads open to automobiles as well as other vehicles. It is a well known fact to all physicians, for instance, that more sickness prevails during winter than during the summer, consequently we are obliged to use the roads more in winter than in summer. In these days of rapid transit, it is pretty tedious to have to resort to the horse for country service.

Why could not the automobile manufacturers of the country be enlisted to bring their influence to bear upon builders of sleds and point out to them the desirability of a standard 54-inch tread for northern latitudes?

Ann Arbor, Mich. JOHN A. WESINGER, M.D.

Balancing Pistons and Connecting-Rods

EDITOR THE AUTOMOBILE:—Can you inform me where I can get scales or whatever is used to balance pistons so as to get them the same weight? I find that most engines have pistons and connecting-rods that weigh nearly twice what they should, especially in some of the older ones. Is there any rule as to how much of the piston should be above the piston pin and how much below?

2—I find that in a 4-inch bore pistons vary in length 1 1-2 inches. Some have nearly all the weight above the piston pin and more than one-half their length. Does not this sort of piston tend to cause piston slap and also knocking from having the spark slightly advanced too much.

3—Some cars seem to knock very easily from too much advance on the spark lever while others can be driven with the spark lever up to the limit all the time. One car I have in mind has rather long pistons and an offset crankshaft and it is impossible to make it knock by advancing the spark lever too much if the carbureter has the proper mixture, such a mixture as you would commonly use. Does not the long pistons have much to do in regard to piston slap?

Haverhill, Mass. DANA D. HINKSON.

—The pistons can be weighed on any scale and the weight noted and in this way balanced. It is generally customary to weigh the entire assembly, including the connecting-rod piston pin, piston, lower connecting-rod bearing cap and the bearing-cap bolts. If desired, these can be weighed upon an apothecary's scale and thus balanced. It is a general rule that the piston is placed about the center of the piston, although in many of the later designs it is near the top. No definite rule as to how much should be above and how much below has been adopted. The idea is, of course, to have the side thrust at the points of greatest connecting-rod angularity taken by as much bearing surface as possible.

2—The piston of the type you describe would seem to have the tendency to knock, due to the lack of balance about the piston pin.

3—Long pistons tend to eliminate slap because they get all the benefit of the greater bearing surface.

Meshing Drive Pinion and Crown Gear

Editor of THE AUTOMOBILE:—Kindly explain by sketch and description the proper way to mesh a driving pinion to the crown gear on a car that has no part of the housing cut away so you can see what you are doing.

N. Y. City. L. H. MANNING.

—The only way that we can suggest as practical would be to mesh the gears as nearly as possible by your sense of touch and then by holding one portion of the shaft, test the amount of back-lash by determining how much the rear wheel will rotate before the motion is transmitted through the teeth of the gears. There is no car, however, that we know of that has no part of the rear axle housing cut away to expose at least a small portion of these gears, without some arrangement at the forward end of the axle for making this mesh, and we would advise another examination of the axle before adopting the trial-and-error method suggested by minimizing the back-lash.

Increasing Stroke on Overland 69

Editor THE AUTOMOBILE:—I have a model 69 Overland and would like to put in a crankshaft for a 5-inch stroke. It has a 4 1-2-inch stroke at present. Can I use the same timing gears, crankshaft and crankcase with the added stroke by raising the cylinders higher?

Clermont, N. Y. ROYAL SAULPAUGH.

—The method you suggest would in no way increase the stroke but would simply tend to greatly lower the compression, which would not be desirable. The clearance in the crankcase of this model is not sufficient to admit of any increase in the length of the throws and it would therefore be impossible to increase the stroke without having a new crankshaft and a new crankcase.

Inquiries

The purpose of the Rostrum department is primarily to aid in the solving of motorists' problems. Readers of THE AUTOMOBILE *are requested to allow our editorial staff aid in the solution of difficulties as they arise and perhaps through this assistance reduce the cost of upkeep of their cars and gain a useful knowledge in the economical phases of the vehicles which they use for recreation or business.*

Answers are made both through the mails and through these columns, the only requirements being that the letters are legibly written on one side of the paper, and are accompanied by the name and address of the sender in order that they may be taken care of through the mails should that be deemed advisable. A nom de plume will be used should the sender so desire.

Strength of Tube and Rod Compared

EDITOR THE AUTOMOBILE:—Would you kindly publish in The Rostrum some information relative to the comparative strength, under bending stress, of seamless steel tubing and solid rod, compared diameter for diameter?

While realizing that the tubing is much stronger than the solid of same analysis and weight under bending stress, I am interested in their relative strengths compared as to diameter.

Del Mar, Cal. JOHN F. GRAY.

—The strengths of tubular and solid steel rods under bending stresses vary as the modulæ of their sections. The formula for the section modulus of a solid circular section is $.0982 D^3$. The formula for the section modulus of a hollow circle is $\frac{AD^2 - ad^2}{8D}$ in this formula A is the area of the circle bounded by the outside circumference and *a* is the area of the internal circle bounded by the interior diameter. D and *d* are respectively the diameters of the outside and inside circles. With these formulæ the relative bending strength for any diameter of solid rod and seamless steel tubing can be figured. To give an example, let us compare a solid rod having a diameter of 1 inch with a tubular section having the same diameter with the thickness of the tube 1-8-inch. The strength of the solid sectioned bar will be to the strength of the hollow section as the modulus of a solid section is to the modulus of a hollow section, as determined by the formulæ above stated.

Substituting in the formula, we find that the modulus of the solid section 1 inch in diameter is .0982.

Substituting in the formula, we find that the modulus of the hollow section 1 inch in outside diameter and .75 inch in interior diameter is 0671; therefore, the strength of the solid section is to the strength of the hollow section for the dimensions as given above, as .0982 to .0671.

In other words, for the conditions assumed the solid section is 1.46 times as strong as the hollow section. It must be remembered that where the benefits of the hollow section come in, are on a weight for weight basis and not on a diameter basis.

Mending a Mohair Top

Editor THE AUTOMOBILE:—Having watched carefully the questions and answers in The Rostrum, I have not seen anything about mending tops. I have a silk mohair top that has several small holes in it and it is so nearly new I would like to find some way of mending it.

Athol, Mass. SUBSCRIBER.

—The only way to mend a piece of mohair such as is used in an automobile top is by patching and it is very doubtful if this will be successful if the holes are all the way through. It would seem that, if the top is nearly new, the top manufacturer should be advised and if your claim is just he will no doubt make good on the material.

The patching is done by cutting out a piece of mohair large enough to fit over the hole and putting it on with tailor's glue or rubber cement. If it is a case where the outside only is chafed and the backing is still good, a piece of mohair with a rubber coating on the back, but without any drill used on same could probably be used to advantage. It would be necessary for the rubber coating to be uncured and then with a little naphtha or gasoline the mohair can be softened so that it will firmly adhere to the backing.

An Anti-Freezing Mixture

Editor THE AUTOMOBILE:—For the benefit of those desiring an efficient anti-freezing mixture for radiators please publish the following:

Denatured alcohol	1 gallon	Boiling point 180 degrees
Sorghum on syrup made of sugar (granulated), 8 pounds, and enough water to make a gallon	1 gallon	Boiling point 230 degrees
Water	1 gallon	Boiling point 212 degrees
		622 degrees
Divided by 3 will give an average of..............		207 degrees

This will give you 3 gallons of anti-freezing mixture for about $1.25.

This is a cheap mixture and is good for 20 degrees below zero to 25 degrees below zero. For colder take more syrup and more alcohol as required.

Rushville, Ill. DR. F. MOENCH.

Information on Spring Wheels

Editor THE AUTOMOBILE:—1—Is there being manufactured a wheel for automobiles that, by use of springs or other devices, makes it unnecessary that the wheel be equipped with either pneumatic or solid rubber tire?

2—If no such wheel is being made, can you advise if any patents have been issued covering such a wheel?

El Paso, Tex. S. A. WOODRUFF.

—1—There are many of these devices on the market.

2—Almost every issue of the *Weekly Patent Gazette* includes several patents covering spring wheels.

Horsepower, Displacement and Rivets

Editor THE AUTOMOBILE:—Will you please tell me the horsepower of a four-cycle, four-cylinder motor 3.375 by 4.75 inches and what would the piston displacement be?

2—The horsepower of a motor 3 5/16 by 4 3/16? What would the piston displacement be?

3—Would a good iron rivet be suitable to rivet a front cross member to the frame on a light car, or should it be put on with steel rivets?

Metz, W. Va. SUBSCRIBER.

—1—The S. A. E. rating of a four-cylinder four-cycle 3.375 by 4.75-inch motor is 18.21 horsepower. The actual horsepower output would perhaps vary from this, due to the individual design of the motor. This, however, is a good approximate formula. The piston displacement is 170 cubic inches.

2—Horsepower, 17.57; piston displacement, 144.3 cubic inches.

3—Good iron rivets would be suitable to use on the frame of a light car. The principal stress endured by these rivets is one of sheer through the tendency to wrack on the part of the frame. A great deal depends upon the manner in which the riveting is done. For instance, it has been shown in experimenting that a rivet is 6.5 per cent. weaker in a drilled hole than in a punched hole and that, by rounding the edge of the rivet hole, the apparent sheering resistance is increased 12 per cent. It is also true that sheering re-

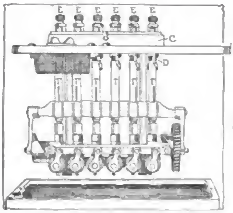


Fig. 1—Disassembled view of Lavigne oiler as used in Stevens-Duryea 1911 cars

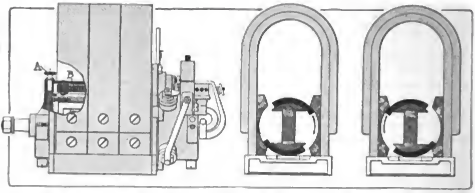


Fig. 2—Diagrammatic illustrations of the Bosch model HDh magneto, showing the parts which it is necessary to remove in performing the operation of re-timing and also showing the armature in its correct position for full retard with the cylinder about to fire on upper dead center. This indicates the correct setting

sistance is probably less for double than for single sheer, and this is probably due to the unequal distribution of the stress on the two rivet sections. Experiments on the sheering strengths of iron and steel rivets would indicate that the proportion of iron to steel is as 19 to 22.1. This ratio is said to be valid only if the sheer is in a plane perpendicular to the direction of rolling, which would be approximately the case in your cross-frame connection.

Carbureter and Oiling of Stevens-Duryea

Editor The Automobile:—Please describe the carbureter and oiling system on the Stevens-Duryea 1911 model

Elmhurst L. I. George W. Gay.

—The model AA carbureter used on the Stevens-Duryea 1911 model is illustrated in Fig. 3. The gasoline is fed through the pipe A into the float chamber B and has a level in this chamber sufficiently high to cause a suction in starting the motor to readily draw the gasoline through the nozzle C. This is the primary jet of the carbureter and the source of mixture at low motor speed. When the motor speed increases the air is drawn through the auxiliary air valve at D, giving the leaner mixture for high speed. This gives the bare principle upon which the carbureter operates and a study of the adjustments and connections will show how these principles are utilized to meet different conditions.

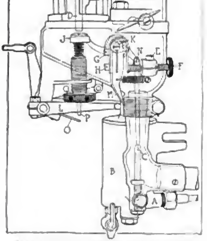


Fig. 3—Carbureter used on Stevens-Duryea 1911 model

In adjusting the carbureter the lock nut E is loosened and the screw F turned to the right until it is closed; the screw G is then loosened slightly and the screw H is turned to the right until the needle valve C just seats. Only light pressure should be used as otherwise the part J would be forced down, allowing the auxiliary valve at D to open. The part K is then locked firmly in position by turning the screw G to the right.

The screw F is turned to the left about two and a half turns to open it and the motor is ready to start. In cold weather the lever on the dash should be turned to the central position of the quadrant in starting and after the start is made it is turned to the extreme right. When the lever is at the central position in the quadrant on the dash the carbureter should be acting as follows:

The lever L is in contact with the lower end of the part K at M, thus opening the needle valve G through the motion of the bell crank lever connected at K and attached to the needle valve G at the point N. At the same time the spring O is contacting with the pin P, closing the auxiliary valve D by forcing against it the part J.

To prime the carbureter before starting, there is a button to the right of the starting crank and after this is pressed the motor will start on revolving the crank. To make the remaining running adjustment retard the spark, close the throttle lever on the steering post and turn the screw F to the right until the motor runs unevenly, then keep turning it to the left until the motor shows the best throttling speed. If the carbureter pops when the throttle is opened quickly with the car running slowly under a load open the screw F for more gasoline, or if this has been turned to the left, more than 2¼ turns, turn the screw Q to the right to increase the tension on the part J. This will give the fundamental adjustments and beyond this point you can determine what further adjustments to make while on the road.

The oiler used is the Lavigne, Fig. 1. It can be adjusted to increase the speed of the oil, if desired. The shell D on each of the tubes T has a hexagonal shape to permit of the use of a wrench. To increase the amount of oil delivered this is turned to the right and to decrease to the left. This regulates the stroke of the plungers and any one may be set from zero to full stroke without in any way interfering with the operation of the other plungers.

Corresponding with each plunger is bleeder valve used to test the oil delivery. If at any time it is desired to note the amount of oil delivered, the slide C is opened and the bleeder valve cap E is pressed down, causing the oil to drop from the bleeder valve nozzle into the tank. The plungers should be adjusted to give about two drops of oil on each downward stroke. The method of operation of the plungers is clearly shown in the accompanying illustration, Fig. 1.

Timing a High-Tension Magneto

Editor The Automobile:—I would like to know how to time my Bosch high-tension magneto, No. 200,083, type HDh model 1908. It seems to be all right in every way but this.

Chittenden, Vt. Joseph E. Crapo.

—To time your model HDh Bosch magneto, the magneto should be secured in position on the engine with its driving gear or coupling loose on the shaft. The screw A and the condenser B should then be removed in order to make the rotating sleeve accessible.

On two of the four longitudinal edges of the sleeve will be found notches similar to the notch on a knife blade, one marked L and the other marked R, indicating respectively left or anti-clock-wise rotation and right or clock-wise rotation. The direction of rotation of the magneto is indicated by an arrow stamped on the end plate at the shaft end.

The sleeve should be rotated to bring the corresponding notch uppermost. The engine should then be cranked to bring one of the pistons, preferably that on cylinder No. 1 on top center, and with the crankshaft held in that position the magneto should be rotated to bring the sleeve into the position shown in the respective diagram, Fig. 2. The arrows indicate the direction of rotation when the magneto is viewed from the shaft end and the clearance between the pole piece and armature in figures should be from 8 to 10 millimeters. This is from .3149 to .3937 inch.

When the sleeve is in the proper position the gear or coupling on the driving shaft should be securely tightened, care being taken to prevent the movement of the sleeve during this operation.

The notch in the sleeve serves also to indicate the position of the distributer segments. The distributer brush holder which corresponds with the notch set into the stated position is therefore to be connected with the spark plug of the cylinder, which is on dead center and represents the first cylinder to fire. The cylinder next to fire is connected with the adjoining distributer brush in the direction of rotation of the magneto, etc. The firing order must be determined, therefore, before these connections are made. After the magneto is set and connected the condenser B is to be replaced and tightened by means of the screw A.

Horsepower of Two Motors

Editor THE AUTOMOBILE:—1—How many horsepower has a four-cylinder motor with 3 1-2-inch bore and 5 1-8-inch stroke according to the S.A.E. horsepower rating?

2—How many horsepower has a four-cylinder motor with 4⅛-inch bore and 4½-inch stroke according to the S.A.E. rating?

Carver, Minn. EDWIN HURTIG.

—1—By the S.A.E. rating this motor has 19.61 horsepower.

2—27.20 horsepower.

The Meaning of Torque

Editor THE AUTOMOBILE:—What is meant by drop forgings?

2—What does A.A.A. stand for?

3—What is the meaning of the word torque?

4—How is cylinder displacement figured?

5—Last year at the race meet at Binghamton, N. Y., between Lincoln Beachey and Barney Oldfield, a Binghamton daily commented on the races and said that Oldfield's racer, the Chintz, was 300 horsepower and that his Stutz and Fiat were 250 horsepower, each having only four cylinders. How can they develop such great horsepower?

Harperville, N. Y. C. W. BONNY.

—Drop forgings are parts which have been made by the drop forging process which incorporates a die in a falling weight. The die strikes upon the heated metal which rests upon the bed-plate of the drop forging machine and the impression carried by the die is transmitted by the impact to the heated metal.

2—A.A.A. stands for the American Automobile Assn.

3—The meaning of the word torque is tangential turning effort. It is generally applied in automobile engineering to the force which tends to rotate the crankshaft. It is given in foot-pounds and is the product of the effort in pounds times the radius or turning arm in feet.

4—The cylinder displacement is figured by multiplying the cross sectional area of the cylinder by the length of the stroke and then by the number of cylinders.

5—The fact that certain motors have only four cylinders would not prevent them from developing 300 horsepower or 250 horsepower. If operated at extremely high speed, with their large bore and stroke it would not render such a performance impossible.

Why Wristpin Seized in Bushing

Editor THE AUTOMOBILE:—We are sending you a wristpin and bushing of a motor which we are now overhauling. Upon removing cylinder block we noted that two of the pins were turning in their pistons instead of connecting-rod bushings. We annealed the pins, bored and sawed same, but still we could not press out pins, so we are compelled to break pistons. You will note that the pin and bushing is not scored but seem to be welded in one small spot. As the writer is a constant reader of your magazine he would like to have you explain same in The Rostrum of THE AUTOMOBILE. The bluish color of pin and bushing came from annealing them.

Freehold, N. J. CENTRAL GARAGE.

—On examination the piece sent in would appear to show that the wristpin had a flaw in the metal, due to the presence of some foreign material that flaked off under the influence of the heat due to seizing. A portion of the part torn away and which became welded to the upper connecting-rod bushing shows that it had never had good contact with the remaining part of the wristpin; that is, this metal, while smooth in exterior, really had an internal crack or flaw which developed at the time of seizing. The welding action is very peculiar in that it would seem to indicate that the foreign substance present was such as to render welding easier at that point than at any other, as there is no indication of scoring or adhering at any other point on the wristpin.

Stutz Racer Is Semi-Stock

Editor THE AUTOMOBILE:—Is the Stutz racing car a stock car or is it a special makeup for the purpose?

2—What is the gear ratio?

3—Which car do they use of the fours?

Nevada, Ia. HARLAND HARRIS.

—The cars used by the Stutz company for racing are semi-stock jobs, that is, they are stock cars which have been specially prepared for racing.

2—The gear ratios are altered to best accord with the track and road conditions.

3—The four-cylinder motor generally used has been the Stutz 40 which has 4.75 by 5 T-head cylinders giving a piston displacement of 389.9.

Chemicals in Fuel Injure Motor

Editor THE AUTOMOBILE:—I would like to know what I can put into gasoline to secure more power?

Salon, Ia. VICTOR O. HYNEK.

—THE AUTOMOBILE emphatically wishes to discourage the use of chemicals added to the gasoline because they are almost invariably detrimental to the motor.

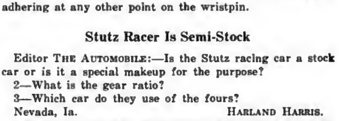


Fig. 4—Wristpin and upper connecting-rod bearing bushing, showing how these two parts were welded together in one spot due to a seizing action from lack of oil

First step in painting a car by the Radio process. Using the steam cleaning apparatus for cutting away the grease

Radio Process Japans a Car in 3 Days

Entire Car Placed in Oven, Drying 3-Day Varnish in 3 Hours

A DIRECT effort to give more efficient service to car owners who desire to refinish their vehicles has been made by the Fickling Enameling Corp., Long Island City. The process used has been named the Radio by this concern and by it complete automobiles can be japanned in 3 days.

The theory upon which this new company is operating is that the average car owner often allows the painting of his car to go undone because he does not wish to be without his automobile for 2 or 3 weeks and at the same time does not believe in the economy of having a cheaper job done in a shorter time. This concern makes a specialty of quick-drying methods and by the use of up-to-date appliances cuts down the length of time spent in each process to the minimum.

When a car is driven in, it joins a group of others to make up a unit job in passing through the plant. The units are comprised of four or six cars which are taken in a single group and are put through the various processes together. The first operation is to clean the car and this is done by the use of a steam jet, which cuts away the grease and eliminates the rubbing which would be necessary by other methods. After all the grease has been removed, the fenders are taken off along with all the small parts which will require separate enameling. The other accessories of the car are placed on horses containing a large number of racks upon which the parts can be suspended and kept together. Thus, each job is divided at once into three units after the preliminary cleaning has been completed. The first unit is the body of the car and that part which requires repainting. The second unit is formed of he small parts to be enameled, such as the mudguards, lamps, fenders, engine hoods, etc. The third unit is the accessories which do not require either enameling or painting and which are placed upon the horse rack and rolled into a long line of similar horses there to await the time when they are to be reassembled upon the car.

The car proper and the small parts which require enameling have reached the parting of the ways, so far as the painting processes are concerned, when they are disassembled.

As a general rule, the paint does not have to be removed down to the bare surface of the body but merely has to be rubbed down and filled after the cleaning has been completed. The filling brings the surface to a level and smooth condition and it is ready for its first coat of paint. This is a coat of color paint and forms the primary foundation. When this coat has become dry a coat of colored varnish is applied which is afterwards rubbed down and finally the finishing coat of varnish is applied.

This corresponds exactly to what would be done in the ordinary paint shop so far as the general details are concerned. It is in the method of application and drying that the Radio process is claimed to save time and give a greater

Left—Removing the fenders and placing them on the rack. Right—Blowing the paint on with a paint gun efficiency than is possible with the ordinary brush method. The paint, instead of being applied by brush is put on with a gun which in appearance resembles an automatic pistol, being operated by a trigger, held by a pistol-shaped handle and with the paint spray issuing from what would correspond to the gun barrel. The gun is a mixing chamber for air and paint, the result being that the paint is atomized and can be directed against the work in the same manner as with the ordinary air brush. This cuts the time of applying the paint and results not only in a more economical use of the paint itself, but is of great aid in applying the paint.

Entire Car in Large Oven

After the color varnish coat has been applied and rubbed down to a smooth surface, the entire car is placed in an enormous oven measuring 42 feet in length and 19 feet, 6 inches in width, and allowed to dry. The temperature in this oven is 110 to 120 degrees with 90 to 100 degrees of humidity, and the air is renewed in this oven every 3 minutes, by means of an exhausting fan. In this oven it is possible to take care of six large cars every 3 hours. During this time the varnish coat is completely dried and rendered hard. After being rubbed down the finishing coat of varnish is applied in another oven or finishing room where the temperature is from 90 to 100 degrees and the job is complete. The humidity here is 60 to 70 degrees, 30 degrees less than the temperature.

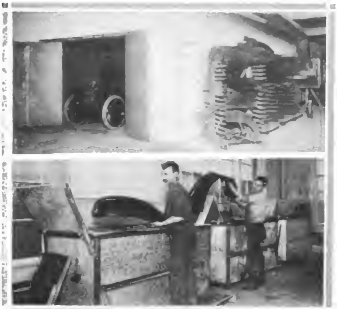
It is in the oven in which the color varnish coat is dried and hardened that the most radical departure from ordinary methods is made. The use of the high humidity and water-washed air keeps the exterior of the surface damp while drying the interior; thus instead of putting a hard shell over the soft layer of paint, it is dried throughout. When the exterior is dried, while the interior remains soft, the paint is apt to sweat through and discolor the finish. This is noticeable on engine hoods where the heat of the motor produces this sweating action rapidly and consequently results in a dulled finish.

Thermostatic control regulates the temperature in this oven and water control on a diaphragm regulates the humidity in this large oven. All the air which enters the oven is water-washed by running it through a water tank before it enters the oven. It is pumped into the oven by a fan blower and superheated by contact with radiator. The varnish which is dried in 3 hours is what is ordinarily known as a 3-day varnish and with the method of humidifying the air the general process where no humidity is employed is virtually reversed because with the dry air method the exterior is the first dry coat, whereas with the moist air the inside coat is first dried. With the outside coat dried first in the form of a hard shell it is stated that it requires about 3 or 4 months before the interior surface becomes absolutely dry.

Besides the bare process, many precautions have to be taken and many accessories used in order not to have the entire work spoiled by overlooking a small necessary detail. The color varnish coat is applied in a varnish room where everything is kept tightly sealed against all possibility of the entrance of dust and the entrance to the oven is had without leaving this room, the oven itself being really a room within this outer varnish room. The entire floor upon which the various departments of the work are kept is cleaned every night by means of vacuum cleaners, and every cubic foot of air taken into these rooms passes through a water-filtering medium.

While the body and the chassis of the car have been going

(*Continued on page* 283)



Upper—Showing an entire car about to leave the oven, with accessory racks to the right

Lower—Dipping the fenders in the tanks of enamel. These receive three coats

Above—The steady heat oven in which the fenders and small parts are dried

Left—Finishing room, in which a dry heat is maintained for the finishing varnish coat

The Improvement of Spring Systems--VI

Magnitude of Forces Taking Effect Horizontally Shows Urgent Need of Cushioning So Far Neglected or Left to Air Tires

By M. C. K.

(2)—Movements and Shocks of Vehicles Equipped with Springs and Rigid Tires

In passing from the studious contemplation of Figs. 9, 11 and 10 to the task of constructing curves of similar character for an assumed set of conditions, among which the use of hard and practically inelastic tires is one, and of adding the shock values which will come into play, it is evident from the outset that the first axle lift after the impact with the hard tires will be smaller than in Fig. 9 and larger than in Fig. 11, as the wheel will follow the obstacle closely to its summit, in accordance with the chart of springless vehicle action, Fig. 5, in a previous instalment, but will descend on the far side under the influence of the spring and gravity combined, reaching the level ground again much earlier than in the case of the springless vehicle where gravitation alone was acting. But it is also remembered that road obstacles which are in the nature of a short hill, Fig. 7, and admit of continuous rolling of the wheels before the obstacle is surmounted do not have the same effect as the kind of obstacle which has so far been mainly considered and, especially, are liable to cause the vehicle to leap, whether the tires are elastic or otherwise, after the summit of the obstacle is passed. Obstacles of this class are often looked upon as the typical comfort-destroyers, being exemplified in nearly every ordinary wave in road surfaces, and they must in fact be the only kind which those have in mind who assume a leap of the running gear after every shock. The movements of the vehicle should perhaps be plotted for this kind of obstacle, also, after the first kind has been disposed of and before proceeding to other specializations of the subject.

The Factors at Work

The factors deciding shocks and movements for a vehicle whose body and running-gear are connected by a single set of springs are, in addition to those so far considered, the flexibility of the springs, their resilience, the distribution of spring-suspended and unsuspended weights, the period of spring oscillation and the mechanical details of the spring system, but the last-mentioned factor relates to refinements rather than fundamentals and is ignored for the present. The period of spring oscillation, being the time elapsing while the spring swings freely from its position of equilibrium to another position and back to the position of equilibrium, is unfortunately a constant. It is found that the amplitude of the oscillation affects the elapsed time very little; so little that the difference can be ignored. On the other hand, the period is affected by the load, the flexibility and by retarding factors which set up frictional resistance to the spring movements. The retarding factors can reside in the metallurgical properties, which make the spring live or sluggish—and those which are sluggish generally take a permanent set sooner or later—in the friction between spring leaves or in friction in other parts of the vehicle which are subject to movement when the springs are working. It is found that in all vehicles, and especially in shaft-drive cars, the friction between leaves, even if they are many and thin, is much smaller than the aggregate of friction from other sources.

Probably the correct period of free spring oscillation, which is usually expressed in number of oscillations per minute, cannot be determined for any given set of conditions except by test and measurement. But to get an approximate picture of the vehicle movements which occur it is sufficient to assume the different factors to be of certain magnitudes which come somewhere near the conditions realized in actual vehicle construction. The flexibility may be taken as 1 inch deflection for 300 pounds of pressure (considering a pair of springs as one) for both front and rear springs (making the front spring action the less sensitive one, by reason of the smaller load, as usually desired with a view to better steering). The unsuspended rear weight may be 400 pounds with a load on the springs of 1,600 pounds, making a total rear weight of 2,000 pounds as in the case of the springless vehicle previously considered, and the unsuspended weight in front may be 200 pounds with a spring load of 800 pounds. The period of free oscillation—meaning an oscillation determined by the resiliency of the spring and not by the velocity of an external force acting with a push—may be 1/90 of a minute, but this may be modified when the spring imparts movement to the lighter running-gear as well as to the superimposed load, as happens when the wheels are off the ground. The efficiency of the springs with regard to their resilience may be 90 per cent.

With these assumed data an approximate course and time schedule for the vehicle and spring movements can be figured. But the very first thing observed in this connection leads to an important digression, as it is discovered that motor vehicles intended to be operated with tires of small yield and resiliency, mainly trucks and delivery wagons, are almost without exception built without a certain much needed spring element to take up horizontal shock.

The Horizontal Component of Shock Not Cushioned

Comparing the vehicle having springs with the springless vehicle it is noticed that they are both springless, practically, so far as horizontal shocks are concerned, as the springy elements work up and down only. There is even a trend among constructors for demanding that the movement imparted to the axles shall be as nearly as possible vertical, and to realize this effect flat springs are used and the front end of semi-elliptic and cantilever springs are lower than formerly. In the case of the front axle this serves mainly the purpose of safeguarding the steering action at the moments when severe impacts cause large spring oscillations, and in the case of the rear axle it reduces sliding motion in the universal joints of the drive shaft to a minimum besides permitting, if this is desired, the traction thrust to be transmitted to the frame wholly or partly through the springs, without bending them appreciably, as well as in the most advantageous direction, viz., nearly horizontally. But the need of keeping the front axle in the same vertical plane is not urgent when the steering rod moves transversely of the vehicle, instead of longitudinally, as it does now in most trucks and in very many small cars.

With large pneumatic tires to take up the horizontal component of a shock these provisions are doubtless based on thrifty reasons, especially for relatively light vehicles, but in the case of heavy vehicles with tires affording very little yield the horizontal shocks are too severe to be neglected with impunity.

Magnitude of Neglected Forces

The horizontal component of BA, Fig. 5, was found in the case of the springless vehicle to amount to 8,524 footpounds, and the shock was concentrated largely in the beginning of the short pivotal movement of the axle around the road obstacle, so that the pressure in pounds at one moment would exceed this figure considerably, but it was understood that, on the other hand, the rotation of the wheel would cause a mitigation of this shock. The figures tentatively suggested were 5,269 footpounds transformed into tangential stress at the wheelrim and 3,255 footpounds reverting to the axle and there perhaps again subject to decomposition, but these figures were admittedly unsafe and subject to revision, it being plain, for example, that with the wheels stopped in their rotation for a moment by the impact the original figure of 8,524 footpounds—holding good for a fixed wheel—might come into force for that moment. At all events large forces, ranging perhaps under circumstances of no great apparent variation from 2,000 to 8,500 footpounds, with the corresponding pressures in pounds even higher, are suddenly applied horizontally against the moving structure when an obstacle of the shape and size here under consideration is encountered, and the shocks due to them are left uncushioned almost to the same degree in vehicles with the ordinary spring suspension as in springless vehicles. The numerous instances of broken radius rods which come to light, mostly with reference to trucks and omnibuses, testify to the practical importance of the omission and give indirect evidence to the effect that other damage which is more likely to escape immediate notice must be due to the same cause—perhaps especially damage to loads, to solid rubber tires and to springs and spring shackles.

Where full-elliptic springs are used a certain amount of cushioning for these shocks could take place, but not without subjecting the upper spring clips to immense stresses, and the axles in such vehicles are therefore uniformly prevented from moving horizontally by radius rods, and the advantage is thereby abandoned.

Many Designs Possible

A mere rearward movement, as is in some cases permitted the rear axle by having the front pivot of the radius rod—or the strongly curved spring—located considerably higher than the axle, does not in itself afford any appreciable relief for the shocks but could be made to do so if spring resistance acting especially against this rearward component of the axle movement were provided, which could be done in several obvious ways. And this form of relief might be acceptable (especially in conjunction with radius rods or springs capable of yielding horizontally to take up shocks received during reverse driving and to ease starting) even if the less important consideration of small sliding movement in universal joints had to be sacrificed. In the case of chain-drive vehicles the yielding point of the radius rod would perhaps have to be provided for in a different manner. The design will of course eventually be properly taken care of as soon as the necessity is realized.

Functions of Tires

In parenthesis it may be mentioned that no better reason probably exists for extending the use of air tires to heavy vehicles, in so far as practicable, than their great efficiency in absorbing horizontal shocks, while, on the other side of this question, a suitable provision for taking up these shocks in the spring suspension should make the use of solid rubber tires more acceptable and their virtues in the matter of reduced traction resistance more conspicuous. Elastic wheels, knotty as the problem of their construction remains, share of course with the air tire both the advantage and the disadvantage at these points, affording some relief for horizontal components of shocks but adding to the traction resistance on smooth ground through the continuity of their flexions.

In the case of solid rubber tires it is known that the yield which they afford does not exceed 1-2 inch in practice, their resistance to deformation increasing very rapidly beyond this limit, and their flexions on smooth ground are correspondingly small. They are mainly dampers of vibration and noise. While their action is slightly elastic under light loads and shocks, it comes nearer to the action of a perfectly rigid tire, so far as the vehicle and spring movements are concerned, than to any other action which could be appreciated in figures—though some data are available by test in this respect—and this action can therefore best be estimated as a modification of the shocks and movements to which the vehicle with springs and rigid tires is found to be subject.

The First Applicable Conclusion

Much emphasis is here laid upon the severity of horizontal shocks and the necessity for absorbing them more gradually than is done in practice, because this is the first conclusion definitely applicable to spring suspension practice which appears fully justified by the points so far brought out in these articles by going back to an examination of the first principles of spring suspension, in preference to following the custom of dwelling upon the refinements.

When all attempts to make the public accept pleasure cars in which a sensitive spring suspension and cushion tires were supposed by the makers to make air tires all but superfluous have so far failed, or have at least not met with pronounced

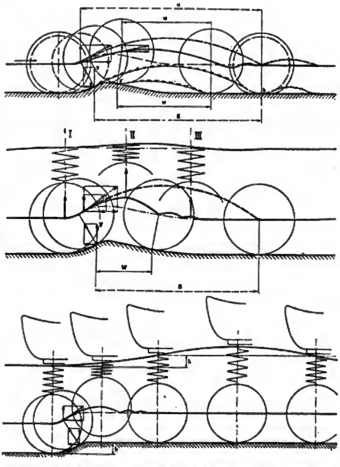


Fig. 12—Riedler's illustration of spring action. (1) Comparison of soft and hard tires. (2) Movements with hard tires. (3) Springs forced to raise body

success, this result may perhaps be ascribed not only to the public's aversion to schemes which might seem to imply a visible straining for economy but also to very actual shortcomings in the provisions for cushioning the horizontal shocks in such vehicles; and better provisions in this particular might change the situation somewhat. Whether the change would be desirable is another question, not to be discussed here at this moment, though it must always be well to remember, with a view to possible future developments, that the air tire, as we know it now, is less well adapted for small and light cars than for those of greater weight, because the inflation required for durability and that required for comfort agree better for the medium weights, and also that for still greater weights the practicability of the air tire is even now disputed on the ground of the liability to puncture and other lesions which comes into evidence when pressures reach certain figures at which the materials of air tires, and of solid rubber tires, too, are at the limit of the fiber stresses which they are fit to endure—conditions which, however, are liable to change as much in the future as they have already been changed for the better in the past.

Why Horizontal Shocks Are Tolerated

Some reasons why the need of cushioning especially for the horizontal shocks has so far escaped adequate attention in practice are more or less apparent. In the first place, the construction of trucks and delivery wagons, where such provisions are most needed, has been borrowed very largely from the construction of pleasure cars, and in these the horizontal shocks are taken care of partly by the air tires and partly in the footsoles and knee joints of the passengers, which are anatomically well adapted to absorb them with a fair degree of comfort, while for shocks arising from sudden accelerations, much milder than the retardations, both the air tires and the upholstered backs of the seats are active. In the copying, the air tires were replaced by solid ones, the reclining position of passengers by a more upright position and the soft seats by harder ones, but the revision of the spring suspension which should have come with these changes was neglected. Another factor is that the horizontal shocks become much milder in the case of the ordinary small obstacles encountered on a street or road, decreasing more rapidly than the height of the obstacle, so that the failure to provide especially for these shocks does not affect comfort so very strongly under the majority of conditions; and when such shocks are received they are therefore usually ascribed to some specially wretched condition of the road rather than to a shortcoming in construction. Nevertheless these shocks increase rapidly in frequency and severity on rough ground, and nearly all vehicles shod with solid tires have to negotiate such ground daily at certain times of the year if not all the year round. And in the matter of security, as distinguished from comfort, the exceptional shocks are, as before mentioned, almost as important as the ordinary ones.

A third factor explaining the omission lies in the fact that those who have analyzed the mechanics of a road shock have been content to accept the obstacle which affords a gradual ascent for the vehicle wheels as the typical one and the only one to be examined, while in reality nearly every obstacle partakes more or less of the characteristics of the obstacle whose mechanical effects have been made the basis for the first examination in these articles, this characteristic being the abruptly rising formation which causes some interference with the continuity in the rotation of the wheels and a momentary pivoting of the wheel around its point of impact, and thereby also a sharpening of the horizontal shock in a manner easily demonstrated. In an interesting popular analysis of spring action by Professor Riedler for example, which was reproduced in extract in THE AUTOMOBILE of April 17, 1913, page 846, this keen investigator drew all inferences, in so far as they were not drawn from practical driving experience, from the consideration of obstacles affording gradual ascent of the wheel and therefore paid little attention to horizontal components of the shocks. The illustrations used on that occasion are herewith reproduced as Fig. 12, as they bring aptly to mind how much the study of spring action has been engrossed in one side of the subject, being the complication of spring action with air tire action, and with one class of obstacles, which is the one that gives the largest vehicle movement when elastic tires are used and the speed is high.

Extract of Riedler's Views

That Professor Riedler's eyes were open, however, to the importance of cushioning the horizontal shocks—even if he had never analyzed the effects of the kind of obstacle producing them in highest degree—is plainly indicated in Report IX of his famous scientific work, *Wissenschaftliche Automobil-Wertung* (Scientific Automobile Valuation), where he takes occasion to describe and illustrate features of the spring suspension of Büssing commercial vehicles and omnibuses which at that time were the only German vehicles embodying provisions for mitigating the horizontal shocks, or at least some of these shocks. The principal features to which he refers are illustrated in Figs. 13 and 14. The remarks accompanying them give a clue to one of the most authoritative opinions which have been placed on record with regard to the requirements, and may therefore be reproduced here in substance. He says: "Elastic thrust rods acting also as chain adjusters transmit the traction thrust from the driving-wheel axle to the vehicle. Thereby the shocks of the tractive force (meaning the horizontal component of the whole shock) at the surmounting of obstacles, etc., is strongly reduced and the acceleration of the mass is effected gradually, with momentary storing of the kinetic energy in the thrust rod spring. This spring likewise results in saving the clutch at starts of the vehicle. During rough driving and at the starts the elastic effect of this spring actually makes a portion of the energy spent in the shock useful for propulsion immediately afterwards.

"Logically such springing is an intermediate step or organic part of the whole spring system, acting to

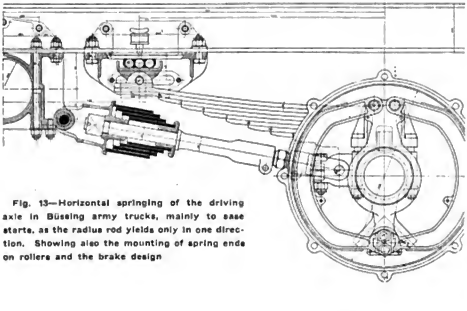


Fig. 13—Horizontal springing of the driving axle in Büssing army trucks, mainly to ease starts, as the radius rod yields only in one direction. Showing also the mounting of spring ends on rollers and the brake design

reduce the masses which come into action at shocks and saving the whole transmission mechanism.

"The effects of these elastic thrust rods and their necessity are shown even on the relatively smooth track of the testing station, which is more favorable than any ordinary street. The spring can also be made to serve as a dynamometer, and, connected with an indicator, could be made to give rough and yet valuable information about the forces at work during driving of the vehicle on difficult ground and at turns. Such observations would constitute a very desirable basis for more accurate examinations on the test stand."

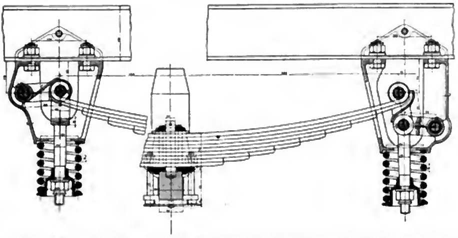


Fig. 14—Büssing front suspension for heavy truck with auxiliary coil springs and horizontal yielding

[Though Professor Riedler mentions the elastic radius rod of the Büssing vehicles as assisting in the allaying of horizontal shocks received in striking an obstacle, this seems to be mostly a theoretical remark as to what might be, as the drawing shows elastic action only in one direction, which would be of assistance only for accelerations, but not for retardations, unless the vehicle is driven backward.]

"The principle of the stepwise springing for all shocks is carried out in the Büssing vehicle, also in the double springing of the front axle, and this is applied to the rear axle, as well, in the case of omnibuses. The auxiliary coil springs absorb the small shocks which follow in too rapid succession for the slow-acting leaf springs. They increase the range of spring action and, provided they are hung and tensioned correctly, improve the whole suspension.

Subdivided Spring System

Professor Riedler dwells thereafter on the necessity for organizing the spring suspension throughout the whole vehicle structure, as it would be inconsistent with actual traffic conditions to look upon the frame or any other part of the structure in the light of a rigid machine foundation, but Fig. 14 is here shown mainly because the auxiliary coil springs, in the manner in which they are mounted and shackled, afford a limited chance for horizontal movement for the front axle against a spring resistance. He says further:

"It would be advisable to extend this principle of a subdivided spring system and yielding spring supports to pleasure cars, also, and not to be satisfied with the alleged suppleness of their structures, even though the smaller masses involved in their case makes the practical results of present methods more acceptable.

"In the Büssing vehicles the support of springs on rollers (see Fig. 13) avoids violence at these important points, reduces spring friction and secures undisturbed spring action in spite of any extraordinary dynamic effects which may occur during rough driving.

"The securing of the springs is in motor vehicles, generally, patterned after that used for vehicles drawn by horses. Such mounting by a pin and clips is unadapted for trucks and not particularly suitable for pleasure cars, as it does not withstand severe shocks. Many drivers have found this out at grade crossings of railways and otherwise in surmounting road obstacles. Better prototypes for correct design are found in locomotives."

In this last remark Professor Riedler refers plainly to the need of providing special spring action against the horizontal components of shocks, since these are the only forces which would be liable to break or loosen clips and pins.

This quotation of Professor Riedler's remarks on the subject is not meant to indicate otherwise an approval of the elaborate construction measures which he seems to favor, as the writer expects to demonstrate—or to come near demonstrating—that equally good and more economical results can be attained without impairing the constructive simplicity.

After this long digression based on the observation that the horizontal components of shocks, under the assumed set of conditions, are the same, or substantially the same, for vehicles provided with springs as for entireless springless vehicles, the examination should now proceed with the dissection of the vertical shocks and movements which have received so much more of practical and theoretical attention and do not present so obvious an opportunity for radical improvement.

(To be continued.)

Radio Process Japans a Car in 3 Days

(Continued from page 279)

through the process above described, the fenders and hood, together with the lamps or other parts to be enameled, have also been taken care of. After removal, the fenders and other parts are dipped in a steam-heated potash bath which removes all the dirt and former coats of enamel, leaving the metal bare and bright. Before going into the next process all the dents are taken out of the fenders and they are restored to their correct curvature and repaired to overcome the effects of rough usage. These smooth parts are dipped and taken into a separate room in which there are two ovens, one a flash oven in which a high temperature could be reached in a short time by a direct gas flame and the other a steady heat oven capable of handling the ordinary small parts as they come through from the dipping bath. The flash oven is only for quick special jobs.

The dipping process is in charge of a workman who has been imported from Manchester, Eng., the home of the enameling art. The large parts are dipped bodily into the enamel and after draining a few seconds are dried in the steady heat oven. Lamps and other small articles have the varnish applied by air brush. Three coats are given, the third being a transparent finish.

After the small parts have been finished and the body painting completed the two meet in the assembly department and everything is replaced. The cost of this work for a medium size, six-cylinder, five-passenger touring car in which the previous paint is in such condition that it can be rubbed down and refilled is $65. The paint has a mineral base. When wheels are refinished in natural wood they are dipped in acid and after 15 minutes a neutralizer is employed leaving the wood clean and white. They are then revarnished to give the natural wood finish.

Battery Systems Improved in Detail

Abrupt Separation of Primary Circuit Points with Elimination of Wear—Sparks Efficient Regardless of Motor Speed

THREE years ago when electric lighting and starting first began to be generally applied to cars of all prices, it was predicted by many that the addition of the generator for charging a storage battery would have a material effect on the ignition apparatus. This has been borne out. The announcements for 1915 show a marked increase in the use of the single battery ignition system.

While varying in details of construction, there is a general similarity between the various non-vibrating battery systems. They are all comprised of three units; primarily a combined timer and distributer which naturally falls into one instrument because the rotating shaft necessary for the timer can be readily employed as the shaft for the distributer. The second unit used is the coil for transforming the current from low tension to high tension. The third instrument is the switch. Besides being a mere device for turning the current on and off or of switching from battery to magneto or generator this device has been made to incorporate features which have eliminated the former objections to single spark battery ignition systems. In the Connecticut, for example, a thermostatic device is used for breaking the battery current when the motor is not in use, thereby removing the possibility of running down the battery. The Atwater Kent switch changes the polarity of the current every time the current is turned off. The Westinghouse system also uses a switch which changes its polarity. The Bosch switch can be placed in such a position that both magneto and battery are firing together, giving a two-point synchronized system.

In general, the non-vibrating battery ignition systems can be divided into two classes, those which work upon the closed, or break-and-make principle, and those which work upon the open, or make-and-break system. The fundamental difference in these two methods of operation is that on the closed circuit the contact points on the primary circuit breaker are in contact until the time arrives at which to break the circuit for the spark while on the open circuit when the time comes to produce the spark the primary contact is instantly made and broken.

This difference in the methods of reaching the same end gives rise to electrical and mechanical differences. The difference electrically is that on the closed circuit principle a long time is allowed for the primary circuit to become saturated and hence a great intensity is produced on the break. The theory of the open circuit is that contact is made and broken so rapidly that there is only a very short time in which the current is allowed to flow through the primary circuit and hence the curve consumption is very small. Both schools claim a hot, intense spark at the plugs, regardless of engine speed and regardless of timing advance, but it is in this primary difference of operating on the open or closed circuits that the systems differ electrically and also in the mechanical mechanism required to reach the desired electrical end.

Distributers Are Simple

The distributers are simple instruments in every installation. All have a quickly removable cover generally snapped on by a spring catch and in general the current is taken from a central point which is in connection with the high-tension coil terminal and distributed by means of a brush to each of the spark plug terminals. As a general rule, the current is not required to pass through a rubbing contact at the spark plug terminal points but instead to jump a small gap between the distributer brush and these spark plug terminal points. The reason for this is to eliminate the wear which would result from a rubbing contact.

The coils all comprise both the primary and high-tension windings. They are wound to meet the requirements of the open or closed circuit upon which they operate. Some of them are wound to take care of a current which falls to about one-half that of the 6-volt current generally used. This is for emergency in case of the necessity of operating on a nearly-discharged battery.

Waterproofing Is Complete

In common with magneto manufacturers, the makers of the battery ignition systems have realized the necessity for ample waterproofing. This is a simple matter in these systems, as the timer distributer is generally quite high in relation to the motor, the coil is generally placed at quite a height and the switch on the instrument board. In order to protect the timing mechanism and the distributer connections the housing for these points, which is always removable for inspection purposes, is of Bakelite or some other hard, durable substance. The terminal connections for the spark plug leads are taken through this hard cover by different systems of connections but which all have tightness and waterproofness as fundamental qualities.

Common aims on the part of the designers can be traced throughout all the battery systems. Whether the system be operated on the closed or open circuit principle, abruptness of separation of the primary contact point is one of the principal aims to which all are working. In the closed circuit system, such as the Connecticut employs, this is obtained by having the steep points on the cams strike the follower at a point on the breaker arm which is closer to the breaker arm fulcrum than are the points to be separated. In this way the speed at which the arm is moved at the point of the cam follower is magnified by the time it reaches the end of the arm at the breaker points. In other words, the end of the arm, by virtue of the greater radius, has to travel a greater distance in the same length of time than the follower and hence must travel at a greater speed.

Quick Action in Open Circuit Type

On the open circuit devices such as Atwater Kent, the making and breaking of contact is effected so quickly that the eye cannot follow its action. This is due to the arrangement by which contact is made and broken by the rapidly passing action of a hammer striking a spring. In all these breaker systems wear has been cut down by the use of glass-hard parts and by using the lightest possible moving masses.

Connecticut Is Closed-Circuit Type

The Connecticut ignition system, made by the Connecticut Telephone and Electric Co., Meriden, Conn., is a high-tension design comprising an interrupter and distributer unit, a coil and a switch. Both the interrupter-distributer and the switch are unique in many respects. The interrupter is so constructed that the primary circuit of the coil is caused to become completely saturated before the breaking point is reached and therefore a spark of maximum intensity is produced upon the interruption of this circuit. Another distinctive feature which is incorporated in the switch is that it is impossible for the battery to become discharged if the switch is left on because a thermostatically operated electro-magnet breaks the current by severing the connection between the battery and the coil should the switch be left on when the motor is not in use.

It is also claimed for this ignition system that both electrical and mechanical lag have been eliminated throughout the range of motor speeds, and the makers state that the eight-cylinder igniter will fire perfectly at a motor speed of 3,000 r.p.m. as well as at lowest possible engine speeds. This means that the igniter is capable of producing 12,000 sparks per minute or 200 sparks every second. The system is made for three, four, six and eight-cylinder motors.

The interrupter mechanism operates upon the closed circuit principle, the theory being that by this method the complete saturation of the primary winding is obtained. At the same time, it is claimed the mechanical and electrical lag are also eliminated, because the mechanism of the interrupter is only required to break the circuit when the spark is desired and not to make and break it.

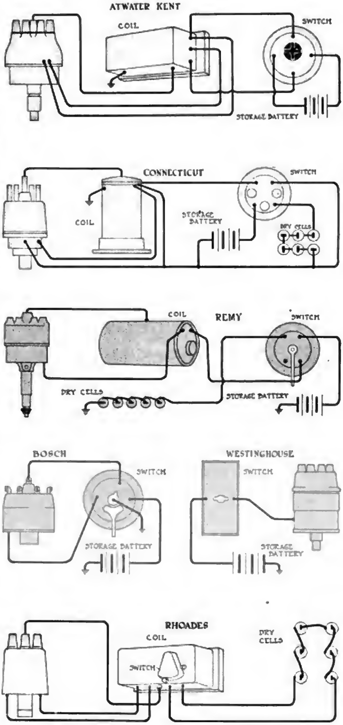
The mechanism of the breaker consists of an arm A carrying one contact piece, the stationary block B carrying the other contact, an insulated roller R, which is carried by the arm A, and the cam C which is mounted upon the driving shaft in the center. Upon the cam C there are as many points or high spots as there are cylinders on the motor. Normally the two contact points are held together by the action of a light spring upon the arm A. When one of the high spots corresponding to the firing point in one of the cylinders lifts the roller the circuit is broken and a spark produced. As the four cam spots for a four-cylinder motor are 90 degrees apart, the period of saturation of the primary or the length of time that the current flows to it from the battery is at a maximum. When the contacts are separated the current which has accumulated in saturating the primary is such that an intensely hot spark is given at the plugs.

Synchronism, or that quality of ignition which allows the spark to occur at the same relative part of the stroke, is obtained by the elimination of the electrical lag due to the intensity of the induced current. In other words, to all practical purposes, the spark occurs at the same position as regards piston travel regardless of the speed of the engine, for any given position of the spark lever.

The switch incorporates a feature that is an ingenious method for obviating the possibility of battery discharge if it should be left in the on position when the motor is not in use. Referring to the illustration, it will be seen that the switch incorporates a small thermostat which becomes heated by the battery current when the motor is not in use and when raised to the operating temperature it automatically operates the electro-magnet which, in turn, releases the switch button and throws out the battery circuit. The switch has three buttons, that labeled B is for the battery current, M for the magneto or generator when a lighting system is employed and a button labeled Off which, when pressed, throws either of the other two back to its original position. The three buttons are so arranged that when either the B or M button is pressed the other is thrown out and both cannot be pressed at the same time.

Circuit-Breaker Is in Switch

The thermostatic circuit-breaking mechanism is entirely housed within the switch. The method of operation is by utilizing the properties of the thermostat T, which becomes warm from the current of the battery and bends downward making contact with the contact point L. This completes an electric circuit which energizes the magnets M causing the arm K to operate like a bell hammer or buzzer arm. This arm drives against a plate which in turn releases the button in the switch which is depressed.

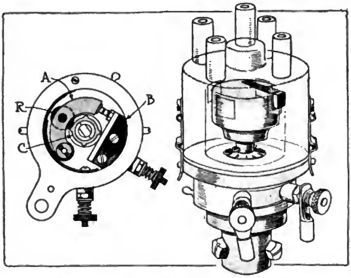


Wiring diagram of some of the leading battery ignition systems, showing method of connecting and grounding the circuits used by representative manufacturers

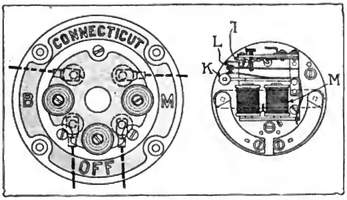
The distributer mechanism is conventional and is shown in the accompanying phantom drawing. The current is taken from the coil lead to the central point and then distributed by means of a brush to the high-tension terminals from where the current is taken on the high-tension lead directly to the spark plugs.

Atwater Kent Has Increased Advance

Only slight refinements in detail mark the Atwater Kent ignition system, made by the Atwater Kent Mfg. Works, Philadelphia, Pa., for 1915. Chief of these is an increase in



Breaker mechanism and timer-distributer used by the Connecticut company



Left—Exterior and Right, interior of the Connecticut thermostatically controlled switch

the speed range of the automatic spark advancing mechanism, to suit the growing tendency toward higher motor speeds. This improved type is now designed to advance the spark proportionately up to a motor speed of 24 r.p.m.

Other changes are the discontinuing of the old type F in favor of the later type H where manual advance is specified. The latter is also now supplied complete with attaching brackets for installation on Ford cars. The type K-2 which has automatic advance is also supplied for Fords.

The Atwater Kent system comprises a coil and a combined breaking and distributer mechanism with a switch for the control of these units. In the K-2 type a centrifugal governor automatically advances the spark in the proportionate ratio to the increase of motor speed. The system is complete in itself and will operate from any standard 6-volt battery. The system is made for four, six and eight-cylinder motors and the only moving part is the timer distributer which the Atwater Kent company has named the Unisparker. This is mounted on a vertical shaft after the general method employed in battery distributer practice.

Five objects are stated to be the aim of Atwater Kent ignition. They are: 1—uniform spark heat for all speeds; 2—automatic retards for safe guarding; 3—automatic advance along a regular curve; 4—unlimited advance and 5—elimination of wear.

By this system a single spark is delivered at the plug and the mechanism is such that the duration of current flow to the primary winding of the coil remains constant regardless of engine speed. Since the make and break mechanical system is positively operated and not dependent upon magnetism, it operates absolutely regardless of the battery condition. The contact maker makes and breaks contact once per each cylinder in turn. It operates by the rotating half-time shaft and the contact maker breaks as well as makes contact, no vibrator being used.

Circuit-Breaker Contact Brief

The circuit-breaker normally has its contact points held apart and they are brought together only for an exceedingly brief period during which the primary circuit is completed and broken. This action takes place so rapidly that it is impossible for the eye to follow the movement of the contact points. Since the circuit is closed at such a short period of time the amount of current consumed is naturally exceptionally small. Another feature is that it is impossible for the two points to remain in contact and hence the battery cannot be exhausted by leaving the switch in the on position when the motor is not running.

The shaft S which is the rotating portion of the breaker distributer mechanism has four, six or eight notches equally spaced peripherally according to the number of cylinders. The trigger T catches in these notches and is drawn around with the shaft a minute distance, when it escapes from the notch, rides up slightly on the round surface of the shaft and then returns to its normal position by the tension of the coil spring P. As the trigger T jumps back under the influence of the coil spring it strikes the hammer H which in turn transmits the blow to the flat spring F bringing the contact points together for a minute period of time. This gives the contact and breaks it in such a short space of time that the eye cannot follow the closing of the circuit by the contact of the points.

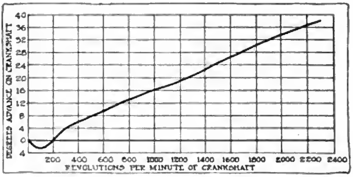
Hardened Steel for Rubbing Parts

All of the parts which are subject to a rubbing contact are made of hardened steel and since the moving parts are exceptionally light, wear should not make its appearance during the life of the car. The tungsten contact points are also well cared for in that the current is automatically reversed by the switch every time it is turned on. The adjustment of the contact points is effected by the removal of shims from beneath the bead of adjusting screw which carries one of the platinum points.

As the contact is made and broken only during the time that the hammer H is in motion, it is impossible for the points to remain together and thus discharge the battery when the motor is not in use, as there is no possibility for the hammer to be held in the position that it occupies at the time it strikes the spring F, making and breaking the contact.

The distributer is a simple blade, insulated on top of the shaft, receiving current from a central contact and delivering it to the several pointed brass collectors in turn. Actual contact between the blade and the collector is not required, owing to the ability of the current to jump a small amount of gap at this point. By eliminating the contact, wear is avoided.

Manual advance, if required, is accomplished simply by



Curve of advance as given by the Atwater Kent centrifugal governor rotating the case and the distributer. The type H relies wholly on this while the type K-2 which is most used puts the responsibility of the advance on the governor. The governing mechanism is obtained by four weights W distributed symetrically about the divided shaft; the upper half of the shaft carries the contact maker and distributer while the lower half carries the governor. As the weights W on the latter are thrown from the center, they rotate the upper shaft through a maximum arc of 38 degrees which is equivalent to 76 degrees on the crank circle as the distributer shaft is operated at one-half crankshaft speed. The weights are in balance and are controlled by springs so arranged as to exert an increasingly direct pull as the weights expand. The tendency of the weights to expand faster than the speed increases, due to the law that the centrifugal force varies as the velocity squared times the radius is counteracted. The resulting curve of advance is shown in the accompanying illustration.

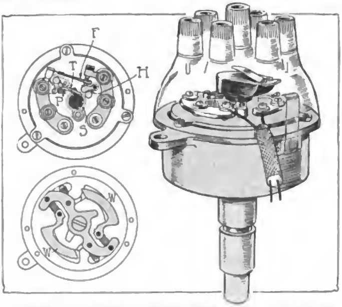
The switch is operated by a handle which continually rotates in a clockwise direction, turning the switch a quarter turn, switches the current off or on and at the same time reverses its polarity. A lock is provided in the form of a removable plug.

Westinghouse System Is Single Unit

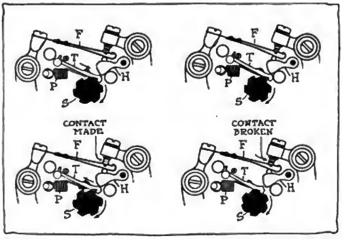
The Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa., has brought out a battery ignition system which is complete in itself and when operated in conjunction with the storage battery and generator generally supplied with the car, makes up the third unit of a complete starting, lighting and ignition system.

The distinguishing feature of the Westinghouse system is that the timer, distributer, coil and condenser are all in a single unit. Besides this, the switch comprises the sole remaining part. The three-in-one unit is designed to be vertically mounted and can be operated from the camshaft or any other suitable rotating medium by means of gear reduction. The casing is cylindrical in shape with a diameter of 3.25 inches and a height of 5 inches.

Referring to page 288, which shows the breaker mechanism, it will be noted that this is similar to other Westinghouse instruments except that it is not provided with automatic spark advance. The breaker operates on the close circuit principle, the contact point C and C1 normally being held together by a small coil spring S. This spring is under compression and holds the flat piece which carries a cam follower F. This flat piece is on a fulcrum keeping the two points tightly together. The cam L is mounted loosely on a shaft being turned by a pin P which comes against the stops A and B according to the direction of rotation. This permits the mechanism to work equally well in either direction. A backward travel of approximately 48 degrees is possible without causing the contacts to separate and induce a spark and a consequent backfire. In rotating the cam L engages with the fiber block F thus separating the contacts.



Atwater Kent breaker mechanism assembled and a view of the centrifugal governor, together with a phantom drawing of the engine timer distributer assembly



Progressive steps in the operation of the Atwater Kent circuit breaker which separates the primary contact points

The condenser K is mounted adjacent to the breaker mechanism and in connection with it is placed below the coil which surmounts it. The entire unit is inclosed in a tube of Bakelized Micarta which forms the body of the unit. The coil itself is imbedded in a heat-proof insulating material. Over the lower parts of the Bakelite tube is a metal ring which can be moved upward after a screw is loosened to give access to the breaker mechanism. On page 288, which shows the Westinghouse unit, this ring is shown pushed up out of the way exposing the adjustment screw for the contact point.

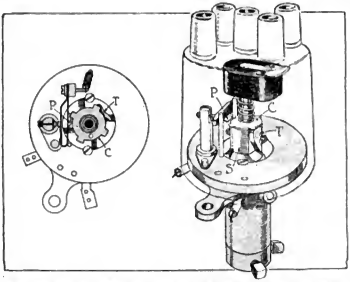
The distributer for the high-tension current is mounted above the coil and being in conjunction with it no external wiring is necessary. It provides a wiping contact and is similar to the distributer used in Westinghouse generators. There are two round brushes which are held apart by a small coil spring. One of the brushes makes contact with the coil terminal at the center and the other has the wiping contact with the points which connect to the wires of the spark plugs.

The Westinghouse switch is another of those involving the change of polarity principle in prolonging the life of the contact points. It is a snap design generally mounted flush with the dash and combined with the lighting switches on the instrument plate. A kick-switch with a lever is also supplied when desired and in this the direction of current flow is determined by the manner in which the plug is inserted and thus it is often changed inadvertently.

Rhoades Comprises Two Units

The Rhoades unit spark system produced by the New York Coil Co., New York City, is a complete battery ignition system operated on a 6-volt storage battery or on the equivalent in dry cells. It can be made for any number of cylinders and connects to any desired shaft size.

The complete system comprises two units, one embodying the breaker and distributer mechanism and the other the coil and switch. The first-mentioned unit is contained in a 5.25 by 3-inch cylindrical housing, the lower part of which contains the breaker mechanism which operates on an ingenius open-circuit principle which renders it impossible to discharge the battery cells when the motor is not running.



Rhoades ignition system as made by the New York Coil Co., showing the breaker mechanism and the timer distributer assembly

This is effected by having the contact of the primary circuit made and broken by a hammer action which does not take place except when the timer shaft is revolving. This breaker mechanism is illustrated above.

The rotating shaft S has pivoted to it a trigger tripper T which revolves with the shaft and in its course slips over four cams in the base plate. As the trigger is raised by the cams it in turn raises a hammer plate C, which has four projections equally spaced around its circumference. For a six-cylinder car it would be six projections, and there would be six cams in the base plate. As the trigger is tripped the projection which is in the proper place strikes the contact spring P, making and breaking contact. The blow of the hammer plate C is rendered sharp by the action of the coil spring above it and the plate itself is prevented from turning by a pin in the shaft which acts as a guide retaining the plate always in the same position as regards the position of the shaft.

Contact is made and broken during the brief period of time required for the coil spring to bring the hammer plate down to its original position, and since the contact can only be made during the fall of the hammer plate, it is impossible for the contact points to remain together when the motor is not running.

With this method of breaking the current a single intense spark is produced at each interruption of the primary circuit of the non-vibrating coil, and since the primary current is only permitted to flow through the coil for a fraction of a second, the drain on the battery is practically negligible. The distributor is carried at the top of the verticle shaft of the breaker mechanism and gives a wiping contact at the center and at the periphery there is no rubbing contact since the spark jumps from the segment to the points which are connected to the high-tension terminals on the top of the housing.

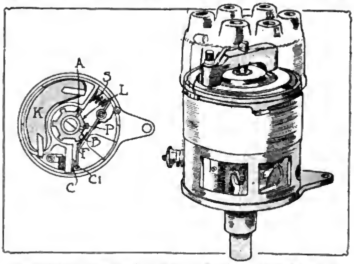
The other unit, which includes the coil and switch, is incased in a box to be mounted on the dash. It is of orthodox construction, the non-vibrating coil being designed to produce the maximum spark possible for the brief period of saturation of the primary coil. A kick-switch and a button for starting on the spark are mounted upon it. In addition to the standard system there is one which is produced especially for use on Ford cars. It uses the regular sparking apparatus and coil, but the outfit includes also all the necessary fittings for mounting this ignition system upon the Ford car.

Bosch Is Single Spark System

The Bosch Magneto Co., New York City, developed its battery system several years ago as part of the Bosch two-independent system. Ignition is permitted with this either by the magneto and one set of plugs, by the battery on a second set or by both operating in synchronism. The battery part of the system comprises the coil switch, lock and a timer distributer. The switch is incorporated in the coil and the timer distributer is also a single unit. The system operates on a 6-volt current and is used in connection with a storage battery. It is recommended that a 6-volt, 60-ampere hour capacity be used. If dry cells are used there should be ten for a four-cylinder motor and twelve for a six-cylinder, connected in series-multiple.

In mounting the Bosch system the coil is generally placed behind the dash with the switch projecting through the instrument board. The timer distributer is attached to a shaft operating at camshaft speed by means of a sleeve and a taper bolt.

The system is a single spark in which ignition is produced by a sudden breaking of the primary circuit. As is common with the single spark ignition systems, the high-tension distributer is mounted directly above the breaker mechanism in order to have the same shaft perform the dual function of timing the spark and distributing it. The breaker is worked out in a very simple manner as is shown on page 289. The rotating shaft A carries the cam C, which is designed to break the circuit as many times per revolution as there are cylinders on the motor. In the illustrated cam there are six points at which current interruption takes place, since it is designed for a six-cylinder motor. One contact point is mounted on the fixed block B, and the other is on the movable arm M. The spring S controls the action of the movable arm. As the cam rotates it bears against the fiber follower piece F, thus separating the points at each high spot on the cam.



Westinghouse battery ignition system, showing an example of a six-cylinder breaker mechanism and the timer distributer

The high-tension distributer consists of a radial arm carrying a carbon brush, which makes successive contact with a number of contact pieces inserted in the sides of the casing. These connect to the lead which go to the various spark plugs.

There are four points on the switch, lettered O.B, MB and M. In the O position the battery circuit is broken and the magneto is grounded. When the switch is thrown to position B, the magneto is still grounded but the battery circuit is completed, and in consequence the breaking of the circuit by the timer distributer will result in the production of a spark that will be transmitted to the proper cylinders by the distributer. In position MB both the magneto and battery are producing sparks and in position M the battery circuit is broken and the magneto alone is in operation.

A button located in the coil end plate will produce a spark in the cylinder that is on the power stroke. With the engine in normal condition a light and momentary pressure on the button will cause ignition, but should the mixture be poor in quality or the motor stiff, it will be necessary to crank. With the switch in the B position cranking will produce a single contact spark on the breaking of the battery timing. Under conditions that make the mixture difficult to ignite there is a vibrator provided which may be locked in position by pressing down the button and rotating it slightly to the right. The motor is then cranked, vibrator sparks will be produced, instead of a single spark, which will tend to facilitate starting.

Remy Consists of Three Units

The Remy Electric Co., Anderson, Ind., has developed a system of battery ignition which it has designated the model 100 magneto type battery ignition system. It is intended for use on cars that are equipped with electric starting and lighting systems, and can be operated on either a 6 or 12-volt circuit. The system is divided into three units, a timer distributer, a coil and a switch. The timer distributer is mounted on any convenient shaft driven at 1-2 crankshaft speed, the coil can be located at any convenient position and the switch is generally placed on the dash.

Simplicity and lightness are features of the breaker mechanism, which is a closed circuit design. The rotating half-time shaft carries with it a cam which has as many faces as there are cylinders. Below this cam C is shown in connection with the follower F, against which it bears in rotating. The follower is fiber and when acted upon separates the contact points, one of which is carried by the movable arm A and the other is located on the ends of an adjusting screw which passes through the thick block B. The two-contact points are normally held in a closed position by the coil spring S which holds the arm A. With this mechanism, as the shaft rotates, the contact between the primary points is broken each time a high spot on the cam comes in contact with the fiber follower, thus producing a high-tension spark.

The distributer mechanism is mounted in the same unit above the breaker and consists of a radial arm keyed to the rotating shaft with a simple spring contact bearing against a carbon contact piece imbedded in the Bakelite distributer cover. There is a gap between the distributer points and the arm which the high-tension spark jumps on its way to the terminals and thence to the spark plugs. By leaving the gap between the distributer on the high-tension terminal point wear is eliminated, since there is no metallic contact and the life of the instrument is correspondingly increased.

The Remy battery ignition system differs from others in that the advance and retard mechanism is entirely separate from the distributer cover. When the timing lever is moved the cover remains stationary, obviating the necessity for moving the wires and avoiding the possibility of chafing the wires and causing leakage in the high-tension current.

The coil is designed to produce a spark on as low a voltage as 2.5 for a 6-volt system, and therefore, should the battery become nearly discharged, a spark will still be produced which will be sufficient for ignition purposes. The dimensions of the coil are not great, as it is a cylinder 2.75 inches in diameter by 4.25 inches in height. The condenser is a part of this unit and is fully inclosed.

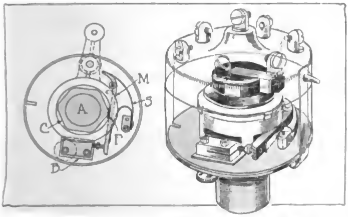
The switch is a three-point design lettered M, O and B, or, respectively, Magneto, Off and Battery. The lever can be locked in the off position and the key is removable. The distributer is intended to be mounted to rotate in a predetermined direction. The only change necessary for a change in the rotative direction of the shaft is the reversal of the distributer segment, which is marked with an arrow to show the preferred direction of rotation.

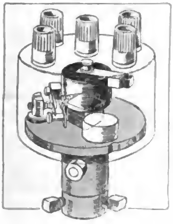
Halladay Is Ford System

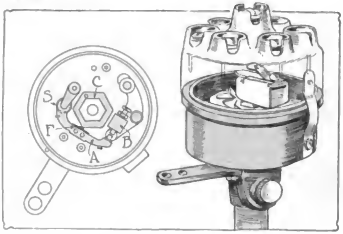
The L. P. Halladay Co., Streator, Ill., has produced a unit coil ignition system for Ford cars consisting of a combined timer and distributer and the necessary fittings to attach it to a Ford motor. With this igniter the Ford switch is employed and one unit of the regular Ford coil equipment.

Since the coil and switch which are regularly placed on the Ford car are employed as part of the system, the principal feature of the Halladay part of the outfit is the timer distributer. This is a combined unit in which a rotating shaft carries a cam which acts upon a follower four times during a revolution of the distributer shaft. One contact point is carried on a flat spring, while the other is attached to a thick post on the end of an adjusting screw by means of which the wear on the points is taken up. The cam acts directly on a flat member attached to the part carrying the flat spring on which the contact point is mounted. The follower is held against the cam by means of a coil spring.

A bracket, which forms part of the system, is supplied with the outfit, and this takes the place of the regular Ford timer, which is discarded when the Halladay system is installed.







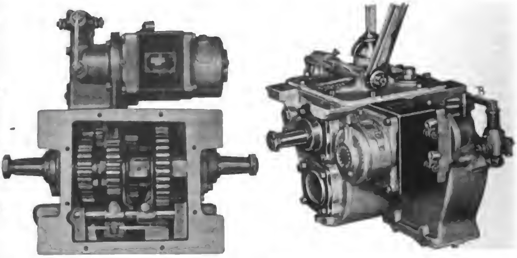
Above—Breaker mechanism and timer distributer of the Bosch Magneto Co. battery system

Right—The Halladay timer distributer

Extreme right—The breaker mechanism and the timer distributer of the Remy company

Brown-Lipe Gearset and Starter Unit

Clutch Can Be Used to Lighten Starting Effort



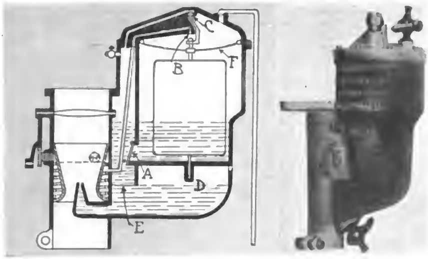
Brown-Lipe gearset with Westinghouse starter. A is starting gear and B shows switch control

THERE are several points in favor of locating the starter elsewhere than on the motor, for the latter already has numerous accessories and fittings to carry. While the flywheel application often has many advantages, it is sometimes not convenient to arrange a place for the starting motor, so gearbox location, if equally efficient in operation, has distinct claims to notice. Illustrated herewith is a new product of the Brown-Lipe Gear Co., Syracuse, N. Y., which has been standardized for manufacture and can now be supplied rapidly.

On the floorboard is a push button that engages sliding gears in the box, marked A in the illustration, and this also throws over the switch B. As soon as the motor picks up, the starter is disengaged automatically both by switch and by gear sliding, so there are no extra parts in constant operation. The makers point out that various gear combinations can be provided to suit the needs of motors of various sizes; they also suggest that there are occasions when the starter may advantageously be employed to rotate the clutch while the latter is held out by the foot, clutch engagement being gradual as the motor gathers speed.

New Suction Feed System

THE idea of utilizing the depression in the intake to lift gasoline from a tank located below a possible gravity feed level finds expression in the vacuum carbureter system which is made by the Vacuum Carbureter Co., Detroit, Mich., either as a separate attachment for carbureters of standard pattern, or as a complete instrument with feed apparatus and carbureter integral.



Suction feed carbureter attachment and diagram of the method of operation

There is a main chamber containing a float, the purpose of which is to control two small valves situated at the top of its stem. When the float is in the dropped or lower position, the lower valve is open and this uncovers a pipe leading to a point in the venturi near to the position of maximum depression. By these means the depression in the venturi is transferred to the float chamber and gasoline is drawn up from the main supply tank. Alongside the float chamber is a second smaller compartment with which the float chamber communicates by a non-return valve A. When the float rises it eventually closes the little valve B and opens the other little valve C, which of course, equalizes the air pressure in the float chamber and in the secondary compartment. As the air pressure is equalized the gasoline level will equalize likewise, the communicating valve A opening until the gasoline has settled in both chambers, whereupon the float falls and returns the top valves to their original setting, which leaves the second compartment a sealed chamber.

Now the jet is supplied from the bottom chamber D and when the level therein drops far enough a little air will bubble up into the smaller of the gasoline chambers through the orifice E. This air allows gasoline to descend, so lowering the fuel level in the small gasoline chamber until such time as the float is again high enough to throw over the top valves and recharge both chambers. By these means there is maintained an ever constant level in the bottom chamber D. In the whole system there are only the three valves A, B, and C.

A flat spring F is mounted above the float in such a state of tension that it tends to hold the float either up or down; when in the lifted position the spring prevents the float from falling till there has been a fair drop in the fuel level, and it likewise holds down the float until a considerable rise has occurred. This guards against fluttering or unsteady action.

Original Knight Racing Motor

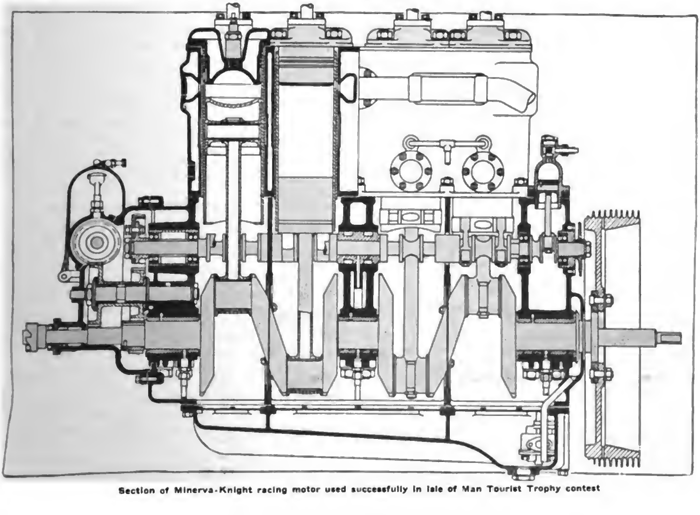
Special Features May Be Used Again in American Development of Design

IT was in the Tourist Trophy race in the Isle of Man last June that the Knight motor made its first entrance to the racing field in England, and, though the Minerva Co. had practically no experience of racing, the success of the car was really remarkable. It was understood at the time that some of the special features of the design had proved good and some less satisfactory, so it will be interesting to compare the Knight motor to be used for American racing with the Minerva in order to see what details have been perpetuated. The Minerva engine's dimensions were 3.54 inches bore and 5.1 inch stroke, the most striking difference in construction being that the sleeves were operated by two shafts instead of one—like a T-head poppet valve motor. The sleeves were lifted from one side only and the use of two shafts was to permit double sized bearings for the little sleeve connecting-rods. At the foot of each cylinder there was a supplementary exhaust port opened and closed by the sleeves and this was responsible for a great loss of oil and heavy smoking. Chas. Y. Knight was reported as having declared his intention of trying, in any future racing motors, the experiment of using the bottom ports as intakes instead of exhaust outlets, but be this as it may, the additional port area has a great effect on the power.

There was a double lubricating system, an ordinary gear pump supplying the drilled crankshaft, while a special plunger pump supplied the sleeves. This pump sent oil under pressure to a cavity in the cylinder wall and also sucked it back from the same place, the idea being to insure a supply to the sleeves and to prevent the accumulation of such pressure that oil could be pumped actually into the combustion space. The outer sleeve was drilled with many large holes, partly to decrease its weight and partly to allow oil to pass to the inner working surface.

In this design the usual silent chain was replaced by spur gearing, since the latter suited better for driving two sleeve shafts and noise was of no importance.

The difficulty with the Knight motor for racing is to get sufficient port opening in conjunction with sufficient overlap of the sleeves effectually to close the ports during the working stroke, but the sleeves allow supplementary ports to be used without their drawbacks as found on an ordinary motor, because they can be opened and closed as desired instead of being open continuously. Thus it is almost certain that some sort of additional porting will be employed on the new designs even though it may be quite different from that of the Minerva motor.



Section of Minerva-Knight racing motor used successfully in Isle of Man Tourist Trophy contest

The AUTOMOBILE

PUBLISHED WEEKLY

Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, February 11, 1915 No. 6

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL

David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES

Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - One Year, 5.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Vibration

HARDLY is it possible to design a machine that will not vibrate in some part or other, and the make up of the automobile renders it particularly prone to produce vibrations within the range that makes them unpleasant to the occupants. In most machinery vibration can be damped greatly by increasing the mass of the parts or the rigidity of the foundation, but an automobile has no foundation and it is impossible to add to its weight. It has, therefore, been the task of automobile engineers to eliminate vibration by scientific design, and in it they have been remarkably successful, the more so when it is remembered that there is no common machine having parts so highly stressed in proportion to their size.

There are not only vibrations arising from the engine to be considered, but those created by the road, by the gearing, by the universal joints and by the bending of the chassis frame under varying load, for example. The elimination of engine vibration has been a special study for a long time, and it was one of the principal causes of the introduction of the six-cylinder motor, which, when manufactured, proved to have peculiar vibratory habits of its own. These latter have had a great influence upon the present experiment with eights, since to free the six from all vibration though possible, is distinctly costly.

Meanwhile road vibration is obtaining almost as much attention, for there is a fresh wave of enthusiasm for the improvement of springs, and gearing shows the attention given to it by the growth of the worm and the spiral bevel—for though these have their reason in the desire to reduce noise, what is noise but another word for vibration? Yet in all these things, motors, springs or gears, we are a long way yet from finality in design, and perhaps further yet in the matter of choosing material and handling it when chosen. It is a curious fact that the approach to a standard type of machine always serves to show up its faults—it was the general use of six cylinders which proved that the original makers of small quantities had not been getting the best results possible: so it might be said as a general rule that we only begin properly to understand a feature of automobile design a year or two after it has become standard practice. At present vibration pure and simple, or the noise that arises from vibration are the most noteworthy faults in automobiles and nearly all recent changes have been aimed at their reduction.

Tire Prices

ALTHOUGH the progress of the various branches of the automobile and accessory industries has been steady and apparently inevitable since their inception, the revision of tire prices is one of the most encouraging signs of rapid improvement in conditions that has been visible for some time.

For years the list prices of our tire companies have been gradually coming down, with the exception of the brief period of panic last summer when the European war threatened to cut off our rubber supply, but also for years the man who knew could always buy new tires at prices far below those listed by the maker and which were meekly paid by the uninitiated. The experienced car owner or driver who knew how to link together the chain of possible discounts secured his tires at a reasonable rate while the tyro was at the mercy of the unscrupulous dealer.

The prices now in effect are apparently much more sensible, being based on manufacturing costs and a rational degree of profit for maker and dealer. The intricate system of discounts is abolished and henceforth the man who buys tires will do so on a business-like basis. Better manufacturing methods and improved factory facilities, together with the lower price of rubber, have made possible the reduction of prices so that the matter of tire expense will not now be so great a bugaboo to the man who wants to buy a car as in the past. Everyone concerned is to be congratulated upon the good sense of adopting business-like sales principles and, even more strongly, upon giving the automobile public a square deal. The dealer is also benefited because he can adhere strictly to his price list and does not have to be constantly combating the arguments of customers who claim that they know of instances where acquaintances have purchased the same make of tire for less money.

138,250 Carloads in 1914 Car Shipments

14 Per Cent. Gain Over 1913—Each Freight Car Carried Two to Six Automobiles—N. A. C. C. to Fight Increases in Railroad Charges

NEW YORK CITY, Feb. 8—At the last meeting of the directors of the National Automobile Chamber of Commerce it was reported that the shipment of automobiles from factories of this country in the year 1914 reached the tremendous volume of 138,250 carloads, each car usually containing from two to six complete automobiles and in some cases more when the machines were taken apart to a greater extent than is ordinarily the case. This is about 14 per cent. greater than the cars required for the shipping of automobiles in the year 1913 and is easily one of the most important items of traffic in high grade manufactured articles handled by the railroads, whose earnings on these shipments are now estimated at upwards of $15,000,000 per year.

The traffic committee also reported that the traffic department had conducted a meeting of the association's representatives at Detroit, January 20, at which all details of freight classification relating to the various kinds of self-propelling vehicles were carefully gone over and that this matter was further considered at a meeting with the uniform classification committee of the railroads at Chicago, January 25.

The department is taking a keen interest in further proceedings before the Interstate Commerce Commission on the proposed extra charge by railroads for placing cars on factory sidings. This service has always been considered as included in the freight rate on automobiles as well as on all other kinds of freight, and it is expected that the N. A. C. C. and all other shipping interests will resist to the utmost any effort to charge more for placing cars on terminals provided on private property than if the manufacturers made use of the railroads' own terminals, which are purchased and maintained at great expense to the carriers and would certainly have to be enlarged many times if all shippers used them.

Another matter that the traffic department is strongly resisting is a suggestion by some of the southern railroads that automobiles be acceped for shipment only when tops are removed or that a higher rating be charged; also a requirement that automobiles must in all cases be covered when shipped and that detachable parts must be removed and packed in iron-bound boxes.

New York January Registrations $564,010

ALBANY, N. Y., Feb. 6—Motorists contributed more than $500,000 during January, 1915, or nearly $200,000 over the amount paid in the same period last year, despite a loss of approximately $40,000 due to a half fee provision for cars registered for 4 years previous, according to a statement issued yesterday by Secretary of State Francis M. Hugo. Secretary Hugo's figures also show that more business was handled by the automobile bureaus during the first month of this year than during all of January and February in 1914, or the first 3 months in 1913.

Last month a total of $564,010.50 was collected from 65,455 owners and 32,733 chauffeurs. The New York office registered 40,103 owners, 29,079 chauffeurs, taking in $371,473.50, while during the same period last year 26,392 owners, 27,767 chauffeurs and $290,483 were attended to. The Buffalo branch handled 14,170 owners, 3,500 chauffeurs, collecting $110,450 against 5,418 owners, 1,299 chauffeurs and $48,590 contributed in 1914. The Albany bureau registered 11,182 owners, 3,494 chauffeurs, from whom $88,899 was collected, although last year only 5,418 owners, 2,760 chauffeurs and $56,025 were accounted for. The deficit due to half fees amounted to $39,140, of which sum $26,287.50 arose in New York, $6,752.50 in Buffalo and $6,100 in Albany.

TRENTON, N. J., Feb. 5—Automobile licenses in New Jersey for January, 1915, amounted to $259,835, an increase of 40 per cent. over December, 1914. The yearly income to the State is $1,140,000. Registrations of 26,839 motor vehicles were made during the past month, against 18,645 in January, 1914.

OLYMPIA, WASH., Feb. 2—There were 741 motor vehicle licenses issued during the month of January to automobile owners in the State of Washington, as compared with 319 during January, 1914, an increase of 132 per cent.

NEW YORK CITY, Feb. 8—Frank H. Bowen has been appointed manager of the sales department New York branch of the Locomobile Co. of America. Mr. Bowen has been with S. G. V. and Simplex during the past 6 years. John F. Plummer, New York manager of the company states that the territory of this branch has been extended to include the entire state, both wholesale and retail, and agencies will be established in some of the larger cities.

1,279 Trucks Exported in December

WASHINGTON, D. C., Feb. 9—*Special Telegram*—Demand for trucks for European war purposes is indicated in export figures issued today by the Bureau of Statistics. In December last 1,279 commercial vehicles, valued at $3,387,729 were exported, together with 1,297 passenger cars, valued at $998,698. In December, 1913, eighty-eight commercial cars valued at $100,660 and 2,301 passenger cars, worth $2,052,484 were exported.

During the calendar year number of commercial cars exported increased from 1,009 worth $1,686,807, in 1913, to 3,430, value $8,985,756 in 1914, while the number of passenger cars decreased from 25,880, worth $25,343,644 to 22,335, value $19,521,708 during the same period.

3,500 Franklins for 1915

SYRACUSE, N. Y., Feb. 6—It is announced that plans have been made by the Franklin Automobile Co., to increase its production to 3,500 cars a year. It is stated that this is a 40 per cent. increase over last year. This shows a steady increase for this company for the past years as the 1914 production was stated to be 30 per cent. greater than that of 1913.

At the annual meeting held last week, the company elected directors and officers. The H. H. Franklin Mfg. Co., president, H. H. Franklin; vice-president, John Wilkinson; secretary and treasurer, F. A. Barton. The directors are the officers and E. H. Dann, G. H. Stilwell, A. T. Brown, W. C. Lipe and Arthur Holmes. For the Franklin Automobile Co. the officers are: President, H. H. Franklin; vice-president, Arthur Holmes; secretary and treasurer, F. A. Barton. The directors are the officers and E. H. Dann and John Wilkinson.

Heising Is Moon Chief Engineer

ST. LOUIS, MO., Feb. 8—G. F. Heising has succeeded L. F. Goodspeed as chief engineer of the Moon Motor Car Co., this city, Mr. Goodspeed having resigned on February 1. Mr. Heising still retains his grasp upon the purchasing department, and is assisted by C. W. Burst, who was formerly assistant superintendent.

WEEDSPORT, N. Y., Feb. 8—The Whitwood Corp., manufacturer of commercial vehicles, this city, will disorganize that corporation and will discontinue the business. The company terminates its existence without financial embarrassment.

Republic Truck Declares 100 Per Cent. Dividend

DETROIT, MICH., Feb. 9—*Special Telegram*—A dividend of 100 per cent. was declared payable today at the annual meeting of the stockholders of the Republic Motor Truck Co., Alma, Mich.

$1,000,000 for Lozier—New Co. Promised

Creditors May Receive 30 Per Cent.—Plattsburg Plant May Remain Closed or Be Sold

DETROIT, MICH., Feb. 6—An even million dollars was bid and accepted yesterday for the total assets of the bankrupt Lozier Motor Co. The purchasers are the Frank Brothers Iron & Metal Co.; the Harris Bros., Co.,—both of Detroit; Theodore Friedberg, and Charles Shongood, both of New York. The first three parties are in the metal and machinery business and Shongood is a United States auctioneer, in New York.

Speaking about the future plans of the purchasers, Samuel Frank stated that the Lozier Motor Co., will be operated as a going concern within the next 10 days and a new company will be organized with sufficient capital to permit the immediate re-opening of the plant. There is a possibility that the Plattsburg property will remain closed for the time being or disposed of to other parties.

The total assets of the Lozier company had been appraised by that concern at $4,899,972.65, but the appraisers of the Detroit Trust Co., trustee, figured the liquidation value of the quick assets at $1,366,584.46 and the land and buildings at $866,873.23, as a going concern, or the total assets at $2,233,457.69.

It is estimated that after all the expenses are paid, such as court fees, attorney's bills, etc., there will be sufficient funds to eventually pay about 30 per cent. of their claims to the creditors.

Rolls-Royce Profits Decrease $71,500

LONDON, ENG., Feb. 3—Profits of the Rolls-Royce, Ltd., decreased $71,500 in 1914, compared with the previous year. A dividend of 10 per cent. was recommended instead of the 20 per cent. in 1913. The loss in earnings and lower dividend rate were due entirely to the war. Net profits in 1914 were $384,255 against $455,920 in 1913. The dividend of 10 per cent. was earned three and one-half times over.

The company has been exceptionally prosperous in past years, and in the last 8 years and 8 months has paid out in dividends a sum equal to the entire capital subscribed by the original shareholders.

The situation caused by the war was saved to a large extent by the acceptance of orders for ordnance, which while yielding little profit, kept the factories running and the men employed. The production of motor chassis has already recovered to half the maximum before attained.

Kelly-Springfield Profits Gain $939,194

NEW YORK CITY, Feb. 9—The Kelly-Springfield Tire Co., which closed its fiscal year December 31, 1914, reports a net increase in income of more than 100 per cent. The gross profit for the year increased $939,194, the net income being $1,215,143. During 1913, the income was but $559,543. Liberal reserves have been made for bad and doubtful accounts receivable and the inventories of merchandise and materials which increased $563,757 during the year have been priced at cost with crude rubber at less than the market prices prevailing at the end of the year. Out of the earnings a sinking fund of 2 per cent. has been set aside for dividends on the 6 per cent. preferred stock.

	1914	1913
Gross profit	$2,203,761.00	$1,264,567
Operating and administrative expense	1,014,015.73	716,189
Net operating income	1,189,745.67	548,378
Other income	41,874.36	43,376
Total income	$1,215,113.71	$559,543

The balance sheet of the company, as of December 31, 1914, shows assets as follows: Cash, $380,414.81; notes and accounts receivable of respectively $114,302.31 and $533,832.78, less reserve for bad debts and discounts of $134,846.02, total $513,289.07; inventories at cost, $1,795,365.33, less the deferred charges to operations of $28,335.72 makes the current assets, $2,717,404.93.

Liabilities are as follows: Accounts payable, $61,099.32; accrued charges, $49,428.13; dividends and interest payable, $143,049, making the current liabilities, $253,576.45; 50-year sinking fund 4 per cent. income debenture bonds, $270,000; capital stock, $8,665,400; sinking fund for redemption of stock and bonds, $201,537.94.

Gray & Davis 1914 Sales $4,000,000

BOSTON, MASS., Feb. 6—The gross sales of Gray & Davis for 1914, are understood to be $4,000,000, a new high mark. The first 6 months registered sales of $2,500,000, the final half year tapering off normally to around $1,500,000. The earnings for the full year were in excess of $300,000, over two-thirds of which was contributed in the 6 months to June 30. At this rate, earnings upon the preferred stock are equivalent to about six times the dividend requirements, the outstanding preferred having increased from $500,000 to $750,000 during the year.

Studebaker Earnings Amount to $4,000,000

SOUTH BEND, IND., Feb. 6—The Studebaker Corp., this city and Detroit, is reported to have earned $4,000,000 in 1914. The exact figures are not available as yet, as the financial report is still in the hands of the accountants. After taking out the $900,000 for the preferred stock dividend, $3,100,000 is left for the common, or approximately 11 per cent. on the $27,931,600 outstanding. This compares with $1,003,338 or 3.59 per cent. for the common in 1913.

SOUTH BEND, IND., Feb. 3—A dividend of 1 3-4 per cent. was declared by the Studebaker Corp. to its stockholders. The annual session of the directors was held at the South Bend offices yesterday, the declaring of the dividend being the feature of the meeting. The dividend declared is payable on March 1 to all stockholders of record on February 20.

Automobile Securities Quotations

NEW YORK CITY, Feb. 8—Although the general tone of the market was somewhat unsteady during the past week the prevailing tendency of prices may be characterized as upward. Kelly-Springfield Tire continued strong, the common going up 10 points and the second preferred 5. Willys-Overland common gained 6 1-2 and the preferred 2, while Maxwell common gained 3-4, first preferred 4 1-4 and second preferred 2. Studebaker common gained 4 5-8 and preferred 2 1-2. Tire companies also showed slight gains. At the end of the week nearly all the stocks either were quoted at the same figure as last week or somewhat higher, there being only five instances of lower prices.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	200	..	250	..	..
Ajax-Grieb Rubber Co. pfd	98	101	100	..	..
Aluminum Castings pfd	97	100	95	100	..
J. I. Case pfd	..	..	.	85	..
Chalmers Motor Co. com	..	90	..	94	..
Chalmers Motor Co. pfd	92½	93½	91	94	+1
Electric Storage Battery Co	..	..	47½	48½	..
Firestone Tire & Rubber Co. com	246	252	370	375	.
Firestone Tire & Rubber Co. pfd	165	107	109	111	..
General Motors Co. com	55	56½	93½	94½	+ ½
General Motors Co. pfd	89	90	94½	95½	— ½
B. F. Goodrich Co. com	25	25½	32⅝	33	+1⅜
B. F. Goodrich Co. pfd	90	92	96⅛	97	+ ⅛
Goodyear Tire & Rubber Co. com	215	225	190	194	—3
Goodyear Tire & Rubber Co. pfd	98	100	101	102	— ½
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	..	..	..
International Motor Co. pfd	..	15	..	..	..
Kelly-Springfield Tire Co. com	..	..	107	107½	+10
Kelly-Springfield Tire Co. 1st pfd	..	..	82	83	..
Kelly-Springfield Tire Co. 2d pfd	..	..	117	120	+5
Maxwell Motor Co. com	5	5½	17¾	18½	+ ¾
Maxwell Motor Co. 1st pfd	28	29	58¼	59¾	+4¼
Maxwell Motor Co. 2d pfd	9½	10	22¼	22½	+2
Miller Rubber Co. com	..	..	158	165	.
Miller Rubber Co. pfd	..	..	101	103	..
New Departure Mfg. Co. com	..	..	117	122	..
New Departure Mfg. Co. pfd	..	..	105	107	.
Packard Motor Car Co. com	..	..	..	100	..
Packard Motor Car Co. pfd	95	98½	93	..	..
Peerless Motor Car Co. com	15	25	13	20	..
Peerless Motor Car Co. pfd	75	80	..	55	..
Portage Rubber Co. com	..	40	30	36	..
Portage Rubber Co. pfd	..	90	80	85	..
*Reo Motor Truck Co	7	7½	11⅝	12¼	+ ⅝
*Reo Motor Car Co	17½	18½	24½	25	..
Splitdorf Electric Co. pfd	..	..	..	..	..
Stewart-Warner Speed. Corp. com	54	56	49½	50½	+1½
Stewart-Warner Speed. Corp. pfd	98	..	100½	103	— ½
Studebaker Corporation com	29	30	46⅛	46½	+4⅝
Studebaker Corporation pfd	86½	87	94½	96½	+2½
Swinehart Tire & Rubber Co	69	71	69	71	..
Texas Company	..	..	131	135	..
U. S. Rubber Co. com	59	59½	56¼	57	+ ¼
U. S. Rubber Co. pfd	101¾	102	102¾	103⅛	+ ⅜
Vacuum Oil Co	..	..	193	196	—2
White Co. pfd	105	110	108	110	..
Willys-Overland Co. com	65	67	96½	98½	+6½
Willys-Overland Co. pfd	91	95	95	97	+2

*Par value $10; all others $100 par value.

To Reorganize Krit Company

Winternitz Buys Assets of Car and Sales Concerns for $120,000 —Will Build New Cars

DETROIT, MICH., Feb. 6—The combined assets of the Krit Motor Car Co., and the Krit Sales Co., which had been appraised by these companies at a total of $879,347.97 and by the official appraisers at $210,436 were purchased yesterday for $120,000 by Samuel Winternitz & Co., Chicago, the sale being confirmed by the referee in bankruptcy.

In commenting upon the purchase, the Winternitz company said that it is its intention to re-organize the Krit concern. An announcement will be made as soon as the plans have been perfected. "We are going to complete all the unfinished cars and with the material on hand build new ones, and hope to have the re-organized company in running order very shortly," said one of the officials of the Chicago company.

The Chicago concern made a deposit of $12,000 and also gave a bond of $25,000 to guarantee that it will keep its engagement, the bond being given to Frank W. Blair, of the Union Trust Co., trustee for the Krit Motor Car Co., and to Henry Lansdale, trustee for the Krit Sales Co. It was also agreed that if the total amount of $120,000 is paid within 90 days a discount of 2 1-2 per cent., or $3,000, will be allowed.

For its purchasing price the Winternitz company obtained stock of material, finished and unfinished cars and chassis, having a total value of $161,546.03; factory equipment, tools, jigs, office furniture, etc., valued at $21,453.71; patterns, dies, drawings valued at $2,500; ten cars and trucks used by the Krit plant and valued at $3,375; equity in buildings, land and in land contract covering the premises on which the Krit Motor Car Co. is located, valued at $15,000; stocks of parts, tools, supplies, office furniture and fixtures, located in the Philadelphia branch, valued at $6,561.28.

Michigan's 1914 Exports $7,890,230

DETROIT, MICH., Feb. 4—The total value of the automobiles, parts and accessories exported in 1914 by the manufacturers located in the state of Michigan was $7,890,230. From this total $6,108,677, or 77 per cent., is credited to Detroit manufacturing concerns.

The exports from Michigan consisted of 4,961 passenger cars of a total value of $4,693,792, or an average of $946 per car; 273 trucks and delivery vehicles valued at $404,873, or an average of $1,483 each; automobile parts and accessories valued at $2,695,788 and $95,777 worth of tires, which are now recorded separately.

Detroit naturally was the center of the export business and of the total of 4,961 passenger cars exported last year 3,923 or 80 per cent. were shipped from this city, also 174 out of the total of 273 trucks, or 63 per cent. Compared with 1913 there was a decrease of 200 in the number of passenger cars exported and fifty in the number of trucks. For some countries the exports were heavier than in 1913, for others there was a great decrease. For instance only ninety-six passenger cars were shipped to South Africa last year as compared with 719 in 1913. The number shipped to England in 1914 was 1,946, or 338 more than in 1913.

Cleveland Plants Busy On War Orders

CLEVELAND, O., Feb. 5—Authentic information in Cleveland financial circles discloses an order received by the White Co., from the Russian government for 500 2-ton and 500 3-ton trucks, at an estimated cost of something over $2,000,000. White company officials, however, have maintained secrecy regarding their foreign business.

The Peerless plant has been busy several weeks on a continuous order from the British government for an unstated number of trucks. Shares of the Peerless Motor Car Co. have developed a much stronger demand in the Cleveland market and it was inferred that the company had increased its weekly output for early shipment. Stock of the company has risen from a weak market around $15 a share to a strong market at above $20 a share.

The activity of the allied governments in placing orders for war munitions and supplies is coincident with the completion of arrangements by J. P. Morgan & Co., of New York to act as representatives of the British government in this country. The Wall street financial firm has named Edward R. Stettinius, president of the Diamond Match Co., as its commercial agent to handle foreign business.

TROY, O., Feb. 3—A cable order has been received from the French government by the Troy Wagon Works Co., this city, for 350 motor truck trailers at $1,256 each.

Ordnance Officer to Buy Trucks

WASHINGTON, D. C., Feb. 6—The war department today issued orders to Capt. J. B. Rose, ordnance department, to proceed to the works of the Packard Motor Car Co., Detroit, Mich., "on official business pertaining to the procurement of armored automobiles for the ordnance department." The issuance of this order indicates the United States army has decided to procure new armored cars of the types that have been so efficient in the European conflict.

Government Wants Truck Estimates

WASHINGTON, D. C., Feb. 6—The secretary of the treasury has issued a call for sealed proposals for furnishing the various executive departments in this city with gasoline and electric trucks during the fiscal year beginning July 1, next. The bids will be opened at 2 o'clock, March 10, by the general supply committee. The number of trucks required is not given. Strict specifications have been issued to which bidders must closely adhere.

Detailed information, together with proposal blanks, can be obtained upon aplication to the General Supply Committee, Auditor's Bldg., this city.

NEW YORK CITY, Feb. 6—The American-La France Fire Engine Co., Inc., reports for the year ended December 31 last net profits $350,645 and a surplus after 7 per cent. dividends on the preferred stock of $210,645. The profit and loss balance on December 31 last was $310,208. As compared with the previous year, the net earnings show a gain of $112,491. As a result of favorable earnings for 1914, the directors have declared a dividend of 1 per cent. on the common stock, payable February 15 to stock of record February 1. The company has $2,000,000 7 per cent. preferred stock, and $1,450,000 common stock, with $51,325 first mortgage bonds.

Market Reports for the Week

NEW YORK CITY, Feb. 9—This week's market reports were fairly steady with the exception of a few fluctuations in the cottonseed oil, tin and tire scrap prices. Cottonseed oil rose to $7.15 and then closed at $7.00 at a drop of $0.12 per barrel; tin went below and then above its opening price and then closed with no change, its price being $37.00 per 100 pounds. Tire scrap dropped to $0.04 1-2 on Friday but immediately rose to $0.05, maintaining that price to the close on Monday. Though fine Up-River Para rubber went up $0.08 1-2, it was fairly steady after Thursday. Trading in crude rubber was restricted to small lots as a rule. The offerings of Para rubber were reported as light and the market was firmer. Supplies are reported to be light. There was a small demand for electrolytic copper at the latter part of the week from domestic consumers for March, April and May shipments. Copper exports in 1914 amounted to 360,299 tons while the imports amounted to 134,000 tons.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Antimony	.17	.17	.17	.17	.17	......
Beams & Channels, 100 lbs.	1.21	1.21	1.21	1.21	1.21	......
Bessemer Steel, ton	18.50	18.50	18.50	18.50	18.50	......
Copper, Elec., lb.	.14⅝	.14½	.14½	.14½	.14⅜	—.00¼
Copper, Lake, lb.	.14¾	.14⅝	.14⅝	.14⅝	.14⅝	—.00⅛
Cottonseed Oil, bbl.	7.12	7.15	7.13	7.10	7.00	—.12
Cyanide Potash, lb.	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	......
Lard Oil, prime	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	3.80	3.80	3.80	3.80	3.80	......
Linseed Oil	.60	.60	.60	.60	.60	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.55	.55	.55	.55	.55	......
Petroleum, bbl., Pa., crude	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.71	.71	.71	.71	.75	+.04
Rubber, Fine Up-River, Para	.50	.57½	.57½	.57½	.58½	+.08½
Silk, raw, Ital.	..	3.90	..	..	3.90	......
Silk, raw, Japan	..	3.42½	..	..	3.40	—.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	......
Tin, 100 lbs.	37.00	36.50	37.13	37.00	37.00	......
Tire Scrap	.05	.05	.04½	.05	.05	......

Decision Rendered in Carbureter Suit

Zenith Wins on Present Model But Loses to Stromberg on Two Discontinued Types

CHICAGO, ILL., Feb. 3—Judge Sanborn, in the United States district court for the northern district of Illinois, decided today the suit of the Stromberg Motor Devices Co., Chicago, against the Zenith Carbureter Co., Detroit, Mich., in favor of the Zenith company, in regard to one model now being manufactured and against the Detroit concern with reference to two discontinued models. The Ahara, Richard, Sturtevant and Anderson patents are those upon which the complainant based the present suit. The testimony was taken in September, 1914.

As the case stands the Stromberg company may collect on the two discontinued but infringing carbureters and appeal on errors in the case just decided. In all probability an appeal will be made by both concerns.

The case just decided in the lower court involved four carbureter patents as named above, two of which, the Ahara and Richard, were claimed to be infringed by previous Zenith types in the suit of the Stromberg company against the John A. Bender Co., Chicago agent for Keeton cars, which were equipped with Zenith devices.

The Bender case was decided in February, 1914, in favor of the Stromberg company. It will be remembered the Stromberg attorney attempted to convince the court that the Zenith company was a party in the suit for the reason it supplied fees and lawyers to conduct the defense. Bender declined to appeal, dropped the Zenith lawyers, engaged his own, dismissed the appeal and consented to final decree. This brought the Stromberg company face to face with the question of bringing suit against the Zenith company, the latter having issued a legal battle in May, 1914. The decision today was the result, but since the time of the Bender case the Zenith company has discontinued two types of carbureters which are said to infringe and is manufacturing and selling one type which is declared by Judge Sanborn to be free of infringement.

"If the Zenith does not infringe any of the complainant's patents in its main operation, as I think it does not, it should not be held to infringe on a minor operation, not clearly disclosed by any of such patents," says the Judge. "Infringement is, at least, doubtful and should not be decreed."

Judge Sanborn continued further, "As no infringement appears by the No. 2 carbureter no injunction should issue, but there should be a decree to the effect that the Ahara and Richard patents were infringed by the manufacture and sale of carbureters like Nos. 1 and 10 and for an accounting and damage without costs to either party."

The No. 2 carbureter is the one now being made and sold by Zenith. Nos. 1 and 10 are the discontinued types.

So it sums itself up into this. That the Stromberg company can collect royalty on the carrbureters called No. 1 and 10 which have been discontinued by the Zenith company but which were being made when the Bender suit was on. The three carbureters in question have manufacturing dates as follows: No. 1, made between August, 1911, and August, 1912; No. 10, made in March, 1912, and shortly afterwards discontinued, and No. 2 made between March, 1913, and April, 1914, and being made at the present time.

In the present case Judge Sanborn, in his decision, likens the suit to the previous one against Bender, saying: "In the Bender suit the decision turned on the distinction between suction-controlled and gravity-controlled noozzles and infringement was found because it was thought the Zenith device there shown like Ahara was not gravity-controlled in the secondary nozzle" . . . So the matter practically comes down to the question whether carbureters with two 3-16-inch vents said to create no vacuum at all in the U-tube, should be held to infringe."

Judge Sanborn evidently came to the conclusion cited above, because as he says, "The Bender decision went upon the theory that a 1-8-inch hole in the Zenith well would so restrict the U-tube as to create a vacuum therein and so operate just like the Ahara. The vents having now been enlarged so there is no sub-atmosphere (vacuum) in the well, the Ahara patent is not infringed."

The Richard patent, being an improvement of the Ahara, the judge similarly decreed that it was not infringed by the Zenith carbuheter now being made by the manufacturing company.

In commenting on the validity of the Sturtevant patent Judge Sanborn said, "Sturtevant is clearly valid but I do not think it infringed."

Relative to the Anderson patent the judge continued, "With all these differences (four were named in the decision) in means, operation and result, particularly in operation and construction, infringement is so doubtful that it should not be decreed."

The patents involved in this case are numbered as follows: Ahara 684,662, Richard, 791,501, Sturtevant re-issue, 12,611 and Anderson, 1,063,148.

The Ahara and Richard are somewhat the same, the latter being an improvement of the Ahara. This is known as the atmospheric well type, that is, a type of carbureter in which the proper mixture is maintained at the various engine speeds by means of an auxiliary supply of fuel from a well which communicates with the atmosphere and which is fed from the constant level fuel chamber or float chamber.

The Sturtevant patent relates to a combination of two distinct mixers, the main one for ordinary use and the other for low-speed and being in operation also when the other is working. The Anderson patent relates to the Stromberg model E, which has not been pushed extensively.

Body Makers Get $15,000 Judgment

DETROIT, MICH., Feb. 4—A default judgment for $15,000 was rendered by Judge Mandell in the Wayne County circuit court in favor of the Griswold Motor & Body Co., of this city, against George H. Partin, Chicago, and Henry E. Graper, of Tennessee, doing business as the Partin Mfg. Co., Lexington, Tenn.

The suit was filed April 28, 1914, on account of breach of contract, Partin and Graper having signed a contract November 21, 1913, with the Griswold company "for 1,000 touring car bodies as a minimum of 1,000 touring car bodies and a maximum of 2,000 to be taken during the season 1914, these bodies to be known as the Palmer Motor Car Six Passenger Body, and to be same as model now in possession of the K. C. Knapp Co." The price of these bodies was fixed at $48 each. December 20, 1913, Partin and Graper suggested several changes in the contract which was agreed upon by the Griswold company, the changes being in the construction of the bodies, which were to cost $50 each. It was further agreed to cancel 500 bodies and the other 500 were to be delivered half in March and half in April.

March 6 and April 6 the bodies were ready for delivery, but all efforts to reach either Partin or Graper or to communicate with them proved unsuccessful, it is claimed by the Griswold company. The bodies had to be stored and in order to cover themselves the body makers on April 13 had twenty-four cars and twelve chassis seized, all belonging to Partin and Graper, and valued at a total of $17,050.

Would Limit Truck Size: Fit Governors

NEW YORK CITY, Feb. 9—The Mayor's Central Committee on Street Traffic and Safety met yesterday at Police Headquarters to offer suggestions for making the city streets safer and for handling traffic more efficiently. Commissioner Woods said he was convinced that speeding motor trucks were one of the chief dangers, and offered the suggestion that these vehicles should be equipped with a governor to keep down their speed. The committee offered some fifty suggestions, one of the most drastic of which was that offered by Inspector Meyers in limiting the size of motor trucks and sight-seeing automobiles. He favored a law prohibiting such vehicles from exceeding 24 feet 6 inches in length, 7 feet 6 inches in width, and 12 feet 2 inches in height. He favored increasing the license tax on sight-seeing automobiles from $10 to $100 and wanted them kept off Fifth avenue and Broadway in the rush hours.

Two More Decisions for Prest-O-Lite

INDIANAPOLIS, IND., Feb. 8—That it is unlawful for anyone to refill a Prest-O-Lite tank, without first destroying its identity as a Prest-O-Lite tank by removing the name and trade-mark, has again been emphasized by the decision of the United States circuit court of appeals for the Eighth circuit in the case of The Prest-O-Lite Co. against Herman E. Heiden and Clark Howell, doing business as the Little Rock Headlight Co., Little Rock, Ark.

In passing upon this case last spring, the U. S. District Court for the eastern district of Arkansas held that it would be sufficient for the refiller to cover up the Prest-O-Lite trade-mark with a paper label. The decree of the U. S. District Court has been modified by the Circuit Court of Appeals so as to enjoin the defendants from "selling, exchanging or delivering such a tank so filled without completely and permanently obliterating and removing the trade-mark and other marks by letters or figures indicating that the tank is a Prest-O-Lite tank, and securely fastening to it a conspicuous notice that the tank is not filed with Prest-O-Lite gas."

This decision in the Eighth circuit is in line with the decision of the Circuit Courts of Appeals for the Sixth and Seventh circuits on the same proposition, the effect of which is to remove from the refilled tanks all wording by which the Prest-O-Lite Co. could be deemed responsible for the service given by such tanks, or for their repair and exchange when empty.

CINCINNATI, O., Feb. 8—The United States Circuit Court at Cincinnati has handed down a decision providing for an injunction and denying the petition for a rehearing in the case of the Presto-O-Lite Co. against Arthur C. Davis and Victor Gluchowesky, as Coughlin & Davis and Davis et al. The injunction order as amended restrains the defendants, Coughlin & Davis, from directly or indirectly refilling tanks of the Prest-O-Lite Co., from reusing them in any way without first replating or enameling the outside surface in such a way as to completely obliterate the trade-marks of the Prest-O-Lite Co. or without permanently plating or stamping on the outer surface notice that the tank has been refilled or recharged by the defendants or their agents.

H. O. Smith Files Voluntary Petition

INDIANAPOLIS, IND., Feb. 6—Harold O. Smith, president of the Premier Motor Mfg. Co., now in the hands of a receiver, today filed a voluntary petition in bankruptcy in the United States court in this city. He states that his liabilities are $142,319.54 and his assets $122,584.06 and he claims the statutory exemption of $600.

Of his liabilities, $80,982.17 represents creditors holding Premier first and second series of preferred and common stock, owned by him, as security. His assets include the following Premier stock, the amount being the par value: 301.5 shares common $30,150; 127 shares first series preferred stock $12,700 and 785.8 shares second series preferred stock $78,580.

Receiver Appointed for Twombly Corp.

NEW YORK CITY, Feb. 9—F. W. Stelle has been appointed receiver for the Twombly Car Corp., with the power to continue business or to close up any of the establishments of the company. The appointment was made on application of D. Stuart Dodge, president and financial backer of the company, who alleges he advanced $114,439 to provide funds for pay-rolls and other expenses. He is the largest creditor. Outside of his claim, which amounts to $468,238, the liabilities will not exceed $10,000, to about seventy creditors. The tangible assets, it is asserted, do not exceed $35,000, aside from the patents and interests in contracts with W. I. Twombly, the inventor, which are of uncertain value.

Mr. Dodge in the petition, filed in the U. S. district court, stated that he was the financial backer of the companies, which included the Twombly Power Co., Twombly Motors Co., Twombly Taxicab Co., Inc., and the Twombly Car Corp., all of 1790 Broadway, this city. He also stated that he had no security for the above amount of money, which he loaned to the companies, beyond their promissory notes.

It is expected that a new company will be reorganized with new capital.

More Tire Makers Revise List Prices

General Tendency Is Downward—Other Manufacturers Considering Change to Meet New Lists

NEW YORK CITY, Feb. 8—The tire situation is clarifying itself and in the process tire lists quite generally are touching new low levels. Since the Goodrich company announced its new list and the abolishment of percentage discounts in favor of established list prices to the user and net prices to the dealer, half a dozen other makers have revised lists and in practically every case the new figures are lower than the old ones.

In the majority of cases, manufacturers have not as yet made definite decision with regard to revisions though it is admitted that these are being considered. Among those who are considering this are Swinehart, Thermoid, Empire, which reports that it probably will meet the general reduction, and Lee.

The reductions which have been announced are substantial in every case, as is revealed by the accompanying table, and they apply not only to plain treads but to non-skid treads and to tubes as well. Although the reductions which have been made apply in nearly every case to all sizes, in at least one case a reduction has been made only in casings 4 inches in diameter and over, no change being made in tube prices. This is the Kelly-Springfield company, which has reduced 4-inch casings 10 per cent. and 4 1-2 and over casings 12 1-2 per cent. At the same time, an important readjustment of mileage guarantee has been made, which is best explained in the company's own words:

"We are going to allow our dealers and distributers to increase the adjustment feature on our tires to 6,000 miles on plain tread and to 7,000 on our Kant Slip tire, in the Ford sizes. We will adjust on a basis of 5,000 miles for all plain tread tires 4 inches and above; and 6,000 miles on the Kant Slip type."

The companies which have as yet made no announcement include: Batavia, Federal, Miller, Falls, Republic and some others.

Strouse Small Car for $325

DETROIT, MICH., Feb. 3—The S. R. K. Motor Co. has been organized to make the Strouse small cars. The capital stock of the new company will be $100,000, none of which will be offered to the public. The incorporators are C. E. Strouse, designer of the car, who is a professor and M.A.; F. T. Ranney, a real estate dealer, and T. D. Knight, a wealthy retired Chicago lawyer. The Strouse car has a four-cylinder block Hermann motor, 2 1-2 by 4, 100-inch wheelbase, tread either 42 or 56 inches, 28 by 3 inches front and rear tires, gearless transmission, and will sell for $325 with the small tread and for $350 with the standard tread.

Old and New Tire Prices Quoted by Makers Who Have Revised Lists

		30 x 3		32 x 3½		34 x 4		36 x 4½	
Make		Old	New	Old	New	Old	New	Old	New
Braender	Plain	$11.70	$9.00	$16.75	$13.35	$24.35	$19.40	$35.00	$27.35
	Non-skid	14.05	10.35	22.10	15.35	29.20	22.30	42.00	31.45
	Tube	2.80	2.35	3.70	2.80	4.90	4.00	6.45	5.20
Firestone	Plain	12.30	9.40	17.60	13.75	26.20	19.90	36.75	28.70
	Non-skid	14.60	10.55	21.20	15.40	30.50	23.30	41.90	32.15
	Tube	2.80	2.20	3.70	2.70	4.90	3.90	6.45	5.00
Fisk	Plain	12.30	9.00	17.65	13.35	25.65	19.40	36.85	27.35
	Non-skid	13.30	9.45	19.05	14.00	27.40	20.35	39.05	28.70
	Tube	2.95	2.35	3.90	2.80	5.15	4.00	6.80	5.20
U. S.	Plain	11.70	9.00	16.75	13.35	24.35	19.40	35.00	27.35
	Chain Tread	14.05	10.70	20.10	16.00	29.20	23.95	42.00	32.85
	Tube	2.80	1.85	3.70	2.80	4.90	4.00	6.45	5.20
Goodyear	Plain	11.70	9.35	16.75	13.95	24.35	20.35	35.00	28.70
	Non-skid	13.70	10.95	19.60	16.30	28.50	23.80	40.95	33.60
	Tube	2.50	2.35	3.70	2.80	4.90	4.00	6.45	5.20
Kelly-Springfield	Plain	15.20	15.20	21.20	21.20	30.50	27.45	39.77	35.80
	Non-skid	18.10	18.10	25.30	25.30	36.90	33.55	46.57	41.40
	Tube	3.20	3.20	4.40	4.40	5.65	5.65	7.50	7.50
Ajax	Plain	12.65	9.60	....	....	26.30	20.65	37.85	29.10
Pennsylvania	Plain	10.80	9.40	....	....	22.90	20.35	32.15	28.70
	Vacuum Cup	14.40	13.00	....	....	34.00	28.95	46.35	38.55

Duesenbergs Win Glendale Road Race

O'Donnell Covers 103-Mile Course at 47.9 M. P. H. —Callaghan a Close Second— Oldfield's Mechanic, Hill, Third in Chevrolet— Ball, Marmon, Fourth

Barney Oldfield acrobatically gives checkered flag to Eddie O'Donnell in finish at Glendale

GLENDALE, CAL., Feb. 3—Eddie O'Donnell on a Duesenberg, won the Glendale road race, staged here today under the auspices of the Glendale Lodge No. 1289 B. P. O. E. O'Donnell's time for the 103-mile course was 2:07:07, or 47.9 miles per hour, which is a slow average, but when the nature of the course is taken into consideration, the speed of the winning Duesenberg is not to be discredited.

Jack Callaghan, also on a Duesenberg, won second place. His time was 2:10:25, or 47.5 miles an hour.

George Hill, Barney Oldfield's mechanic, driving a Chevrolet, captured third place, covering the 103 miles in 2:11:19.

There were twelve entries. At the wire, Tom Alley on Duesenberg No. 2, broke an axle and failed to get away. Huntley Gordon on the Gordon Special burned his brakes out in the first few miles of the race and after seventeen laps of nerve-racking driving he retired. Harry Reynolds, driving an Isotta-Fraschini, skidded on a turn and running into the curb, bent a front axle and retired in the twelfth lap.

A. A. Cadwell went out with a broken water system in the forty-eighth lap.

The Duesenbergs jumped into the lead on the first lap and held first and second places throughout the race. Gaston Morris, on a Renault held third place for twenty-seven laps then dropped to the rear when he over-ran a turn and blew a tire, losing nine minutes.

Cadwell held third place for ten laps, going back when trouble first developed in the water system. Hill went into third place on the fortieth lap and held that position to the finish. He drove a conservative race and never stopped during the contest.

Guy Ball on a Marmon won fourth money and William Taylor on the veteran Alco, which has figured in practically every California race during the past 2 years, won fifth money. Taylor's Alco has finished in the money in every race it has started in with the exception of the last Los Angeles to Phoenix road race. In the Desert Classic, the Alco was wrecked when it skidded into a telephone pole near the start. The old car came back and won a place in the San Diego race, having been in the repair shop at the time of the Corona Classic.

Harry Reynolds on his Isotta-Fraschini skids into death curve

The length of the Glendale course is 1.9 miles, giving 53 laps to the race of 103 miles.

There were more than 16,000 spectators. Half the gate receipts went to the lodge for expenses and entertainment funds while the rest of the gate receipts went to the purse, which was cut into five prizes.

Chicago Speedway Purse $50,000

CHICAGO, ILL., Feb. 9—The Chicago Speedway management has announced a $50,000 purse for the first ten placed in the 500-mile race which is to be run on June 19. In addition $1,000 will be given to the leaders at 100, 200, 300 and 400 miles, making the total of the purse $54,000. First prize is $20,000.

Exposition Entries Near 30 Mark

LOS ANGELES, CAL., Feb. 4—Huntly Gordon, owner of the fast Gordon Special which figured at Corona and at San Diego, announced here tonight that he had mailed his entry blank to Chairman W. L. Hughson, entering both the Vanderbilt Cup and Grand Prix races. This will bring the number of entries up to an even twenty-seven.

Arthur Klein stated today that he had entered his King car and would ship the machine to San Francisco at once. Klein's entry will take the place of one of the Peugeots, it is claimed, to complete the entry list. The second Peugeot entered is still in Los Angeles and Dario Resta and Fred J. McCarthy, both of the Peugeot team, said today that on account of the failure of parts to arrive from Europe, the Peugeot No. 9 will not start in the San Francisco races, but will remain here and be put into condition for the Venice Grand Prix, March 17.

It is almost certain that there will be more than thirty cars entered at San Francisco. The third Duesenberg has been repaired and it has been announced here that Jack Callaghan will have the car in the San Francisco races.

With the announcement that Harry Grant has been signed by the Maxwell interests, comes the news that another Maxwell is to be entered as a special of some kind with Grant up.

Bob Burman returned to the coast yesterday and is still considered a likely entrant. Ralph De Palma reached Los Angeles today, and while he refused to commit himself, it is claimed by close

Start of Glendale road race staged by the Glendale lodge of Elks

friends that he returned to the Pacific Coast to compete in the Vanderbilt event and that also means that he is to be figured in the Grand Prix, barring accidents.

The number entered for the Vanderbilt Cup and Grand Prix events has reached twenty-seven, according to the official list given out today by W. L. Hughson, chairman of the exposition racing committee:

Car	Driver	Entrant
Stutz	Gil Anderson	Stutz Motor Car Co.
Stutz	Earl Cooper	Earl Cooper.
Stutz	Howard Wilcox	Stutz Motor Car Co.
Peugeot	Dario Resta	Peugeot Auto Import Co.
Mercer	Glover Ruckstell	Mercer Automobile Co.
Mercer	Eddie Pullen	Mercer Automobile Co.
Mercer	Louis Nikrent	Mercer Automobile Co.
Marmon	A. A. Cadwell	A. A. Cadwell.
Marmon	Wilbur D'Alene	Wilbur D'Alene.
Simplex	Louis Disbrow	Simplex Auto Co.
Chevrolet	Jack Le Cain	Chevrolet Motor Co.
Maxwell	Barney Oldfield	Maxwell Motor Sales Co
Maxwell	Wm. Carlson, Jr	Maxwell Motor Sales Co.
Maxwell	E. V. Rickenbacher	Maxwell Motor Sales Co.
Maxwell	Harry Grant	Maxwell Motor Sales C.
Duesenberg	Tom Alley	F. S. Duesenberg.
Duesenberg	Eddie O'Donnell	F. S. Duesenberg
Duesenberg	Callaghan	F. S. Duesenberg
Delage	C. R. Newhouse	W. E. Wilson.
Thala	Jack Gable	Frederick Robinson
King	Klein	Arthur Klein.
Edwards Special	Unannounced	J. Paulding Edwards.
Edwards Special	Unannounced	J. Paulding Edwards.
Californian	Caleb Bragg	George R. Bentel.
Bugatti	J. B. Marquis	J. B. Marquis.
Parsons Special	Jim Parsons	Jim Parsons.
Gordon Special	Unannounced	Huntly Gordon.

Resta to Drive for Peugeot

New York City, Feb. 6—Dario Resta, the racing driver, has signed a contract with the Peugeot Auto Import Co., of this city, to drive Peugeot cars in the Vanderbilt, Grand Prize and Indianapolis races this year. In the races on the coast Resta will probably drive a car with 100 millimeter bore and 180 millimeter stroke, in inches 3.93 by 7.08 giving a piston displacement of 341 cubic inches. For the Indianapolis 500-mile race he will use a car of the type driven by Duray, who finished second in this race last year. This has a motor 78 by 156 millimeters, or 3.07 by 6.14 inches, giving a piston displacement of 174 cubic inches. Both machines will be four-cylinder types. The Peugeot company will probably have two cars in the Indianapolis race.

Brooklyn to Hold Show March 2-9

Brooklyn, N. Y., Feb. 6—The Fourth annual show of the Brooklyn, (N. Y.) Motor Vehicle Dealers' Assn. is to be held March 2-9 in the 23d Regiment Armory. It is under the management of Chas. A. Stewart, Hotel Woodward, New York.

Lewis Brings Out Eight at $985

Detroit, Mich., Feb. 6—Believing this to be an eight-cylinder year, the Lewis Spring & Axle Co., Jackson, Mich., has just announced an eight-cylinder five-passenger car to sell at the record low figure for this type of machine of $985, equipped. The car is known as the Hollier eight, and special emphasis is placed upon the fact that it is not assembled but is manufactured complete in the Lewis factory.

Equipped with a 3 by 4 1-4 V-type motor with the two blocks of four cylinders set at 90 degrees to each other on an aluminum crankcase, the motor, in its general design, adheres to the recognized practice for engines of this class. Suspension is at three points. Specifications of the chassis include a cone clutch of 12-inch nominal diameter, three-speed gearset, combination motor-generator for cranking and lighting which is attached to the gearbox, floating rear axle with annular bearings, 40-inch cantilever rear springs, 112-inch wheelbase, standard tread (60-inch optional), and 32 by 3 1-2 tires on demountable rims. The equipment is in accordance with present-day requirements.

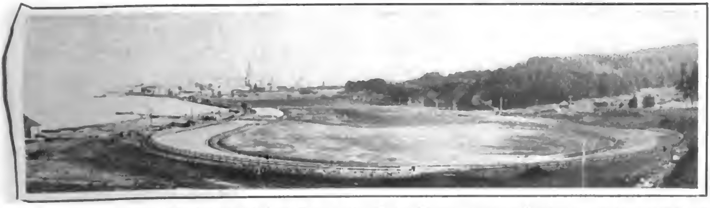
The Lewis concern has been working on this car for about 8 months, but has kept the fact a profound secret until the present time. Active manufacture and distribution of the Hollier is to begin at once, the company expecting to turn out 3,000 in the next year.

Jones Six Appears in Wichita

Wichita, Kan., Feb. 6—A new car announced here is the Jones six, made by the Jones Motor Car Co. The car is assembled from standard parts and the location of the factory in the heart of the Middle West is believed to provide advantages from a market viewpoint that would not be present if manufacturing were to be carried on further east. Advantages in the way of freight charges are urged for consumers in that territory as it is held that the knockdown parts can be brought to the West at a lower shipping cost than could the completed car.

The new car appears as a five passenger, six-cylinder touring car of 118-inch wheelbase at $1,150. The motor is built by the Lycoming Foundry & Machine Co., and has T-head cylinders, 3 3-8 by 4 3-8, three-bearing crankshaft, thermo-syphon cooling, Remy distributer ignition, combination splash and pressure oiling and Stromberg carbureter with vacuum fuel feed.

The clutch is a steel cone that provides its own spring action. The gearset is a four-speed selective type bolted directly to the motor, which is a part of the unit power plant. Final drive is through a single universal, inclosed in a torque tube. The drive taken through three-quarter elliptic springs, tires are 34 by 5, and equipment includes demountable rims with a spare on the rear. Body lines are smooth, and running boards unencumbered. Starting and lighting is provided by a Leece-Neville system, and such features as one-man top, electric horn, and so on, are supplied. The steering gear is the Warner worm and gear design, and the radiator is a compromise between the V-shape and the flat style.



Panorama showing west end of Vanderbilt and Grand Prize course at Panama-Pacific International Exhibition. Considerable progress has been made since the photograph was taken

Factory Miscellany

MOSLER Purchases Hodgman Plant—A. R. Mosler & Co., New York City, has purchased the large plant occupied formerly by the Hodgman Rubber Works, New York City. This addition measures 273 feet long and four stories high. The screw machine department will be set in the basement, while the next floor will be the stock room, tool room, shipping and receiving department. The next floor will be the offices and assembly department of spark plugs, and the top floor will also be assembly department and stock room. The company does not expect to be moved until some time in April or May.

Motokart's $50,000 Factory—Bids are being received for the construction of a 60 by 300-foot factory for the Motokart Co., Scranton, Pa., the estimated cost being $50,000.

To Enlarge Chandler Plant—The Chandler Motor Car Co., Cleveland, O., will begin construction of an addition to the present plant at once. The addition will be of brick, steel and concrete.

Neighbors Mfg. Electrical Specialties—Electrical specialties used in the automobile industry are to be built by R. C. Neighbors, formerly sales manager of the Hupp Motor Car Co. His headquarters will be at 100 Beaubien street, Detroit, Mich.

To Manufacture Magneto Parts—A. S. Hecht, doing business as Hecht's Magneto Exchange, New York City, has formed the Magneto Parts Co., Inc., to manufacture and distribute parts for all standard magnetos. Associated with Hecht is E. M. Lowe, secretary-treasurer of the new company.

Allis-Chalmers Adds—The Allis-Chalmers Mfg. Co., Milwaukee, Wis., is erecting a large addition at its main works in West Allis, Milwaukee County, to accommodate the transformer department, moved from the Bullock Works in Norwood, Cincinnati, O., to make room for the recently established electric starter-lighting system department.

To Mfr. Metal Specialties—G. N. Prentiss, an inventor, of Racine, Wis., is organizing a $25,000 corporation with the assistance of the Grand Rapids Merchants & Manufacturers' Assn., Grand Rapids, Wis., to manufacture a line of metal specialties, including a compact cook stove for motorists, gasoline and oil gauges, auxiliary seats and a number of light farm implements.

Grant Leases Buildings—The Grant Motor Co., Findlay, O., has leased the buildings formerly occupied by the Findlay Table Co., which will give them about 40,000 square feet of additional room. Automobiles will be finished at this place. It will also be the shipping point of the factory product. In a few weeks the company will begin to turn out fifty of its new sixes per day. A trainload will be sent to California.

To Mfr. Trucks and Automobiles—The Hub Motor Truck Co., Columbus, O., has been incorporated with a capital of $300,000 to manufacture and sell all kinds of automobiles. It is planned by the organizers to open a factory in Columbus for the manufacture of the Hub Motor trucks, basic patents for which are held by the Hub Motor Truck Co. of America, a New York corporation. The incorporators of the Columbus company are T. C. Haney, J. L. Herpich, J. B. Bass, R. Wilke and J. J. Chester. A truck is now being built by the Kaiser Motor Car Co.

The Automobile Calendar

Feb.	Portland, Ore., Show; Portland Auto Trade Assn.
Feb.	Battle Creek, Mich., Show, Rathbun & Kraft Bldg.
Feb.	Toledo, O., Show, Toledo Auto Show Co.
Feb. 8-13	Salem, Mass., Show, North Street Skating Rink, C. O'Shea.
Feb. 8-13	Toledo, O., Show, Terminal Bldg., Toledo Auto Shows Co., H. W. Blevins.
Feb. 8-14	Kansas City, Mo., Show.
Feb. 8-14	Troy, N. Y., Show, Troy Auto. Dealers' Assn.
Feb. 8-15	Wilmington, Del., Show, Hotel duPont.
Feb. 9-12	Eau Claire, Wis., Eau Claire Auto Dealers' Assn.
Feb. 9-12	Peoria, Ill., Show, Peoria Auto & Motor Cycle Dealers.
Feb. 10-13	Davenport, Ia., Show.
Feb. 15	Fort Wayne, Ind., Show, Fort Wayne Auto Trade Assn.
Feb. 15	Tacoma, Wash., Show, Glide Rink.
Feb. 15-20	Grand Rapids, Mich., Show, Klingman Furniture Exposition Bldg., Grand Rapids *Herald;* C. L. Merriman.
Feb. 15-20	Omaha, Neb., Show, Auditorium, C. G. Powell
Feb. 15-20	Bridgeport, Conn., Show, State Armory; B. B. Sterber.
Feb 16-18	Bloomington, Ill., Show, Deere Bldg.
Feb. 17-20	York, Pa., Show, Coliseum.
Feb. 18-20	Racine, Wis., Show, Lakeside Auditorium, Racine Auto Show Assn.
Feb. 22	Newark, N. J., Light Car Club of N. J., Hillclimb at Teaneck.
Feb. 22	San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Feb. 22-25	Allentown, Pa., Show.
Feb. 22-27	Duluth, Minn., Show, Auditorium.
Feb. 22-27	New Haven, Conn., Show, Second Regiment Armory; W. N. Lindsay.
Feb. 22-28	South Bethlehem, Pa., Show, Coliseum; J. L. Elliott.
Feb. 23-27	York, Pa., Show, Coliseum Hall.
Feb. 23-27	Syracuse, N. Y., Show, Armory, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27	Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 24-27	Freeport, Ill., Show, Freeport Automobile Show Co.
Feb. 25	New York City, S. A. E., Metropolitan Sec. Meeting; Report of Research Committee on Kerosene Carbureters. Research Com. Report on Non-Electric Continuous-Torque Transmission.
Feb. 27	San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 1-5	Wilkesbarre, Pa., Show, Vehicle Trades Assn.
Mar.	Benton Harbor, Mich., Show, St. Joseph and Benton Harbor, St. Joseph Garage, St. Joseph.
Mar.	Charlotte, Mich., Show.
Mar. 2-9	Brooklyn, N. Y., Show, Motor Dealers' Assn., 23rd Regiment Armory.
Mar 3	Albany, N. Y., Associated Garages of America, General Convention.
Mar. 3-4-5-6	St. Joseph, Mich., Show, St. Joseph Auto Co. Bldg.
Mar. 4-6	Springfield, Mass., Show; J. H. Graham.
Mar. 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13	New York City, Made in the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13	Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13	Canton, O., Show, Auditorium, Stark Co. Auto Show and Electrical Exposition.
Mar. 8-13	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 8-13	Utica, N. Y., Utica Automobile Trade Assn.
Mar. 13-20	Harrisburg, Pa., Show Arena, Harrisburg Dealers' Assn.
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
Mar. 22-27	Bangor, Me., Show, Bangor Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
Apr. 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., Two-mile Track Meet.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
June 25	Sioux City, Ia., Track Meet.
July 4-5	Tacoma, Wash., Road Race.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

SPENCER Resigns from Autocar—C. H. Spencer has tendered his resignation as advertising manager of the Autocar Co., Ardmore, Ps., having been with that concern for about 6 years' time. He will undertake a program of work which will include writing on the subject of motor trucks and the opening of an advertising service office in the Land Title Bldg. of Philadelphia.

Williams Goodyear Mgr.—C. H. Williams is manager of the Portland (Ore.) branch of the Goodyear Tire & Rubber Co.

Hunt Dunlop's Montreal Mgr.—M. J. Hunt has been appointed manager of the Montreal (Que.) branch of the Dunlop Tire Co.

Shick Cleveland Goodyear Mgr.—E. G. Shick has been appointed manager of the Cleveland (O.) Goodyear tire branch, succeeding L. L. First.

Derrickson McQuay-Norris Rep.—C. L. Derrickson has been appointed general representative of the McQuay-Norris Mfg. Co., St. Louis, Mo.

Beall Promoted—F. F. Beall, who has been factory manager of the Packard Motor Car Co., Detroit, Mich., has been promoted vice-president in charge of manufacturing.

Williams Succeeds Hartman—W. S. Williams has been appointed manager of the Dallas (Tex.) branch of the Studebaker Corp. in place of C. W. Hartman, who has resigned.

Wright Mgr.—F. J. Wright, formerly with the Wright Motor Car Co., Memphis, Tenn., has taken the management of the electric department of the H. A. White Auto Co., that city.

Findeisen Sales Mgr.—C. W. Findeisen has been appointed general sales manager of Findeisen & Kropf, Chicago, Ill. For the last 4 years he has been in active charge of the factory sales.

Gilbert Mgr.—The Oregon Motor Car Co. has secured the services of Steve Gilbert as manager of the commercial car department, agent for the Signal line of trucks for Portland, Ore., and vicinity.

Splitdorf Man Gets New Post—E. A. Kelley, long branch manager in Chicago, Ill., for the Splitdorf Electrical Co., has been transferred to Detroit, where he will be the special representative for the Apple Electric Co.

Anderson Dayton Rubber Mgr.—W. E. Anderson has been appointed district manager of the Dayton Rubber Mfg. Co., Dayton, O. His headquarters are 2011 Michigan avenue, Chicago, the new branch in that city.

Girard Joins Reo Agency—F. J. Girard, formerly manager of the Columbus (O.) branch of the Peerless Motor Car Co., has resigned and become financially interested in the Capital Motor Car Co., Columbus agent for the Reo.

Wildhack Oldsmobile Agent—G. O. Wildhack, formerly manager of the Indianapolis (Ind.) branch of the Oakland Motor Car Co., is now owner of the Wildhack Co., which has secured the agency for the Oldsmobile cars.

Morton Sails for London—R. L. Morton, of the Morton Truck & Tractor Co., Harrisburg, Pa., sailed February 3 on the liner "Adriatic" for London, England, where he will represent his company in securing contracts for the allied armies.

Marks N. Y. Olds Mgr.—S. A. Marks, Jr., has been appointed manager of the Oldsmobile Co., of New York. He will assume his new duties immediately upon the opening of the new salesrooms of the company at 1800 Broadway, New York City.

Seidel Succeeds Hill—G. E. Seidel, president of the Pilot Motor Car Co., Richmond, Ind., has succeeded to the duties of treasurer and general manager formerly performed by T. H. Hill, who has severed his connection with the company.

Winsor and Clarke Mgrs. Detroit Office—S. A. Winsor and W. J. Clarke are managers of the offices which have been opened at 965 Woodward avenue, Detroit, Mich., by the Spencer Smith Machine Co., manufacturer of automobile pistons in Howell, Mich.

Adds to Sales Staff—The Dimond-Apperson Motor Co., New York City, distributer of the Apperson car, has engaged T. F. Skelly to look after its wholesale business. Mr. Skelly has been with the Apperson company at Des Moines, Ia., for the last 5 years.

Nadjer Cotta's Detroit Representative—The Cotta Transmission Co., Rockford, Ill., manufacturers of automobile transmissions, has appointed K. W. Nadjer, a consulting automobile engineer, as its Detroit representative. He will have his offices in the Chamber of Commerce Building.

Grant in New Rôle—G. B. Grant, until recently superintendent of agencies of the Oakland Motor Co., has become a member of the Pittsburgh Apperson Co., Pittsburgh, Pa., and will have supervision and appoint agents in western Pennsylvania, eastern Ohio. western Virginia and part of western Maryland.

Veal Joins Saxon Agency—S. H. Veal, formerly secretary and general manager of the Cleveland Motor Car Co., and late secretary of the Colt-Stratton Co., Eastern distributors for Cole, has joined the forces of the Saxon Motor Car Co. as traveling representative for New Jersey, with headquarters at 278 Halsey street, Newark, N. J., where the Essex County agency and the New Jersey service station of the Saxon will be located.

Nelson Organizes New Co.—G. V. Nelson, former advertising manager and second vice-president of the Auto Parts Co., Chicago, Ill., will organize a new company along the same lines in Kansas City, Mo., to be known as the K. C. Auto Parts Co., of which he will be president and general manager. This new concern will occupy a two-story and basement building at 1827 McGee street. where a complete line of automobile accessories and parts will be carried.

Garage and Dealers' Field

Chandler Adopts New Sales Plan—The increasing business has made it necessary for the Chandler Motor Car Co., Cleveland, O., to add more men to its sales department force. The sales territory has been divided into two sections, each with an assistant sales manager at its head. W. G. Clay has been appointed in charge of the Eastern district and Sid Black in charge of the central district. F. G. W. Sudrow, formerly sales manager of the Marion Motor Car Co., and Benjamin Rennard have been appointed special factory representatives of the company.

J. I. C.'s New Innovation—The J. I. Case T. M. Co., Racine, Wis., manufacturer of farm implements and machinery and motor vehicles, has made an innovation by establishing a wholesale and retail store, service station and display room for all products near the downtown works in Racine. Recently the Case company took over the plant of the former Fish Bros. Wagon Co., Racine, and has remodeled the first floor of the State street frontage into a store where all Case products, from threshing machines to motor cars, will be exhibited and sold. The station is in charge of A. J. Kellam, who has been for 3 years manager of the Case automobile branch at Little Rock, Ark.

Philadelphia Cos. Move—The Overland Motor Co. has removed from 132 North Broad street, Philadelphia, Pa., to the northeast corner of Broad and Wood streets. The former home of the Bergdoll Taxicab Co., in the rear, has also been added to the new quarters, giving the company approximately 55,000 square feet of floor space in its new location. Harry Greenwood is the general manager and treasurer; R. P. Greenwood, sales manager, and Judson Sprankle, president of the company. The Johnson Motor Car Co., distributer of the Haynes and Saxon cars, has vacated 326 North Broad street and removed to the new sales and service building, 132-134 North Broad street.

Big Oakland Deal in Cleveland—One of the largest deals consummated in Cleveland automobile circles in recent years is that concluded by the Oakland Motor Co., in transferring the business of the Cleveland and Pittsburgh branches to a new local organization to be known as the Adams-Oakland Co., with H. M. Adams as vice-president and general manager. The transaction involves approximately one-half million dollars, automobile men are given to understand, and includes the territory of both branches, nearly all of the counties in Pennsylvania and Ohio. H. M. Adams has for years been connected with the White and Peerless companies. Fred C. Wood, formerly branch manager, though no longer directly connected with the new organization, does not sever his connection with the parent concern. Salesrooms will continue at Euclid avenue and East Nineteenth street, Cleveland. Mr. Adams has already assumed office in charge of the branches.

Automobile Agencies Recently Established

PASSENGER CARS

Connecticut

Hartford	Monarch	Hartford Garage Co.
Hartford	Moon	Kingsbury & Wetherall
Hartford	Allen	J. M. McDonald Co.
Hartford	Dodge Bros	Charter Oak Motor Car Co.
Hartford	Hupmobile	Charter Oak Motor Car Co.
New Britain	Dodge Bros	W. J. Morrin
New Britain	Briscoe	W. J. Morrin
Stamford	Moon	H. Hendrie
Wethersfield	Allen	J. M. McDonald Co.

District Columbia

Washington	Hupmobile	Burger Motor Co.
Washington	Jeffery	Combs-Howard

Florida

Jacksonville	Dodge Bros	Sinkler Auto Co

Georgia

Atlanta	Saxon	G. W. Hanson

Idaho

Twin Falls	Moon	Smith & Spafford

Illinois

Aurora	Regal	W. S. Miller
Bloomington	Haynes	Dan Sullivan
Bloomington	Regal	L. I. Gilmore
Casey	Westcott	Westcott Motor Sales Co.
Chadwick	Regal	George Etnyre
Champaign	Herff-Brooks	E. E. Burton
Chicago	Detroiter	The Farrington Motor Co.
Fairbury	Regal	H. M. Sutton
Hamilton	Regal	F. C. Kopsicker
Homer	Regal	J. G. Davidson
Huntley	Regal	F. A. Weltzien
Joliet	Regal	Joliet Motor Co.
Kankakee	Regal	E. A. Jeffers
Lacon	Haynes	J. R. Balsley & Son
Long Creek	Regal	Hayden Veatch
Maron	Regal	T. E. Kelly
Mendota	Oldsmobile	A. J. Austin
Monmouth	Regal	C. M. Barnum
Peru	Regal	Branner Fdry. & Mch. Co.
Quincy	Moon	J. W. Meyer & Son
Shermerville	Regal	E. Landwehr
Smithshire	Regal	F. R. Gunn
Sycamore	Regal	James Shaw
Tolono	Haynes	Guy E. Duell
Tremont	Regal	F. E. O'Brien
Wenona	Oldsmobile	Robinson Motor Car Co.
Woodhull	Regal	Union Sales Co.

Indiana

Delphi	Haynes	R. C. Julien
Ft. Wayne	Westcott	D. H. Harris
Greensburg	Haynes	H. P. Overleese
Hartford City	Westcott	A. W. Tindall
Indianapolis	Monarch	E. M. Holmes
Indianapolis	Stutz	Conduit Automobile Co.
Marion	Saxon	H. V. Smith
Sullivan	Haynes	E. E. Russell
Terre Haute	Haynes	J. G. Matheny
Wabash	Oldsmobile	J. W. Bloomer

Iowa

Ainsworth	Oldsmobile	Marr Hdwe. Co.
Bennett	Oldsmobile	Harding & Trotter
Bode	Regal	Kenseth & Ries
Buffalo Center	Glide	Clark Brothers
Burlington	Regal	Sheagren Hunt Co.
Clear Lake	Oldsmobile	Scott & Leonard Auto Co.
Creston	Regal	J. F. Russell
Davenport	Oldsmobile	C. F. Zoeckler
Eagle Grove	Regal	Wm. Fletcher
Fort Dodge	Chandler	Hanson & Tyler
Granger	Oldsmobile	Fred L. Anderson
Grinnell	Glide	J. E. Alexander
Grundy Center	Oldsmobile	A. C. Shafer
Hastings	Haynes	Sandiland & Parker
Hudson	Oldsmobile	Ray McDowell
Lake Park	Franklin	H. C. Meyer
Lanyon	Kissel	G. T. Peterson
LeMars	Glide	Ernsterhoff Auto Co.
Marshalltown and Eldora	Regal	H. W. Emeny Auto Co.
Mason City	Moon	Harris Auto. Co.
Merango	Haynes	Jos. Mulhern
Mt. Pleasant	Moon	V. E. Bellinger
Minburn	Regal	S. D. A. Guernsey
Moville	Haynes	E. E. Fiegan
Nevada	Haynes	Central Iowa Garage
New Providence	Haynes	W. L. Thornton
Newton	Oldsmobile	C. S. Weston & Co.
Newton	Regal	Woody Auto Co
Osceola	Herff-Brooks	Keeran & Collins
Perry	Haynes	Wilson Auto Co.
Redfield	Haynes	Redfield Auto Supply Co.
Sabula	Herff-Brooks	E. L. Smith
Sioux City	Haynes	Wyckoff Auto & Supply Co.
Story City	Oldsmobile	Story City Auto Co.
Tiffin	Herff-Brooks	August Amish
Tripoli	Oldsmobile	Arneman Auto Co.
Van Meter	Oldsmobile	England Auto Co.
Villisca	Haynes	H. C. Evans
Vinton	Haynes	O. C. Prescott
Washington	Oldsmobile	Donaldson & Benn
Wilton	Herff-Brooks	F. Schweitzbreger & Son
Yale	Regal	N. M. Caple

Kentucky

Campbellsville	Studebaker	Buchanan-Lyons Co.
Elizabethtown	Studebaker	A. H. Douglas
Glasgow	Studebaker	Glasgow Motor Car Co.
Hodgensville	Studebaker	D. G. Hays
Lebanon	Studebaker	T. M. Estes
Lexington	Haynes	Commercial Auto Co.
Louisville	Maxwell	Monarch Auto Co.
Louisville	Ohio Electric	Electric Garage Co.
Louisville	Milburn Electric	Electric Garage Co.
Louisville	Allen	Kenton Motors Co.
Louisville	Lewis	Kenton Motors Co.
Louisville	Detroiter	Co-operative Motor Car Co.
Munfordsville	Studebaker	C. A. Dawson
Pleasureville	Studebaker	Riner & Wood
Shelbyville	Studebaker	E. R. Wilson
Springfield	Studebaker	McClure & Mays

Kansas

Cawker City	Oldsmobile	J. F. Meyer
Great Bend	Moon	Great Bend Hdwe & Imp. Co.
Hutchinson	Haynes	Painter & Olphant
Kingman	Studebaker	Grant & Oakes
Kingman	Overland	Grant & Oakes
Larned	Haynes	H. T. Taylor & Son
Liberal	Moon	W. G. Woods
Macksville	Oldsmobile	R. W. Welch
Rexford	Moon	Fred Masher & Sons
Russell	Chandler	H. A. Fink
Salina	Haynes	C. W. Tibley
Scranton	Moon	Sappenfield & Co.
Topeka	Chandler	Independence Auto Co.
Topeka	Oldsmobile	Kansas Motor Car Co.
Wichita	Moon	H. W. Schroeder

Massachusetts

Boston	Detroiter	Reed-Crockett Co.
Boston	Briggs-Detroiter	Reed-Crockett Co.
Boston	Crow	A. P. Sackley
Boston	Coey	E. P. Blake
Brockton	Westcott	Marble Auto Co.
Brockton	Buick	White Auto Co.
Concord	Ford	Torrey & Viaile
Haverhill	Paige	Hayden Brown
Haverhill	Studebaker	Ellison Motor Supply Co.
Lynn	Reo	John J. Hinn
Malden	Haynes	Malden Center Garage
Millers Falls	Oldsmobile	A. H. Sawyer
New Bedford	Kissel	B. A. Vance
North Adams	Ford	Van Sleet Motor Co.
Somerville	Ford	Hill-Michie Co.
Worcester	Paige	J. V. Ekberg
Worcester	Hupmobile	J. W. Grady Co.

Maine

Augusta	Oldsmobile	Fiffield Bros. Co.
Bangor	Oldsmobile	A. L. Towle
Caribou	Oldsmobile	W. L. Collins
Lake View	Oldsmobile	A. E. Rome
Oakland	Oldsmobile	C. R. Blaisdell
Port Fairfield	Chandler	Bishop & Doran
Portland	Studebaker	Studebaker Corp.
Portland	Chandler	Leighton, Durrah & Griffin
Portland	Oldsmobile	D. E. McCann
Saco	Chandler	H. A. Harris

Michigan

Adrian	Ford	Johnson & Mitchell
Allegan	Dodge Bros	W. W. Vosburgh
Azalia	Haynes	A. J. Howe
Battle Creek	Haynes	L. S. Knowles
Bellevue	Ford	F. Clark
Charlotte	Ford	Barber Brothers
Charlotte	Overland	Barber Brothers
Grand Rapids	Franklin	Security Auto Sales Co.
Grand Rapids	Saxon	Grand Rapids Saxon Co.
Grand Rapids	Metz	Metz Garage
Greenville	Dodge	John & M. Christensen
Holland	Studebaker	M. Barnum
Kalamazoo	King	W. O. Harlow
Ionia	Monroe	R. H. Van Vleck
Ionia	Hudson	Eugene Kerstetter
Ionia	Studebaker	Eugene Kerstetter
Ionia	Oldsmobile	Eugene Kerstetter
Ishpeming	Overland	E. R. Nelson
Lainsburg	Oldsmobile	E. E. Leland
Lebanon	Franklin	N. A. Meyers
Lebanon	Studebaker	N. A. Meyers
Lebanon	Chalmers	N. A. Meyers
Ludington	Haynes	J. H. Cornelly
Monroe	Reo	C. A. O'Lone
Mt. Pleasant	Ford	F. H. Johnson
Mt. Pleasant	Ford	O. L. Kigar
Mt. Pleasant	Dodge	Standard Garage
Muir	Paige	Sykes & Dilley
Ovid	Ford	G. F. Smith
Port Huron	Maxwell	Wm. Varkell
Sandusky	Dodge Bros	Woolman & Ferguson
St. Johns	Maxwell	The Moss Garage
St. Johns	Studebaker	The Moss Garage
St. Johns	Ford	G. F. Smith & Son
Sheboygan	Studebaker	Sheboygan Auto Sales Co.

Minnesota

Marshall	Haynes	M. F. Thomas
Minneapolis	Remington	G. L. Moore

Missouri

Green City	Oldsmobile	J. D. Bohrer
Glasgow	Oldsmobile	E. Ballew
Kansas City	Pullman	I. D. McGrew
Kansas City	Cole	Myers-Eberaole
Kansas City	Westcott	Kansas City Auburn Auto Co.
Kansas City	Velie	Velie-Thorp Motor Co.
Kansas City	Pullman	I. D. McGrew
King City	Haynes	Leith & Croon
St. Joseph	Chandler	Leslie Motor Car Co.
St. Louis	Kissel	Colonial Motor Car Co.
St. Louis	Milburn	Cartwright Motor Car Co.
St. Louis	Pullman	Ideal Motor Co.
St. Louis	Cole	Cole-Arbogast Auto Co.
St. Louis	Metz	Deluxe Automobile Co.
Washington	Moon	C. A. Krumsick

Montana

Helena	Oldsmobile	T. C. Power Co.
Missoula	Oldsmobile	Tumulia & Bleier Auto Co.
Sidney	Oldsmobile	J. A. Barrett

Nebraska

Omaha	Paige	Murphy-O'Brien Co.
Palmer	Haynes	John Kruse

Nevada

Tonopah	Oldsmobile	H. H. Bacon

New Hampshire

Conway	Haynes	W. F. Chapman
Wilton	Oldsmobile	F. W. Clark

New Jersey

Bloomfield	Regal	Central Motor Car Co.
Closter	Regal	Costner & Brown
Elizabeth	Regal	Elizabeth Auto Co.
Red Bank	Kissel	E. von Kattengell
Summit	Oldsmobile	F. A. Wahl
Washington	Regal	Eckle's Garage

New Mexico

Albuquerque	Glide	F. F. Trotter
Deming	Chandler	Case & McKinley

New York

Binghamton	Moon	S. & O. Motor Co.
Bloomingburg	Kissel	Clapman & Hagan
Brooklyn	Regal	Woods Garage & Sales Co.
Brushton	Regal	B. F. Harris
Buffalo	Kissel	B. F. Milson
Buffalo	Saxon	Poppenburg Motor Car Co.
Buffalo	Moon	Hurd-Landschaft Motor Car Co.
Clifton Springs	Franklin	C. L. Bailey
Dundee	Haynes	Earnest & Co.
Elmira	Franklin	F. M. Jones
Harleyville	Haynes	W. J. Prince & Son
Ithaca	Haynes	J. P. Lang Engine & Garage Co.
Ithaca	Oldsmobile	E. J. Trapp
Kingston	Moon	Stryker & Youmans
Maugatuck	Regal	L. A. Dibble
New York	Enger	Mutual Motor Sales Co
New York	Regal	Webster-Macgowan, Inc.
New York	Herff-Brooks	Diamond-Warren Motor Co.
Potsdam	Oldsmobile	G. P. Lyman
Rochester	Moon	W. M. Kipp
Rome	Oldsmobile	R. C. Laigai
Schenectady	Regal	Mabey & Maloney
Schenectady	Hudson	Stratton-Rose Co.
Schenectady	Oldsmobile	C. C. Kenoe
Troy	Hudson	Listman-Stratton Co.
Walden	Regal	J. R. Walker
Watkins	Haynes	Watkins Garage
Waverly	Moon	State Line Motor Co.

North Dakota

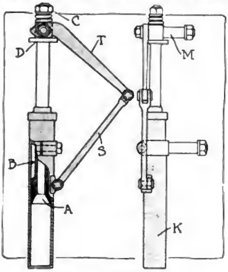
Bowbells	Oldsmobile	Heath & Drinkwater
Clio	Haynes	F. G. Covington Auto Co.
Dickinson	Franklin	Dickinson Motor Car Co
Fargo	Studebaker	King & Dahl

Ohio

Ada	Franklin	Stemple & Smith
Akron	Haynes	J. J. Stickles
Ashtabula	Oldsmobile	Windermere-Euclid Garage Co.
Athens	Regal	J. S. McCarter
Bowling Green	Westcott	C. C. Richardson
Bucyrus	Empire	S. Hirtz & J. M. Smith
Bucyrus	Ford	A. L. Holloway
Camden	Regal	Crauder & Pugh
Canton	Haynes	The Canton Haynes Co.
Canton	Overland	Canton Motor Car Co.
Carey	Oldsmobile	Black & Black
Christiansburg	Regal	Bright & Neal
Cincinnati	Briscoe	Citizens Motor Car Co.
Cincinnati	Maxwell	The Kruse Motor Car Co.
Cincinnati	Reo	Herold Motor Car Co.
Cincinnati	Grant	Eureka Auto Co.
Cincinnati	Princess	Hunter-Dammel Co.
Cincinnati	Franklin	The Franklin Motor Car Co.
Cincinnati	Allen	Kenton Motors Co.
Cincinnati	Lewis	Kenton Motors Co.
Cincinnati	Studebaker	The Imperial Motor Car Co.
Cincinnati	Pullman	Pullman Motor Car Co.
Circleville	Hupmobile	G. L. Schlear
Circleville	Cadillac	G. L. Schiear
Circleville	Oldsmobile	Noecker & Brehmen
Cleveland	Princess	Albaugh Motor Sales Co
Cleveland	Chalmers	J. H. Greenwald
Cleveland	Allen	Stark Auto Co., Inc.
Cleveland	Oakland	Oakland Motor Co.
Cleveland	Oldsmobile	Windemere-Euclid
Cleveland	Pullman	M. D. Coate
Cleveland	Detroiter	M. D. Coate
Cleveland	Studebaker	A. R. Davis
Cleveland	Allen	The Stark Motor Car Co.
Cleveland	Kisselkar	Brandt Motor Car Co.
Cleveland	Hupmobile	The Cleveland Motor Sales Co.
Columbus	Milburn Electric	The Standard Motor Car Co.
Columbus	Jeffery	Capital Motor Car Co
Columbus	Monarch	Monarch Motor Sales Co.
Columbus	Kissel	C. G. McCune
Columbus	Argo	Auto Inn & Exchange
Coshocton	Saxon	G. J. Beck & Son
Coshocton	Oldsmobile	E. F. Conrad
Coshocton	Haynes	The Fifth St. Garage

ACCESSORIES

NACO Shock Absorber—Theoretically a shock absorber ought to offer increasing resistance with the increase in movement of the spring to which it is attached. For small deflections the car springs ought to be satisfactory, and the function of the absorber is to resist extra violent motion, by adding to the natural frictional resistance of the leaves of the main spring. One of the most recent attempts to produce a shock absorber that offers growing resistance as deflection increases is the Naco illustrated here. Not only is the absorber extremely simple, but it should be light in weight and moderately inexpensive to manufacture. It is easy to adjust and any wear that may take place can be compensated for without affecting the range of working to the slightest degree. The friction is supplied by a piston sliding in a cylinder, and the ingenuity of the device lies in the means adopted to vary the amount of friction in accordance with degree of movement. To this end the piston is split in two halves, being cut in two vertically, and it is coned out inside so as to present a bell mouth whichever end is uppermost. A rod with a conical end passes through the piston, shown at A, and there is a tube B, with another conical extremity that rests in the top of the piston. The rod is carried up to the nut C, and the tube ends at the collar D. The cylinder K is attached to the axle and the bracket M to the frame of the car. Deflection of the main spring causes the cylinder to slide up the piston but this lifts the arm S, and since this arm is pinned to the other arm T, the latter is also lifted. Now, the end of T is a cam which lies between the nut C, and the collar D, so that lifting T turns the cam and forces apart C, and D. This separates the upper ends of the tube and the piston rod causing their respective coned ends to be forced nearer together inside the split piston, so expanding it and pressing it hard against the cylinder walls thereby increasing the friction. Adjustment is made by turning nut C, which puts more pressure on the coil spring beneath.—National Appliance Co., Grinnell, Ia.

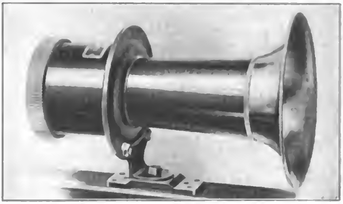


Naco shock absorber

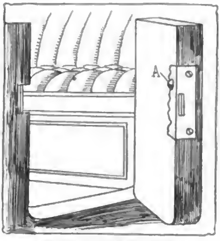
Positive Steam Tube Vulcanizer—The manufacturers will place on the market shortly an improved portable steam tube vulcanizer, designed exclusively for repairing inner tubes. The new Positive repairs any hole in one operation and makes larger repairs by resetting the vulcanizer. It will repair automobile, bicycle, cyclecar and motorcycle tubes.

The Positive has a water compartment between the tube and fuel compartments which controls the heat and insures perfect repairs, eliminating all danger of burning, overcuring or undercuring. It is portable, so can be carried in a tool kit of a car. It sets on the running board, fender or bench or can be fastened by means of a wood screw that comes with the outfit to a post wherever convenient. It is automatic in its operation, repairs a tube in 12 minutes' time and extinguishes itself after the work is completed.

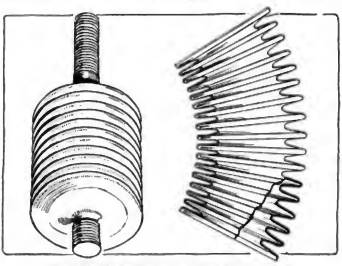
The Positive is packed in a neat box with complete vulcanizing outfit consisting of a measuring cup, screw, sand-paper, scissors and enough tube repair stock. Sold under a money back guarantee.—Positive Supply Co., Davenport, Ia.


Boyce hand horn

Thermostatic Controller for Water Circulation—The accompanying sketch shows the construction of the expansible part of the water circulation controller employed on the new Cadillac. An ordinary barometer contains a flat box of spring steel which has its top and bottom corrugated in a series of rings, and sealed inside is a small quantity of air that expands or contracts with each change in the atmospheric pressure. This lifts or withdraws the top of the box and so operates the pointer mechanism. The thermostat works on somewhat the same principle, only the action of heat upon a small quantity of sealed air is used to cause the expansion. In order to utilize the expansion of air to control a valve a corrugated box is used, but of a different type to that in the aneroid barometer, as it consists of a copper tube with thin walls on which a number of hollow flanges are raised by a spinning or pressing process. The left view shows the sealed box with its solid ends for attaching to the valve and the right the corrugated tube pulled out to show form.—Fulton Co., Knoxville, Tenn.



Button operated door lock

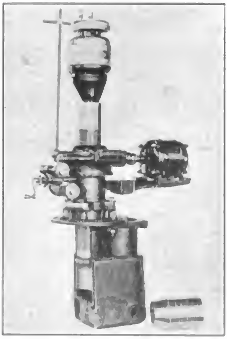

Thermostatic controller for water circulation

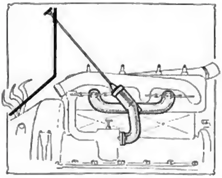
Push-Button Door Lock—The See-Rite is a door latch operated by a push button on the top edge of the door, this being the only part visible when the door is closed. When the thumb or finger presses the button below the level of the top of door, the bolt is withdrawn and the door can be opened. When in the withdrawn position the bolt is locked back by a small spring plunger shown at A, and when the door is closed again it is the contact of this plunger with the strike plate that releases the bolt. It is stated that only a slight pressure is needed so the door need not be slammed but can be closed quite gently. The device has claims to notice because it is impossible to beat for neat appearance, it is safe, since there are no projections to catch in garments or rugs, while the fitting should be easier than usual.—Searight Mfg. Co., Detroit, Mich.

An Unpickable Lock—The Jones Autolock for Ford cars is of a type that defeats the most expert lock picker, since not only is the lock controlled by a combination of right and left turns of a knob, which could not possibly be hit upon by accident, but the mechanism is enclosed so that a whole battery of spanners and cutting tools cannot suffice to free it. The device is supplied made integral with an aluminum manifold of Ford type, to which the carbureter is bolted in the ordinary way, and which is bolted to the cylinders in place of the old manifold. Opening off the manifold is a short passage containing the lock and a plunger which can be dropped across the intake passage so as absolutely to close it. It is only by knowing the lock combination that the plug can be withdrawn, so the only way in which a thief could get away with the car would be to fit a complete new intake manifold. As shown in the sketch, the control is carried up through the dashboard and ends there in a neat, plated thumb nut.—Jones Auto Lock Co., Tacoma, Wash.

Portable Grinder—This is a cylinder grinder intended for repair shop use, being easily set to regrind cylinders of any bore customary in automobile practice. The machine is designed for direct attachment to the cylinder upon which it has to operate and the process is automatic once it has been started. The main frame of the tool that is bolted to the cylinder carries a big bar inside which the grinding wheel spindle revolves, the latter being driven by a one-sixth-horsepower motor. For the feed the main bar is threaded, and is caused to rotate and descend simultaneously by means of a train of worm gearing driven by a second electric motor of one-tenth horsepower. It is stated that the current from a lighting socket is sufficient to operate both motors. Judging by appearance, the tool should find a wide field of use awaiting it.—Boxhill & Bruel, Cincinnati, O.

Twist-of-Wrist Horn—A mechanical warning signal with a new method of operation is shown in the illustration herewith. Instead of providing a handle to be turned, or a button to be pushed down the rear end revolves, and has its periphery knurled so as to afford a grip. It is thus much the same as the rotating handle type, only with a simpler exterior. It is stated that a movement of so little as 1 inch, circumferentially, is sufficient to produce a loud note and it does not matter in which direction the motion is made.—The Boyce Co., 1790 Broadway, New York City.


Portable cylinder grinder


Ford Autolock

New Solar bracket

Swiveling Bracket—A Solar novelty is a swiveling bracket mounting for an electric headlight which can be swung in both a vertical and horizontal direction. As can be seen from the illustration, the device is very neat in appearance and it should also be light in weight. The 1915 Solar catalogue contains descriptions of many different styles of lamps and has also a page or two devoted to the principles of headlight design which make interesting reading.—Badger Brass Mfg. Co., Kenosha, Wis.

Imperial Welding Outfits—The Imperial Brass Mfg. Co. are the manufacturers of a line of oxy-acetylene welding outfits. Five types are offered, four being unmounted and one fitted to a platform truck. All come equipped with suitable torches and a number of special tips, high-pressure hose and clamps, regulators and all the accessories, such as goggles and wrenches. Besides the welding line, the concern is showing oxygen decarbonizers, pressure gauges and regulator valves for all classes of welding.

Catalogs Received

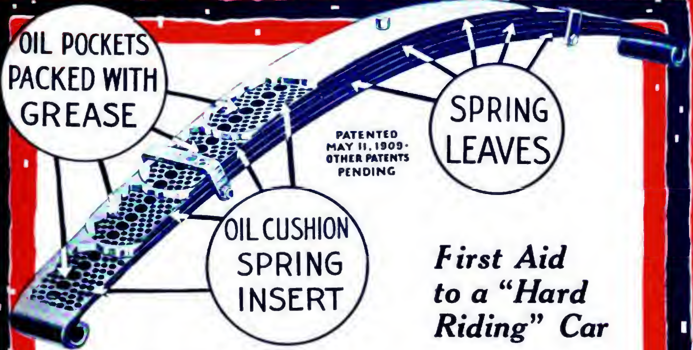
Leather Fittings for all automobile purposes. Magneto boots, straps, cushions, steering gear boots and similar sundries.—W. H. Hoover Co., New Berlin, O.

Gasoline Storage is dealt with fully in the Bowser Bulletin. This describes Bowser outfits for all kinds of garage installations, both inside the building and outside, on the sidewalk.—S. F. Bowser & Co., Fort Wayne, Ind.

Small Fittings such as taps, cocks, hose bands and pump connections. Also lubricators, small gauges, and little tools like punches and small screw drivers, radiator caps, hub caps and brass fittings of various kinds.—E. Edelmann & Co., Chicago, Ill.

Veedol. This is the title of an interesting treatise on lubrication, in which all automobile motor oiling systems are illustrated by a series of diagrams representing sectional motors, and printed in color. The booklet is well produced and contains many useful hints upon car maintenance.—Platt & Washburn Refining Co., New York City.

Trunks are now made in an immense variety of patterns and their manufacturers' catalogs become quite bulky volumes. The 1915 catalog of Ajax trunks is no exception to this rule, and contains a few novelties, notably a large and very completely fitted buffet case. Composite cases containing several individual grips are a feature of the Ajax line.—Ajax Trunk and Sample Case Co., New York City.


OIL POCKETS PACKED WITH GREASE
SPRING LEAVES
PATENTED MAY 11, 1909. OTHER PATENTS PENDING
OIL CUSHION SPRING INSERT

First Aid to a "Hard Riding" Car

It keeps rust, dust and grit *out*, and all the shock absorbing qualities of the spring *in*—

DANN INSERT

"The Perfect Shock Absorber"

Springs are the natural shock absorbers with which every car is equipped.

Permanent, continuous lubrication, however, is imperative to their proper functioning as shock absorbers.

Lack of proper spring lubrication causes rust and pitting. Pitting caused by rust is as injurious to a spring as if notches had been filed in its metal. Rust and pitting stiffen a spring—lower its shock-absorbing efficiency 50%.

It is impossible to lubricate springs properly by prying their leaves apart. The most important bearing surfaces cannot be reached in that way. Moreover, the lubricant quickly squeezes out.

DANN INSERT is the only device of its kind that will keep springs up to their original shock-absorbing efficiency. DANN INSERT provides permanent, thorough and automatic lubrication throughout the spring's life of service. DANN INSERT retains the lubricant between spring leaves—it can't squeeze out. It keeps springs as supple as the car manufacturer meant them to be—their shock-absorbing qualities intact.

DANN INSERT is supplied ready boxed in sets for any make of car. Ask your dealer, or write for pamphlet "What Users Say."

DANN Oil Cushion SPRINGS, with DANN INSER[illegible] ready installed between their leaves, are a new a[illegible]dition to our line. Supplied for any make or mode[illegible] of car. Write for particulars.

Dealers Wanted Everywhere

Dann Oil Cushion Spring
Insert Company
2282 Indiana Avenue, Chicago, Ill.

The Car You Buy Should Be Equipped With A High Tension Magneto

[illegible] are two kinds of ignition—the ordinary [illegible]m and the high tension magneto system.

[illegible]ry system is the cheapest.

[illegible] priced [illegible] is the most ex-[illegible]

[illegible]e *most* certain.

It is the *most* uniform.

Practically all the highest priced cars are equipped with the high tension magneto system.

So is the Overland!

Catalogue on request. Please address Dept. 38.

The Willys-Overland Company
Toledo, Ohio

FEBRUARY 18, 1915 10 CENTS A COPY

Automotive Industries 40

The AUTOMOBILE

MAGAZINE LOAN COLLECTION

Maxwell

M[illegible]vell Cabriolet

$840

Fully Equipped

The Maxwell Cabriolet has the same chassis as the renowned "1915" Maxwell 5 Passenger Touring Car. The body of the Maxwell Cabriolet is a splendid example of the modern coach builder's art. When closed it is a comfortable coupé; when open a racy roadster. It is an ideal car for all-weather use, par- [illegible]ated to the requirements of doctors, sales- [illegible]. A most popular car with women.

ell Cabriole $840
ell 5 Passenger Touring [illegible]
ell 2 Passenger Roadst[illegible]
nodel equipped with El[illegible]
$55 Extra

lian Price, 5 Passenger Touring Car, [illegible]925
Electric Starter, $70 Extra

"Every Road is a Maxwell Road"

well dealer nearest you will show you,
Maxwell Cabriolet.

rite for beautiful illustrated catalog.
Address Dept. D.

ell Motor Company, Inc.
DETROIT, MICHIGAN

Cleveland Public Library
MAGAZINE LOAN COLLECTION
Date when due marked below
C.P.L. Form 1218 Rea[illegible]

BRISCOE

Individuality stands out all over the BRISCOE car. It is not a copy but a creation, possessing an air of exclusiveness that makes an instant appeal to every buyer—built to stand up indefinitely.

In representing the BRISCOE, you are selling a car that gives the purchaser greater value than anything else at anywhere near the price.

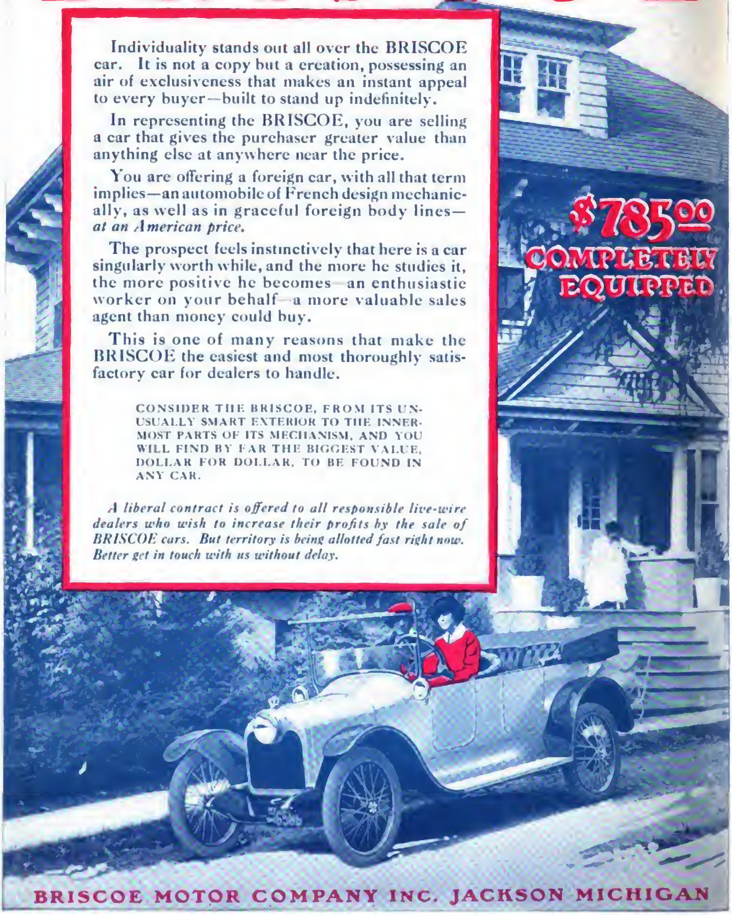
You are offering a foreign car, with all that term implies—an automobile of French design mechanically, as well as in graceful foreign body lines—*at an American price.*

The prospect feels instinctively that here is a car singularly worth while, and the more he studies it, the more positive he becomes—an enthusiastic worker on your behalf—a more valuable sales agent than money could buy.

This is one of many reasons that make the BRISCOE the easiest and most thoroughly satisfactory car for dealers to handle.

CONSIDER THE BRISCOE, FROM ITS UNUSUALLY SMART EXTERIOR TO THE INNERMOST PARTS OF ITS MECHANISM, AND YOU WILL FIND BY FAR THE BIGGEST VALUE, DOLLAR FOR DOLLAR, TO BE FOUND IN ANY CAR.

A liberal contract is offered to all responsible live-wire dealers who wish to increase their profits by the sale of BRISCOE cars. But territory is being allotted fast right now. Better get in touch with us without delay.



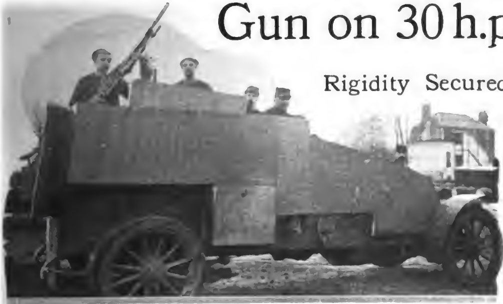
BRISCOE MOTOR COMPANY INC. JACKSON MICHIGAN

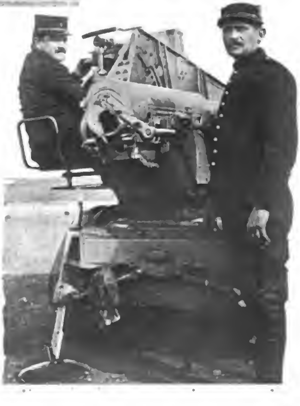
Vol. XXXII New York—Thursday, February 18, 1915—Chicago No. 7

The AUTOMOBILE

French Mount 75 mm. Gun on 30 h.p. Chassis

Rigidity Secured by Swivel Jacks—Artillery Tractors—Allies Gain in Truck Fleets





Left—Renault with high-angle gun manned by French infantry and Zouaves

Below—French 75 mm. gun mounted on chassis. This is the first photograph of this gun ever taken

By W. F. Bradley

Special Representative of THE AUTOMOBILE *with the Allied Armies in France*

PARIS, Jan. 30—France's most formidable weapon, the 75 mm. gun, the rival of the German 77, is now being used very extensively mounted on an automobile chassis. This improvement had just been completed when war broke out, but no time had been available for building the chassis and fitting the gun to it. The adoption of the new weapon has therefore been carried out while the nation is at war. No serious problems were presented in the automobile itself, but the mounting called for careful work and it was necessary to cut out the action of the spring in order to give to the entire base the same degree of rigidity as with the ordinary horse-drawn gun carriage. A 30 horsepower chassis is used, the make principally employed being De Dion Bouton. No armor plating is fitted to the chassis, for a gun of this size is not intended for reconnoitering or ordinary road work. Obviously, details of the automobile fittings are as carefully guarded as the details of the gun itself. Briefly, the gun is mounted on a pivot carried on a steel platform bolted to the frame members; normally, it is directed forward, over the heads of the driver and his assistant. The gunner has a seat attached to the rear left side of the gun, this seat being attached to and revolving with the gun pivot. When the gun is about to be brought into action, the chassis is raised from the ground just sufficiently to remove all weight from the springs, but not to lift the road wheels. This raising is obtained by means of four special hydraulic jacks, one attached to each corner of the chassis, and capable of being operated simul-

The fortunes of war. A battle-scarred French car at the corner of village street near Soissons

taneously and instantaneously. Each jack consists of a stout steel leg, inclined a few degrees from the vertical, and having at its lower extremity a big diameter circular foot, flat on its under surface. These give sufficient area to carry the weight of the chassis and gun on all ordinary surfaces.

The great advantage of this new weapon which, it should be noted, is receiving its first application in this war, and had not even been tried out in maneuvers, is the extra mobility it gives to the batteries. A horse-drawn battery of 75 mm. guns does not average more than 4 miles an hour under best road conditions. Under similar circumstances a battery of 75 mm. automobile guns can maintain an average speed of 12 miles an hour. The only problem, therefore, was to perfect the details of the chassis so that the automobile gun could get into action as quickly as the horse-drawn type. This has been accomplished, with the result that the automobile 75 mm. gun is decidedly the more formidable weapon.

The French gun discharges a projectile weighing 7 kilos 240 at an initial speed of 530 metres. The German 77 mm. gun sends a projectile of 6 kilos 850, at an initial speed of 465 metres. Another advantage of the French gun is the method of mounting and the hydraulic brake which removes even the slightest variation in the angle of the gun after each shot has been fired. In other words, the range having been given, there will not be the least necessity to set the gun again, no matter what number of shots may be fired. A French battery of 75 mm. consists of four guns. The German 77 mm. battery comprises six guns. The French claim that the choice of four guns is more rational, and that one of their batteries is superior to the larger German battery.

Special Ammunition Wagons

Comprised with the 75 mm. French batteries are automobile ammunition wagons of a special design. The majority of these vehicles have been furnished by the De Dion Bouton company, and are that firm's 30-horsepower chassis with important modifications. The motor is carried under a bonnet; drive is taken to the rear wheels by transverse cardan shafts, in the special De Dion Bouton manner. In addition, a powerful winding drum with steel cable is fitted within the frame, back of the gearbox, thus making it possible for this vehicle to haul itself out of a tight place, or to pull the gun out of soft ground. On the chassis is a wood and metal body divided into several large lockers, each one being subdivided into divisions made to receive a 75 mm. shell.

The 75 mm. gun appears to be the largest weapon mounted on and fired from an automobile chassis. There are hundreds of lighter vehicles in use fitted with one or two mitrailleuses, but these are for an entirely different kind of work from that undertaken by the bigger gun. Much of the heavier French artillery is now motor hauled. These must not be confused with guns which are motor-carried.

The Use of Tractors

Many of the cannon of 105, 120 and 155 mm. are hauled by motor tractors. It does not appear that the French 280 mm. gun makes use of automobile traction. It is claimed that this gun has a considerably greater mobility than the German weapon of the same calibre, for it can be dismounted into four parts, each of which can be drawn by six horses. The use of gasoline tractors is not entirely new, for the French have studied this problem of the abolition of the horse in artillery work for at least 3 years, and had developed a most successful type of tractor before war was declared. A 120 mm. battery consists of seven tractors, each one with a 35-horsepower motor driving to front and rear wheels, both sets of wheels being steerers as well as drivers. The make most largely employed is Panhard-Levassor, others being Renault, Latil and Schneider. Each tractor carries the men necessary for handling the gun, it hauls one ammunition wagon, and finally the gun on a special type of four-wheel carriage. The average speed on roads is 12 miles an hour. Across country, where no serious obstacles have to be met, a speed of 6 miles an hour is maintained. Naturally this is reduced if the nature of the ground necessitates the fitting of paddles or chains to the wheels, or if the motor driven capstan has to be brought into operation to get the tractor out of a difficult position or pull the gun and ammunition wagon up hills which cannot be climbed in the ordinary way. Each tractor replaces from twenty-five to thirty horses. In

French trucks bringing up men and trenching tools for French construction in the Argonne district

Peugeot cars fitted with quick-firing guns. These cars are credited with great execution

addition to the higher speed on the road, these batteries have the great advantage of being able to get under way in a much shorter space of time than is necessary for bringing up horses. I have timed a battery which was in position on soft, sandy ground, some distance from a main road, which ceased firing and got clear away from the position it occupied within 5 minutes. Attached to each of these heavy batteries is a reserve tractor carrying chains, paddles, ropes, and other material necessary for use under adverse conditions. The tractor is also ready as a stand-by in case of break down.

Double-Steer, Double-Gun Light Cars

Recent additions to the French artillery consist of the lighter type of Peugeot high-speed chassis fitted with double steering wheels, so that the driver can face either front or back, a couple of reverse gears, and two quick firing guns, each one having a horizontal range of 180 degrees. In producing these armed cars the French have merely copied German example, for on the outbreak of the war the enemy had in readiness large numbers of light, fast, armored automobiles with which it was possible to make rapid attacks and strike terror into small forces and the civilian populations. This movement was followed on the part of the Allies by the fitting up of ordinary touring car chassis with armor plating and the mounting of a gun on the platform. The final development is the adoption of double steering and two speed reverse.

One of the surprising features of this war is the revelations it has made of the respective automobile strength of England, France and Germany. According to the most reliable statistics, England had a decided lead over any other European country in the number of commercial vehicles and motorcycles, a slight lead over France in the number of private cars, and a substantial lead over Germany. The indications were that France and England would put into the field the greater number of automobiles than Germany possessed. It is now seen that for military purposes England possessed a mere handful of automobiles. Her subsidy scheme had not met with success. The war department fixed on a certain type, admirably suited for their purpose, and asked manufacturers to build it and the public to buy it. Neither party responded, with the result that when war broke out the English authorities had to requisition thousands of trucks in the hands of private owners and had to place orders for the ordinary commercial type with every manufacturer willing to execute the same. From the day war broke out until the present moment, requisitions of suitable types of trucks have been carried out, until commercial England now possess but its steam wagons, the trucks of absolute necessity to civil and military home life, and the older models unsuitable for sending abroad.

In France the situation was different, for although the French army, like that of England, possessed but a small number of trucks in active service, and had no armored cars whatsoever, it was able to make use of its well developed subsidy scheme which automatically brought several thousand trucks into army service with the call to mobilization. This, however, was not sufficient, and after the subsidy types had all been taken, other privately owned vehicles were requisitioned until France is more completely cleared of privately owned trucks than is England. So searching has been the call that it is doubtful if there are to be found in Paris and neighborhood six automobile trucks not in direct army service or in public work on which the army is dependent.

Germany's Many Trucks

Germany's situation was strangely contrasting. Knowing that she had not the same civilian resources to fall back upon as her neighbors, she had secured for permanent army service a quantity of all types of automobiles in comparison with which the fleets of England and France looked ridiculous. Authorities had been content to accept the official figures given out by England, France and Germany, and note with satisfaction that on a total count Germany was decidedly inferior. It was not until war had broken out that the realization came that Germany's inferiority only applied to the total count, and that in the number and quality of automobiles for immediate military service, she was far ahead of any of her opponents. Thus, while German armored cars were scurrying across Belgium, the automobile service of the Belgian army was arranging with manufacturers to obtain from fireproof safe makers the necessary steel plates for converting touring car chassis into instruments of war. In France and England the situation was practically the same.

Official statistics published last year showed that there were 60,876 touring cars in use in Germany during the preceding year. At the same date France possessed 90,959. English returns, being based on registrations, are less accurate than those of France and Germany. It is probable, however, that England had not less than 120,000 touring cars. Germany possessed 9,739 trucks. The number in France cannot be determined with the same degree of ac-

Below—French Red Cross automobile bringing in wounded to the train in which they will be carried far away from the scene of the fighting

Above—Women and children being removed from the danger zone around the village of Soissons by a Red Cross automobile

curacy, for trucks are taxed in a different manner and are not under the rigid fiscal control as private cars. The French fleet can reasonably be set down as 18,000 to 20,000, or twice as many as Germany. England probably possessed 25,000 to 30,000 commercial vehicles at the outbreak of war. These are not military but civil figures, and the advantage which France and England appeared to have over Germany at the outbreak of war did not exist in reality.

The Situation Reversed

During the 6 months the war has been in progress the situation has been reversed. Germany has not the productive resources of her rivals. She is cut off to a very large extent from outside supplies. Italy has been furnishing a small number of trucks and probably some American trucks have gone into the Fatherland through Italy. Assuming that the German automobile factories have been working at full pressure on army orders, her output is considerably less than that of France, where work has also been carried on at an intensive rate. France and England have been able to call in an almost unlimited supply of automobiles from America. By turning all the resources of the passenger car factories into the commercial field, it has been possible to produce trucks at a greater rate than during times of peace. There is a shortage of men and of certain grades of material, but this shortage is not sufficient to interfere with the production of motor trucks at a good rate.

The Allies Are Prepared

It is obvious to any observer that the next phase of the war will entail more aggressive action on the part of the Allies. So far as the motor phase of this action is concerned, the Allies are in a decidedly better position than the Germans. The special armored types of vehicles which they had failed to produce prior to the war have now been brought into existence. While Germany's automobile fleet has decreased with 6 months' active service, that of England and France has been augmented in proportions which would cause surprise if figures could be revealed. If Germany is driven out of Belgium, there will be no railways for the use of the Allies. Thus men, food, and guns will have to be brought up by automobile. All this has been provided for on a scale which makes it possible for practically the whole of the Allied armies to travel forward on gasoline.

Restrictions on Private Automobile Travel in France Increase

EARLY in September the German army entered the town of Senlis, 24 miles northeast of Paris, and claiming that shots had been fired by civilians, set fire to all the buildings in the main street, shot the mayor, and buried him head downwards in a field. A few days later the retreating French and British forces were pulled up smartly by General Joffre, faced around, and told that they were to fight and win, or die on the spot. They routed the German armies, driving them back to the Aisne, a distance of nearly 30 miles. The various centers of that series of battles on the Marne, in which probably 2,000,000 troops were engaged, and where the dead and wounded were counted by thousands, are from 20 to 40 miles due east of Paris.

If the mayor of Trenton, N. J., had been shot and half his town burned by an armed force; if one of the world's greatest battles had been fought but a few miles to the east of Brooklyn, it can be imagined that the civil and military authorities would have a difficult task to keep New Yorkers away from such spots. If the rail roads and trolley car services were cut off, there would apparently be nothing to prevent motorists going out; indeed the man who owned an automobile might be expected to be the first and the most persistent visitor to the places which must loom big in the history of nations. But a supposition as to what would doubtless happen around New York gives no indication as to what really has happened around Paris. The civilian motorists who have been able to make the 25 to 40 mile run from Paris to Senlis and the battlefield of the Marne might be counted on the fingers of one hand. Those battles were great victories for the French, they were fought more than four months ago, the districts are now cleared of troops, the wreckage has been gathered up, the dead have all been buried, the wounded have all been evacuated—yet to make an automobile trip into this neighborhood is more difficult than a mid-winter journey from New York to Seattle.

Many Restrictions

Automobile travel has never been absolutely forbidden in France, but it has been subjected to such restrictions that the man who is willing to undertake it must be possessed of more patience than the early enthusiasts who went from

New York to Philadelphia in 3 days and were proud of the feat. In the early days, or rather the early hours, of the war, every village and hamlet in France formed a guard for the protection of the roads. They were old men and boys; armed with every kind of arm from a shotgun to a modern army rifle, and they went on duty within a few hours of the order for mobilization. Sometimes they used their rifles first and asked for explanations afterwards. Such accidents were too trifling to get in the newspapers, even if there had been no censor to keep them out.

Such a system produced fussiness, not efficiency. It held back soldiers who were entrusted with urgent, life and death, messages, and it let through the skilful spy and the idler who had a pull with some local authority. Now all that is changed. There are plenty of men who have a pull, but they invariably find that there is nothing at the end of it. Nearly 6 months' war experience has been sufficient to put the army authorities wise to all the subterfuges for securing automobile permits, and to reduce the travelers by road to the lowest number and hold them to the narrowest and most restricted area.

Newspaper men gave the greatest trouble. They had influence with the police, with the civil authorities, with army officers, and as the Frenchman considers the law is made for the other fellow, they found means of making use of cars. By an unfortunate accident half a dozen Paris newspaper reporters happened to pull up their car in the midst of a group of staff officers who were studying maps. General Joffre was in that group, and although the commander in chief of the allied forces has a reputation for self-restraint, he saw red for a few moments and issued orders which have made even newspaper men hesitate before driving into the war area. A group of American and English war correspondents, trading on their influence with the ambassador, secured a valid military pass to travel in a Packard car to the scene of operations. Chance took them into the village occupied by the general staff of one of the British armies. They were arrested, imprisoned in a barn, their car retained for army service and at the end of a week released on a promise that they would not write anything for 6 days.

Red Cross Is Wary

It seemed an easy matter for newspaper men to loan their cars to the Red Cross organizations, or to offer their services as stretcher bearers to the convoys going to the front. Some time ago this was frequently done; but the army became wise to the move. Now the officials of the various Red Cross organizations are afraid of their own shadows. A man who offers a car is first of all looked upon with suspicion. When the Red Cross authorities are convinced of his good intentions, detectives pry into his life's history, and if he should have had any connection with newspapers, if he has written a magazine article, if he is 90 degrees removed from a German family, they decide to take no chances. One prominent English newspaperman slipped on overalls and visited the battlefield as a mechanic on a Red Cross car. He wrote a story of his experiences, but next day found it prudent to remove into Russia.

Hauling a damaged Peugeot car aboard a French truck for delivery to the repair depot

Berliet trucks in French army service with protection for both drivers and motors. Note big tarpaulin cover over driver's head and brushwood and moss on bonnet

Every motorist in France is registered with the police and carries a police driving license bearing his photograph, place of birth, age, residence, etc. This, however, is only a peace time precaution. Such a measure is altogether insufficient when the nation is at war. In Paris and district no man is allowed to travel by automobile until he has secured a special pass from the police. The ordinary pass allows him to travel in the Seine et Oise district, or about 8 miles east of the city and 30 miles in a westerly direction. This pass must be renewed every fortnight, it mentions the number and sometimes the names of the persons who can travel in the car, it is examined by the police every time the driver passes through the gates of Paris, it is called for from time to time on the road, and if used for any other than the area indicated the car may be confiscated.

To travel further afield the motorist must pass through an even finer sieve. Passes are only given for a clearly defined journey, either out only, or out and home. Permission is not given to travel about from point to point. Each application is considered on its merits. If it is for the south, the west, or the southwest, far removed from the army operations, there are few difficulties. But if it is for any part of the army zone, strict inquiry is made first by the civil then by the military authorities, every occupant of the car must be presented and the photograph and signature of each one must appear on the pass.

Gasoline Is Unobtainable

The obtention of a pass for the army zone does not remove the difficulties, for gasoline is inaccessible to all but military motorists within the military territory. Benzol can only be supplied to firms working on army contracts. There does not appear to be any shortage, and if the price has increased it is due to higher freight, but the war department has no intention of carrying gasoline to the front for civilians.

The grip on the non-fighting motorist is extended to the military man. No soldier can take a car out until he has received a written and stamped order from his superior. At the gates to Paris and the entrance to every important city a guard is maintained to examine soldiers' passes. This restriction puts a stop to joy riding and makes it impossible for the military motorist to extend courtesies to his friends.

Engine Balance and Vibration—Part II

Unbalance Caused by Heavy Spots in Flywheel or Crankshaft and Oscillations Due to Lack of Stiffness in Crank or Bearings

By A. Ludlow Clayden

LAST week the explanation was given for vibrations due to the mechanics of engines with pistons and cylinders, vibrations which are inherent with the various types and which we can only hope to reduce by the use of light reciprocating parts or the adoption of multicylinder motors which have all *natural* vibrations of so high a pitch that they are above the sensory range. It was pointed out that the stiffness of the crankshaft had a part to play in that it has to resist forces due to the pistons and is the medium whereby forces due to one piston are enabled to cancel out similar opposite forces due to another. We can now turn to the forces created by the explosion, which do not enter into the matter of the inherent characteristic balance of the type considered in the first part.

Twisting Action on Crank

If we take a long piece of thin steel rod and fix one end in a vise it is possible to twist the free end, if we attach a suitable handle. If one were to try this experiment on a rod with a line drawn along it, then this line would form a spiral.

If we cut the rod in two, refixed the handle and then applied the same twisting force as we had used before, on the long rod, we should find that the remaining portion of the line would take just the same form as it had before the rod had been cut, while the handle had been turned through only half the angle. This is equivalent to saying that the amount a fixed force will twist a rod is in proportion to the length of the rod. Fig. 1 shows the rod with the line on it as it would appear twisted in both the long and the short condition.

Now, a crankshaft is a bent rod which has twisting forces applied to its central parts (the parts which form the bearings). The twist originates from the force of the explosion, which is the same for any cylinder, and the cranks are a series of levers of equal length, but each corresponding to the handle used in Fig. 1 to twist the plain rod. Thus, the length of lever being the same for each piston, and the explosive force the same also, the front piston when on its firing stroke has four times the power of twist production that is possessed by the piston nearest to the flywheel. This means that, if the shaft is weak enough actually to twist with each explosion, it will twist different degrees according to which cylinder is firing. Looking at an automobile crankshaft it seems impossible to imagine that it could ever twist, but the fact remains that much of the trouble in eliminating "periodic vibration" from six-cylinder engines is due to crank twisting. If the crank does twist the piston attached to it is pulled out of place relative to the other pistons. It has been explained before that vibration arises from any displacement of the common center of gravity of all the pistons together (see Fig. 3 page 262 of THE AUTOMOBILE for February 11) and if we have a six-cylinder in theoretically perfect balance, and then move one of the pistons irregularly, we shall upset the whole static system and cause the common center of gravity to move rapidly in a small orbit, so producing vibration of a possibly violent character.

Why Twist Makes Vibration

While this is easy to understand as expressed thus simply, there is another and more potent reason why this twisting should cause vibration and this may be explained by harking back again to Fig. 1. Suppose when the rod has been twisted the handle is released suddenly; then it follows that the rod will not slowly return to the straight state but will go past the straight and twist in the opposite direction oscillating in this manner a good many times before coming to rest. The duration of this oscillation will depend upon the length of the rod, the material of which it is made, the diameter and the degree of original twisting, but the *rapidity* is not affected by the last named. This means that any given rod has a natural period of vibration in twist, just as a tuning fork has a natural period in a crosswise direction. It does not matter how hard one strikes a tuning fork, it gives out the same note, but the severity of the blow affects the length of time that the sounding will continue.

When a crankshaft is deformed by the explosion pressure acting on the piston, as the pressure is removed suddenly towards the end of the stroke, we have reproduced the case of the twisted bar that has the handle let go suddenly. So the crankshaft will oscillate at its natural period, for it cannot very well do otherwise. Now were the shaft alone in the crankcase, the oscillations would not be felt, but since it has the pistons attached to it they are forced to vibrate at a speed corresponding to the crank's natural period and we have seen already that any irregularity of piston movement produces vibrations of an unpleasant character. Suppose again that the speed of the motor and the period of the crankshaft are in tune. We all know that a pendulum has a natural "period" or time of swing, and that to make it swing more and more it is necessary to keep on giving it little pushes at just the right instant. Suppose now that the speed of a motor is such that the firing takes place at time intervals just suitable to the natural period of oscillation of the crank. In such case we have the pendulum illustration reproduced, each successive explosion just "nicks" with the crankshaft oscillation and so tends to make it greater.

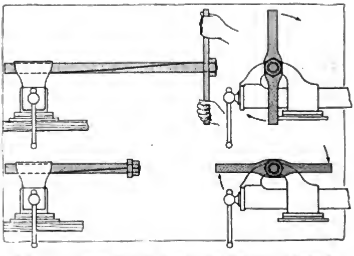


Fig. 1—The amount of twist which a fixed effort will produce in a shaft is in proportion to the length of the shaft. Halve the length and the twist is halved also

Coming back to the pendulum again, we know that if we time our pushes badly the swing may be not only increased, but actually damped out or negatived. Just so with the crank, if we increase the speed of the motor or if we decrease it we get away from the correlation between time of explosion and time of oscillation.

Suppose now that a crankshaft is stiff enough to resist the twisting stress of one explosion under ordinary conditions, it may not be stiff enough at the critical speed when the explosions are all in tune with the natural oscillation period of the crank, and it is this that explains one of the principal reasons why a six-cylinder motor is liable to vibrate quite violently at just one speed but not either above or below that speed.

Damping Torsional Vibration

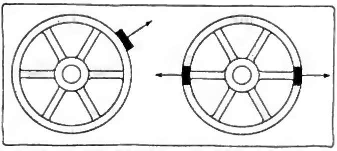
If it is desired to overcome this vibration period in the speed range of a motor, there is only one thing to do, and that is to make the crankshaft of such a large size that its period of oscillation is well above the maximum possible speed of the motor. To do this requires a shaft of altogether surprising dimensions, which is costly by reason of the material it contains and still more expensive in labor of making. Vibration at the critical period can be overcome almost completely if we can confine the deformation of the crank to its first twist; if we can prevent the oscillation by causing it to come back *slowly* to the unbent position; as we could prevent oscillation of the rod in Fig. 1 by releasing the handle slowly only letting go altogether when the rod had completely untwisted.

To do this the Lanchester anti-vibrator or vibration damper was invented. This consists of a little flywheel mounted on the front end of the crankshaft having the rim separate from the center and connection made between the two by means of a small plate clutch continuously under pressure. Since the inertia of the flywheel rim causes it to do its best to run at a steady speed it resists any attempt made by the crankshaft to oscillate it rapidly. When a crank is deformed by explosion pressure the inner part of the flywheel slips a little inside the rim, and the energy of the return movement as the pressure on the crank is released is used up in overcoming the friction of the clutch plates. This means that the natural oscillation is damped and the crank brought to its normal position after one or two vibrations instead of after perhaps a few score.

Still, however effective any damping attachment may be, it is unquestionably better to do away with the original bending by means of making the crank sufficiently stiff. The twisting has been considered above as if it were confined to the plain parts of the crankshaft, but actually there are tendencies for the webs to bend and for the crankpins to pull out of straight. These are, however, slight, and if the webs are made in proportion symmetrically with the diameter of the plain parts of the shaft they will be amply strong. Furthermore, it was pointed out last week that a crankshaft required strength against bending to enable the unbalanced couples in a multicylinder motor to balance each other, and if the crank is stiff in torsion it is probably stiff enough in this respect also.

Rotational Balance

It has now been explained how the pistons in an automobile engine can be wholly or partially balanced against each other by *arrangement*, and how that piston balance can be interfered with by irregular movement due to a crank of insufficient strength. Supposing, however, we have a motor in which the reciprocating balance is practically perfect and in which the crankshaft is stiff enough to resist any kind of deformation, it is still possible to find vibration, especially at high speeds if rotary balance is not cared for.



Left—Fig. 2—Centrifugal pull of weight tied to wheel rim. Right—Fig. 3—Balanced pull of equal and opposite parts of rim

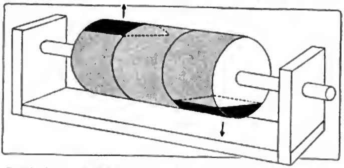


Fig. 4—Cylinder of metal with two heavy sections that balance each other while shaft is stationary

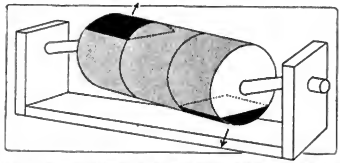
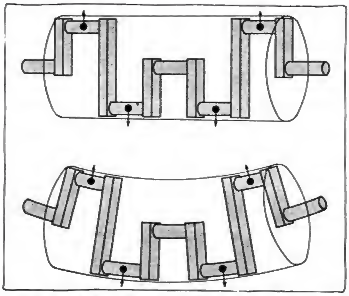


Fig. 5—Tendency to distortion of shaft produced by centrifugal pull of heavy sections when shaft is revolved

To explain the nature of rotary balance refer to Fig. 2 which shows a wheel with a weight attached to the rim. We know that centrifugal force causes every part of any rotating body to try continuously to fly away in a straight line, that the circular motion is only brought about by the strength of the spokes of a wheel being sufficient to hold the rim together. Now, if a wheel has a plain rim the centrifugal pull of a bit of it; say an arc an inch long, on one side of the center, is balanced exactly by a similar arc on the opposite side (Fig. 3), pulling in the opposite direction. But if one side of the rim is heavier than the other then there will be extra pull on the heavy side and, if we imagine a wheel with a weight tied to it as in Fig. 2, it is easy to see that the centrifugal pull due to this weight will be unbalanced; that is the load due to it will revolve continually around the bearing that supports the shaft. Carry the imagination one stage further and suppose that the bearing was set in a block of rubber, and it is at once obvious that the bearing would wabble as the wheel revolved, the rubber always giving way on the side that the weight was for the instant. Thus, if we have a heavy spot on a rotating wheel, that heavy spot puts an uneven pull on the bearing which can only be resisted by the rigidity of the mounting.

It might easily seem that the flywheel of an automobile motor could not have any heavy spots in it since it is turned from cast iron, which appears to be homogenous material, but it was soon discovered that the density of a casting is so inconstant a quality that flywheels had to be balanced by mounting them on a spindle provided with free bearings, and then drilling small quantities away from the side which tended to always come to the bottom until the wheel would



Upper—Fig. 6—Showing how the weight of the pins of a crank shaft correspond to four heavy spots in a cylinder. Lower—Fig. 7—Effect of the crankpin weights when shaft is revolved tending to bend the shaft into a bow

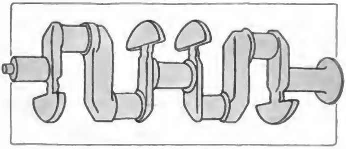


Fig. 8—Crankshaft with balance weights that balance each crankpin in its own plane and so give rotary balance

rest in any position. Even when this is done with great care, however, it is still possible for the wheel to be out of balance when it is spinning. Look at the next illustration, Fig. 4, and suppose we have a cylinder of solid metal mounted on bearings and balanced with the greatest of care. Let us now imagine that the cylinder is made up of several sections; taking three as a convenient number, suppose that the central one is actually homogenous, but suppose that the other two have heavy sides as shown at A and B in Fig. 4. If we mount such a cylinder upon a shaft and then rest the shaft on knife edges (which is the usual way of balancing a flywheel) the two heavy sections will balance each other and the wheel will seem to be perfect. Now, let the same wheel be spun rapidly and each heavy spot will exercise a centrifugal pull, but the two pulls will not balance unless the support is stiff enough to compel them to do so. The natural tendency is for the two centrifugal forces to pull the wheel out of straight, so bending the shaft and producing a state of affairs as sketched in diagram in Fig. 5.

How Flywheels Are Balanced

So far we have avoided the use of any figures, but as it is always difficult to grasp the amount of the forces that can be introduced by this sort of action it will not be out of place to mention that the weight of as little as an ounce on the rim of a flywheel can create a force of a very great many pounds within the limits of automobile engine speeds. All up-to-date automobile manufacturers take care to balance their flywheels rotationally on a special machine wherein the wheel is so mounted that it can actually run out of true. That is, it is allowed to take its natural position of spinning and the amount which this is out of true with the proper position is measured. Small lumps of clay are then added to the flywheel by being stuck inside the rim and a new trial made. When the wheel has been thus weighted until it runs correctly, the bits of clay are removed and a corresponding weight of metal is drilled out from the point in the flywheel opposite to that where the clay had been attached. Really expert men may even dispense with the clay and drill direct but to do so requires a good deal of practice in the use of the balancing machine.

Unbalanced Cranks

So much for flywheels, but the effect of rotational unbalance is also present in crankshafts and it is more serious in one respect, because it cannot be overcome by any simple means. Turn to Fig. 6 and imagine a crankshaft enclosed in a cylinder of a homogenous material. Now we can imagine the two long webs of the crank to balance each other exactly, but imagining the weights of the four crankpins to be concentrated at the four black dots it becomes clear that they do not balance each other rotationally since if we cut up the cylinder into four sections A, B, C and D, A and D are pulling centrifugally one way and sections B and C in the opposite direction. The effect of these unbalanced centrifugal forces is to try to bend the crankshaft into a bow as sketched in Fig. 7. Of course such action is resisted and prevented by the center bearing of the crank but the extra load on this bearing due to this cause alone is often as much as 500 pounds.

It was for this reason that we said in the first part of this article that it was always an advantage to put balance masses on a crankshaft, for we can overcome this bending tendency completely if we balance each crankpin individually. In Fig. 8 the webs are extended so that the weight of the two extensions either side of each crankpin is equal to that of the pin itself and when this is done, each part of the shaft is in perfect balance and the center bearing is relieved of a heavy revolving load.

It is not common automobile practice to take any notice of this rotational unbalance in a crankshaft because it is easy to make the shaft so stiff and the bearing so rigid that the whip in the shaft cannot happen, but it is not easy to make a crankcase so rigid that a revolving load of 500 pounds on the center bearing does not produce some slight vibration, since it is not like a load that is constant in direction. Still, the vibrations arising from the simpler causes are usually so much larger that the lesser ones can be neglected safely, and a shaft that is stiff enough in torsion and stiff enough to resist the static couple dealt with last week, is usually not whippy enough to affect the case perceptibly. It is far more important to see that the pistons and connecting rods are all of exactly the same weight and that the rotational balance of the flywheel is correct.

Conclusions

Vibration is caused by:

1. Impossibility of using designs of motor that enable the reciprocating masses completely to balance each other during every stage of the revolution of the crankshaft.
2. Tendency of the explosion effort to twist the crankshaft so that it becomes unsymmetrical and so pulls a piston or pistons out of symmetry with the others.
3. Tendency of the balanced couples in multicylinder engines to bend the crankshaft.
4. Tendency of the crankshaft to bend by reason of the couples created by its own rotation and its shape.
5. Tendency to wabble the flywheel caused by heavy spots in the metal of which it is composed.

It is only the first of these things that is capable of exact mathematical determination and the others are all matters of compromise but it is significant that three of the five conditions are met best by the use of a very heavy crankshaft.

The natural smoothness of the six-cylinder due to its premier position in static balance can only be taken advantage of by the use of a shaft that overcomes the twisting and bending forces, and it is easily possible for a four-cylinder motor to have less vibration than a six. The eight has the advantages of the four and not all the disadvantages of the six, and the eight with cranks set at 90 degrees as shown in Fig. 7 last week, appears to have all the advantages of the four and most of the advantages of the six.

There is one point in balance and vibration that has not been touched upon except in passing, and this is regularity or otherwise of torque or driving effort. With each explosion the speed of revolution of the flywheel receives a momentary acceleration and this speed slowly falls off till the occurrence of the next explosion. If we draw a curve to represent these accelerations and decelerations it will constantly cross the straight base line representing a steady revolution speed. The greater the number of cylinders the more closely will the curve approximate to the straight line. Now each time there is an explosion the flywheel driving effort is accompanied by a corresponding recoil, which means that the motor tends to turn as a whole in a direction opposite to that of the flywheel. At slow speed this effort may make itself felt by the motor giving a little kick in the frame with each explosion, but the effect vanishes as the speed rises and the kicks become merged in a continuous push. The even torque of the six and the still better torque of the eight are thus most advantageous at low speeds; as revolutions go up the four is not noticeably inferior. The reason for mentioning this is that if the problem of providing an automobile with a motor to drive it is regarded from a first-principle point of view, there are reasons for and against every kind of cylinder number and arrangement. If our choice is limited by the amount of money available for the motor then there are several reasons why a well-made four might prove more satisfactory to the user than a poorly made six or eight. Neither the four, the six or the eight has all the advantages from a smoothness viewpoint; it is a question of give and take and it is likely for this reason, if for none other, that we shall see all three kinds of motor continuing to exist.

New Russel Internal Gear Drive Axle

Detroit Concern Develops Type for 1-Ton Trucks

NOTING the strength and weakness of the various rear drive systems now in use, the Russel Motor Axle Co., Detroit, Mich., has spent over a year on the development of an internal gear drive rear axle for 1-ton trucks. Its entire attention has been devoted to this type, and the concern is now in position to supply the design commercially.

The internal gear drive principle is not new, but there is no doubt that some of its advantages have been overlooked until the present time, when much attention is being devoted to it, and several truck makers have adopted it as standard.

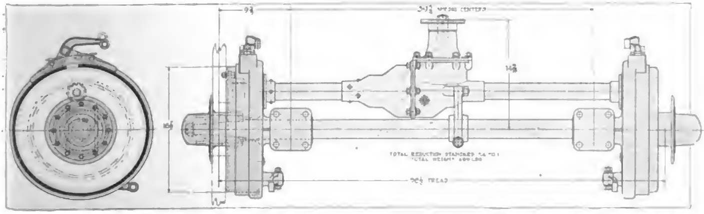
The Russel construction is shown in the illustration. The unit combines a forged steel fixed axle which carries the load with a light, high-speed jackshaft, driving direct through pinions and internal gears attached to the road wheel hubs. The driving member is ahead of the dead, load-carrying axle, and all driving parts are inclosed.

The driveshaft runs directly back from the gearset in the usual way, and connects to the driving member. In this member there is a differential unit, each axle shaft running out to a pinion in mesh with the internal gear attached to the wheel drum, which in turn connects to the spokes of the wheel.

An advantage of the construction is in the small permissible diameter of the bevel ring gear which carries the differential gears. The use of pinions and gears at the wheels obviously admits of any desired gear reduction at this point rather than at the bevel gear, and hence the latter may be made of a size which gives almost a 1 to 1 ratio. This makes the housing for the differential gearing very small with consequent minimum weight and compactness. In the standard Russel type, the total reduction is 7.4 to 1 between propeller shaft and wheels, most of this coming at the wheels. The total weight of the axle is 495 pounds.

Directory of Piston Ring Sizes

The Burd High Compression Ring Co., Rockford, Ill., has issued a pamphlet in which the size ring for practically every make of automobile, motorcycle and truck is given. The pamphlet which is paper-bound and measuring 4.5 by 6.7 inches contains sixty-seven pages of piston ring information. Following a ten-page dissertation on the requirements of piston rings, there is a tabulation of sixty pages in which the different makes of motor are listed under the piston ring sizes. The remainder of the booklet is taken up by an index under which the car and motor makes are listed under their names. Thus if it is desired to determine to find the size rings in a Ford T, for instance, Ford is listed in the index as being on page 13. Turning to this page it is found that the Ford is listed under cars with 3.75 by .25 rings. Another column tells us that there are three rings to a piston. Remaining columns on each page enable the dealer in piston rings to keep a record of his stock.



Russel internal gear drive axle for 1-ton trucks. At the left is a diagram showing the operation of the internal gear which imparts the drive through the wheel hub. At the right is a plan view of the system, showing driving member mounted ahead of dead axle and connections to hubs, etc.

Silent Chain Drives on Increase

Motor Makers Use Wider Face Than Formerly—Advantages and Difficulties in Their Construction

OPPORTUNITY for a summary of the varied installations of silent chains in American automobile motors was afforded by the year's national automobile shows. Representative uses of this method of drive are all grouped together in an exhibition of this kind; therefore a better means of comparing them could not be obtained. With one installation and its advantages and disadvantages clearly in mind, a few steps brought one into contact with another before the previous ones could become indistinct in his memory.

Some typical methods of using chains are shown diagrammatically herewith, and they indicate that the uses of chains are many and varied and that the problems connected with each case are comparable in no way with those encountered in another. Different center distances and uses bring different demands for adjustment or require none. One oiling system will make a certain means of getting the oil to the chain and its sprockets a very feasible proposition, while another will make that oiling scheme impractical and call for another.

It is encouraging, however, to see the generally increasing use of silent chain drives in American motors, for the design is unquestionably most meritorious when properly worked out. It is a more costly construction than gears, although it not only admits of greater flexibility as regards the placing of certain units, due to the permissible variation in center distances where gear centers are fixed, but, in the average case, because a greater number of chain teeth than gear teeth are in mesh at one time and because chain flexibility allows for easy engagement of its teeth with the sprockets, chains are usually more silent than gears when properly installed.

Factors to Be Considered

Chain makers seem to agree that there are a number of considerations which must be properly satisfied in order to insure a satisfactory installation. Chain width, adjustment, oiling, speed, number of teeth, center distances and so on must be given their correct attention.

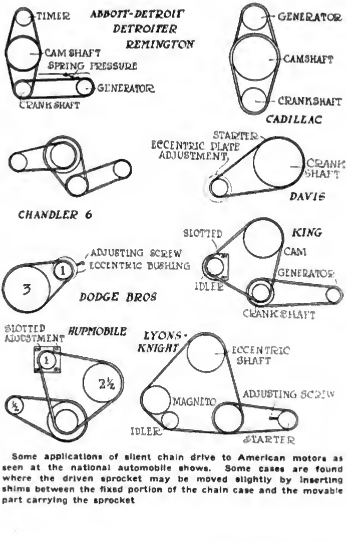
One of the most common mistakes made in the past in the use of chains is that they have not been wide enough for the particular service required. This mistake does not appear to have crept into the drives at present used. The drive of a camshaft or generator is peculiar in that the operative speed of the chain is high, while at the same time its length is short as compared with the average drive. Hence it requires a good bearing surface, and this is accomplished by increasing the width over that required of a gear train.

The oiling of chains is an important consideration, for like any other machinery, proper lubrication reduces wear and increases the efficiency of transmission. This is one reason why an inclosed chain is superior to open designs. The latter do not admit of proper running in oil, and a humming or singing at speed is almost bound to result. Where pressure feed is used, a common method of introducing oil to the chain cases is by a pipe which directs a stream of lubricant onto the *inside* of the chain. This carries it around and distributes it to the various surfaces in contact in a very satisfactory manner. A point must be immediately made, however, of the fact that it is bad practice to allow the stream of oil from such a lead to play upon the *outside* of the chain. In its rapid motion, such placing of the oil is very unsatisfactory due to the centrifugal action tending to throw it off from the chain and sprockets, splashing it against the inside of the gearcase, and preventing it from performing its function. Splash oiling has the advantage of simplicity.

Preventing Whip

There has been considerable argument among chain users as to whether a means of adjustment of the sprocket centers is advisable and the consensus of opinion of the makers of chains seems to be that wherever possible some means of taking up any play in the chains should be provided. Whipping, which is a natural consequence of looseness in a chain, is apt to break the chain in time, and there is only one way of removing such looseness. That is by means of lengthening the center distances, however little.

Where the chain is used for ignition or camshaft drive, any slackness is apt to make inaccuracies in the valve timing and the ignition timing. With adjustment in the average case an easy thing to provide for, it seems foolish to sacrifice its benefits, and most designers have recognized the fact to the extent of making it a comparatively simple matter to



Some applications of silent chain drive to American motors as seen at the national automobile shows. Some cases are found where the driven sprocket may be moved slightly by inserting shims between the fixed portion of the chain case and the movable part carrying the sprocket take up any looseness, even without removing the chain case cover. On drives where the sprockets are very close together, and there is very little of the chain free, whipping is obviously reduced, and the necessity of adjustment is less than where there is considerable free length. It is advisable, however, where adjustment is not feasible and desirable that the chain be made as wide as possible, thus bringing in as much inertia effect as is admissible to combat the tendency to whipping. Wear is also less with the greater contact width, which reduces the need of adjustment.

The diagrams indicate the various means of adjustment as practiced in most American engines. Some cases are found where the driven sprocket may be moved slightly by inserting shims of varying thickness between the fixed portion of the chain case and the part carrying the sprocket, which part may be moved. The Chandler and the Golden, Belknap & Swartz motor are good examples of this scheme.

A very popular and simple means of adjustment externally is by means of slots in the base plate of generator or other driven unit so that it may be moved along with its shaft on its base, and thus slightly change the position of the driven sprocket. Nuts hold the unit in these slots, and it is usually only a matter of loosening these, sliding the unit along on its support and then tightening the nuts again. Such means of taking up wear are found on the Overland, Metz and Hupmobile among others.

The Eccentric Bushing

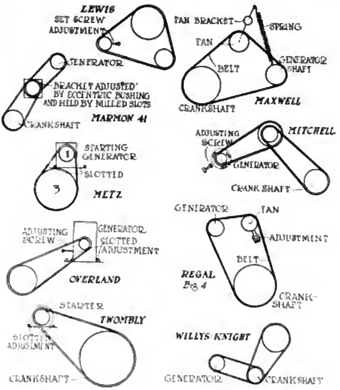
The eccentric bushing on which the driven sprocket shaft is carried is also a very simple means of varying the center distances. By holding this eccentric design in position by some form of set screw, it insures a positive means of positioning. To take up wear it is only necessary to loosen the set screw, when the eccentric may be turned to accomplish the desired degree of center changing. The Marmon, Dodge and Davis come under this head.

Idlers are often used as a means of taking up slackness in chains, they being so mounted as to admit of moving them outward from the inner side of the chain. It usually means removing the chain cover to get at such a means of adjustment. Chain makers caution designers not to use idlers unless they can be fitted so as to have at least 100 degrees of contact with the chain. The King eight-cylinder motor shows a good example of this idler form. The idler sprocket is mounted on a slotted plate, which may be moved after loosening the nuts.

Another form of construction is that in which the driven sprocket itself may be turned with respect to its shaft by means of milled slots in its web. In these slots are bolts attached to a plate which is fixed with relation to the shaft. This has the disadvantage that when the sprocket is turned, the drive side is tightened right enough but the following side is made so much the looser. The center distances remain fixed, which means that the slack has to come somewhere in the length of the chain.

Some installations have adopted a means of keeping the following side of the chain free from whipping by using a flat form of idler which has a fiber face bearing against the back of the chain. In the new Massnick-Phipps eight this idler design is modified to the extent of using a flat steel spring against the back of the chain instead of a fiber-faced piece. When such a position for taking up slack is employed, only some form of flat idler should be employed. Any form of round pulley design is not advised.

Chains of the silent type are advantageous further because they can be used at comparatively high speed with satisfaction. Makers state that any speed up to about 1,200 to 1,400 feet per minute is permissible, though there are instances where 1,800 feet has been considered good practice where oiling is properly taken care of.



Another group of diagrams showing various means of adjustment. A popular and simple method is by means of slots in the base plate of the generator or other driven unit, so that it may be moved along on its base and thus slightly change the position of the driven sprocket

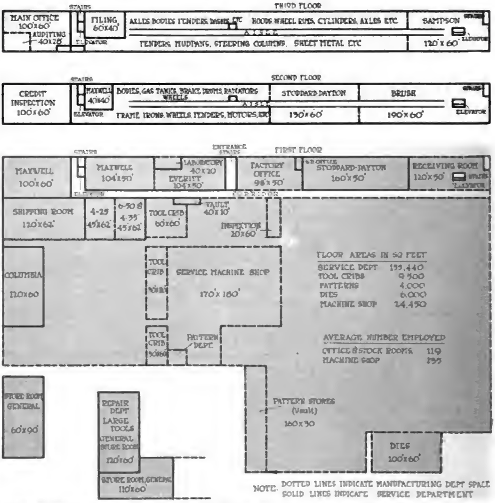
One point which should not be overlooked in designing a chain drive for least wear is the use of sprockets which are so related to each other that one has an even number of teeth while the other has an odd number. That is, if one wheel has eighteen teeth and the other thirty-six teeth, there will be unequal wear because the same combination of links of the chain will come into action with the same teeth of the sprockets each time around. To avoid this and to cause even distribution of the wear, one sprocket should have, say, twenty-one teeth while the other has forty-two teeth; or nineteen and thirty-eight; seventeen and thirty-four, and so on.

One chain maker in particular, the American High Speed Chain Co., advises that on camshaft drives, pinions of not less than seventeen teeth should be used. Nineteen or twenty-one teeth are preferable as they give better action and tend to longer life. On generator and starter drives this same company states that thirteen and fifteen tooth wheels are permissible.

Chain makers as a rule have fixed relations between the center to center distances, pitches, and number of teeth in the sprockets. Supposing the ratio of the two wheels to be required two to one. There are several sizes of wheels that can be used to attain this ratio, but they have to be designed to meet the sizes which the chain maker recommends. If the sprockets can be made of a size to admit of one having twenty-one teeth and the other forty-two, then with a 1-2-inch pitch, the center distances could be any of a list of from ten to twenty-five dimensions. For a total chain length of 70 pitches, say, the center distance would be 9.475 inches. If the designer desired to have a distance between centers of about 10 inches with sprockets of the above-mentioned size, he would find that the closest he could come to it with a 1-2 inch pitch chain would be either 9.981 inches, or 10.49 inches, these giving chains of 72 and 74 pitches, respectively. Therefore, the designer cannot arbitrarily say his center distances are to be a certain amount. They must come as near to that required distance as the chain requirements will allow.

Solving the Spares Problem

Centralized System Supplying Used Car Parts Shows Efficiency—Prompt Supply and Reasonable Charges Insured by Systematized Control



Plans of first, second and third floors of the Newcastle, Ind., plant of the Maxwell Motor Co., from which it supplies parts for 164 different chassis models

THERE comes a time in the history of every automobile when the service department of the company which built it must be called upon to furnish replacement parts or equipment, and much of the machine's ultimate value to the owner depends upon the efficiency and promptness with which these can be obtained when needed. As the motor car buying public grows wiser, it becomes harder for the concern with no well-organized spare parts department to sell its cars. The buyer investigates that end of it nearly as carefully as he does the mechanism and appearance of the vehicle he is about to purchase, knowing what it means to break a spring or strip a gear and then have to wait several weeks for a new one to arrive from the factory.

It may safely be said that up to a few years ago many of the automobile makers were too busy selling their automobiles in the first place to worry about replacement parts for old cars, but today, the majority of those who have built the foundations of permanent organizations realize the great advantage of keeping their cars sold. It means much to a car owner to know that should he break an axle shaft he can have another one by express, as the result of a wire order, within 2 or 3 days. It usually means that the next time he is in the market for a new car, he will get one of the same make, for he realizes that he is buying service as well as machinery.

Thus it has come to be the rule with the bigger makers to have a carefully planned system of filling parts orders with the greatest haste. To do this it is necessary constantly to have on hand a fairly large stock of parts for every model which the factory has built, for if it were necessary to make an obsolete part after the order came in, the anxiously waiting car owner would soon give up in disgust and make up his mind that it would do no good to buy even a current model of that concern's make, for it would one day be obsolete and he might then experience the same trouble in getting parts for it that he is now experiencing in securing them for his 1907 model.

Fully aware of all of the advantages of an efficient service organization, the Maxwell company, in taking over the property of the bankrupt United States Motor Co. some 2 years ago was confronted with the problem of how best to build up a service department which could efficiently serve the owners of all of the different makes and models for which the parent company had been responsible. There were nine different cars. Stoddard-Dayton, Maxwell, Columbia, Everitt, Brush, Courier, Sampson, Alden-Sampson truck, and Courier Claremont, which latter was at one time a part of the Brush plant's output. Nearly all these companies had made a number of different models in its time. The first Maxwell was a two-cylinder runabout constructed in 1905, and the last a 1913 40-horsepower touring car. Similarly, the first Columbia was an 1896 creation in the form of an electric stanhope; the last a Knight-motored car of six cylinders made for the 1913 market. The same applies to the other makes, so that, taking the stock models of all the companies, there were in all 164 different chassis for which the U. S. Motors Co. had been attempting to supply parts when the Maxwell company took the reins.

Why Plant Was Founded

It is estimated that this number meant the total number of parts to be kept on hand was 146,000. No small task this, particularly as the Maxwell company was under no legal obligation to take care of the owners of all these models when it bought the assets of the defunct concern. At this time there were 122,000 of these cars of various types and models on the road, and it meant that, if the Maxwell company did not take care of them, the spare parts business would have to be turned over to a concern making a regular business of supplying parts for old cars. This would put the whole 122,000 owners at the mercy of a parts concern which could exact any prices it might be able to get, a far from desirable condition of affairs.

But the Maxwell company felt that had there been no way for these owners to obtain replacement parts, the second hand value of their machines would have been cut to a very low level. Realizing this, and recognizing the value of such an investment in good will, the concern took steps to concentrate the parts for all of these 164 models under one roof. It was a herculean task and it required months to bring the thousands of parts to the one point—Newcastle, Ind. Here the Maxwell company inherited the plants which the Maxwell-Briscoe company had used for making its cars. The geographical position being central, and the plants being best adapted to such a parts station as was required, led to the decision; and to the ultimate investment of $2,000,000 here in the conversion from a strictly manufacturing proposition into a combination manufacturing and storage plant where literally miles of bins and piles of parts are now kept in readiness to answer to the hurry calls from owners in all parts of the country.

Order Out of Chaos

The history of the troubles which the new Maxwell company had in establishing this service center have been told before in these columns. How the stocks of parts which the U. S. Motors Co. dealers had carried in different parts of the country were all shipped to Newcastle, how it took months to sort, index and identify them, has been explained. It was discouraging to those to whom the work was entrusted, but finally came order out of chaos and by the close of 1913, J. E. Burns, Superintendent of Service, and his staff, had accomplished the difficult task and had in running shape a well-ordered service department with a stock of parts for each one of the 164 models.

A Complicated Task

The drawings, jigs, tools and dies for the multitude of parts were scattered in different parts of the country, and these had to be brought to the Indiana plant in order to make up a supply of certain pieces for which there was sure to be a call later on. Many drawings were missing, many could not be identified properly, and it took the best efforts of men brought from each of the old factories, who were familiar with the parts of their cars, to determine just what many parts were, and for what model. Some of the old firm's stock inventories and records were incorrect and, considering everything, the task could scarcely have been more complicated.

Today, if you order a right rear fender for a 1908 model K Stoddard-Dayton, or a front axle for a Brush runabout, it will be shipped to you not later than 48 hours after the order is received at Newcastle. You can get these parts for obsolete models just as quickly as any of the parts for the present Maxwell 25, now being manufactured, and the service business of which has just been transferred to the main service plant, along with the rest.

How Ordering Is Simplified

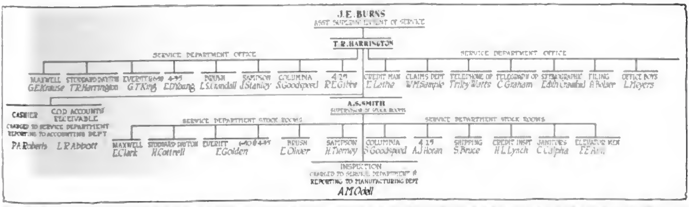
The Maxwell Newcastle plant is strictly a factory which makes a business of selling parts for cars. It may be likened to any of the great mail order houses. Its stock in trade is parts for cars in service and its special machine shops are concerned principally in keeping that stock up. Under the name of the Maxwell Motor Sales Corp., it is simply a unit of the Maxwell organization, only instead of selling cars it sells parts. It must show its own profits and has its own organization.

Like a mail order house, a catalog plays an important part, though it is not called a catalog, but is known as the dealers' master parts price list. It is unquestionably the largest parts price list ever issued in the automobile industry, with 417 pages enumerating every part of every model of each of the nine makes of cars already mentioned. Its size and thickness make it resemble a big city telephone directory, and it is the dealers' handy reference. It gives the list price of each part, the part number and so on. All models of any one make are segregated into one section of the master book and are printed on a different color of paper from the rest, so it is a simple matter to ascertain the number and the price of any desired part.

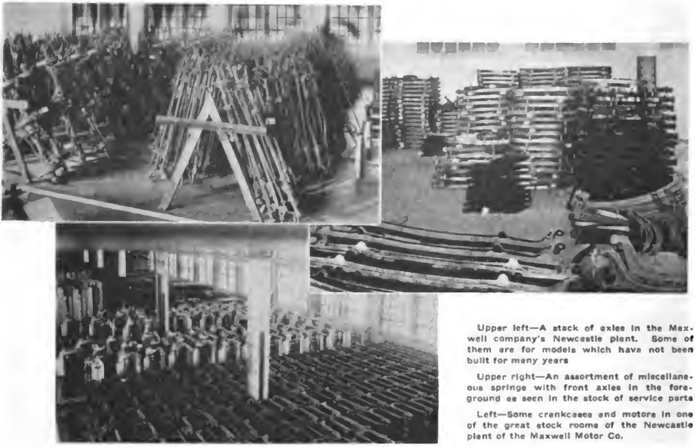
This master price list did not come until after the Newcastle plant had everything sorted out and inventoried and, as it has recently come off the press, after months of preparation in order to weed out duplications, check the parts numbers for accuracy and so on. The book has been given wide distribution, the idea being to place one in the hands of every dealer so that, should he be called upon to repair one of the makes of cars for which the Maxwell company is sponsor, he will know where to look for parts. Thus the book is valuable not only to the Maxwell dealer but to other garage men as well. Of course, every garage man and dealer gets the regular discounts of a trade transaction.

Organization of Plant

The total floor space at Newcastle is about 650,000 square feet, of which 155,000 is occupied by the service department proper and the balance given over to the manufacturing



System of organization worked out for Newcastle plant of the Maxwell Motor Co., which supplies parts for all old models of the U. S. Motors Co.



Upper left—A stack of axles in the Maxwell company's Newcastle plant. Some of them are for models which have not been built for many years

Upper right—An assortment of miscellaneous springs with front axles in the foreground as seen in the stock of service parts

Left—Some crankcases and motors in one of the great stock rooms of the Newcastle plant of the Maxwell Motor Co.

division. The main building, in which the majority of the bins of parts and racks for larger articles are located, is 722 feet long by 60 feet wide and three stories high. Behind and adjoining is the machine shop, which has a saw-tooth roof and is 500 feet long by from 250 to 400 feet wide. Also behind the main building and parallel to the big machine shop is a forge department with thirty-two hammers, this doing all the forging for the present Maxwell car.

In a portion of the rear building is the shipping department, 120 by 63 feet, and also storage for Columbia and Maxwell models 45 and 62. Other supplementary departments consist of the power house with its big Allis-Chalmers direct-connected steam engine and generator and turbine and generator; the testing laboratory in which samples of each heat number in each shipment of materials to the manufacturing department is analyzed to determine whether or not it comes up to specifications; the vaults in which the patterns and blue prints of parts are kept, and the store houses.

The service department employs about 300 men in its various divisions, these being in two main groups; those directly under the supervision of the administrative heads, and those directly answerable to the supervisor of the stock rooms. The latter reports to the service superintendent along with the other divisions, however.

The scheme of organization is, in the main, to have a certain corps of employees to handle the orders and service parts of each make, or group of makes, of cars. To this end, the office force is divided into sections, these turning their orders over to a part of the stockroom force which deals exclusively with parts of that make or makes of cars. For instance, there is a group of office men to which orders for Everitt parts are given: they determine just what parts are required and have been chosen for Everitt work because of their former connection with that make of machine—either on the service or manufacturing sides. In the stockroom another set of men also familiar with the same car are employed.

This scheme gives most efficient service in the handling of orders. Men who have had long experience with the construction of any one make of car are naturally best adapted to filling orders for its parts and, when an order comes in which is not very clear the value of this experience is apparent. Anyone would know what is meant when the part number is specified, but in cases where the customer does not know the number and orders by description, the experienced man must determine what is required and enter the proper part number on the order which goes to the stockroom. To get these experienced men the company had to scour the country for former employees of the different plants.

Stockroom Organization

The stock rooms are arranged to segregate all of the parts of any one make of car in one part so far as possible. However, some of the larger parts such as radiators, fenders and so on, are put together, since they require special racks and it would not be feasible to have a few of them in each make's particular section. This segregation applies specially to the bins of small parts. For instance, one division looks after the filling of orders for Sampson trucks and for all makes of radiators and fenders. Two men who know the difference in construction of the various radiators used by the nine makes of cars handle this division. They know if a certain radiator ordered is interchangeable with that used on another make, and which would be the best to send.

Order Record System

The order and record system is simple, direct and efficient. Starting with the coming of the mail to the plant, each letter is consigned to a compartment of the mailing desk, this corresponding to the division men who will handle the order. Having passed through the hands of the credit man, who determines whether to send c.o.d. or charge, the order goes to the special division men who indicate just what part number it is and otherwise check it to see that it can be filled intelligently with the information at hand.

Suppose a front spring bolt for a model 40 Maxwell is ordered and that the order does not specify the part number. The division dealing with the Maxwell 40 gets the letter and, looking in the master parts book, finds this to be part No. 17,805. This is indicated on the letter, which is then turned over to the stenographic department where the order is transferred to a shipping order. This is on 8 by 10 paper and is made out in five copies, the white original, the yellow office copy, pink stock room copy, buff shipping department copy and the blue acknowledgment, which is shown herewith.

Having been entered in quintuple on the regular forms, these stenographic copies are checked by the division clerk against the original letter. Finding that No. 17,805 is correctly entered on the forms, the acknowledgment is immediately sent to the customer by mail. The pink stock room copy, the white original and the buff shipping copy then go down a chute to the parts office handling Maxwell 40. Here they are time-stamped, and a clerk refers to a card index which has for its reference number the part No. 17,805. On this card is indicated in what bin number the spring bolt will be found. This is entered on the three copies of the order, which are then turned over to a stock boy. He goes to the bin indicated, secures the bolt and after inspecting it, sends it to the shipping room along with the buff-colored and white copies, the pink one being filed in the parts office file. The time stamp also indicates when the bolt was turned over to the shipping department.

Having wrapped the bolt for shipment, this department weighs it and indicates the weight, together with the classification, on the white copy. The buff copy is packed with the bolt and goes to the customer, and the white copy then goes to the office where the charge for the shipping is entered, and the total charge is figured. If the bolt goes c.o.d., these charges are entered and the original sent back to the shipping department, giving it instructions as to how much must be collected at the receiving end; if it is to be charged, this instruction comes back to the shipping department. Having completely cared for the bolt in either case, the shipping clerk time stamps the white copy and sends it back to the office for billing and filing purposes. Inasmuch as the yellow office copy is filed with correspondence from the customer, a cross index of the transaction is afforded when the white original finally gets into the files. At any future time, the office can learn from this just when the part was shipped, how shipped, who checked it, who filled the order in the stockroom and so on.

In using these five copies, a series of symbols are employed, these prefixing the order number and referring to the make of car. For instance, an order for obsolete Maxwell parts goes on a form having N.M prefixing the number. Brush parts have N.B as a prefix, Maxwell 6-50 has N.F, Everitt N.E, and so on. Thus if any reference is made to order No. N.B 23675, the filing department knows immediately that it deals with Brush business and goes to the Brush files for the No. 23,675; when it is considered that there are some 150,000 live parts orders, the advantage of this system will be readily apparent.

In connection with the stockrooms, a perpetual inventory of parts on hand is kept. This is done by bin cards which show at any time how many parts are on hand, in addition to indicating on what order numbers any of them were taken out. When a part is removed from a bin, the clerk notes this on the bin card, and also subtracts from the total, bringing the inventory up to date at all times. Each stock keeper has a minimum stock quantity record and, when the quantity of a certain part reaches this minimum, an order for a fresh supply is placed with the supervisor of stock. This is referred to the superintendent and, if the part is one for which he deems it advisable to issue a manufacturing order, he sets the machinery in motion for replenishing the supply.

Credit for Unused Parts

The credit inspection department is a division which has an important work to perform. To it go, immediately on receipt, parts which the customer claims are defective, or any which have been sent in as samples for duplication. It is the duty of this department to examine claimed defects and to pass upon them, making out proper credit slips. If the inspection reveals that the part is good, it is put back into stock. Frequently a customer will return a part for credit which he had ordered with the intention of using, but later found that he did not want it, and the credit department must assure itself that such returned parts are not defective. Or, if it is the case of a sample sent for duplication, this is identified and a correct shipping order made out for it which then goes through the regular procedure.

If a part comes to this credit inspection department without explanation, a report slip for the office is made out notifying its arrival. At the office, correspondence relative to it is looked up, and proper disposition instructions issued to the credit inspection division. In this department there is a

Above—A view of the correspondence department of the Newcastle plant where letters from owners of old models in need of parts, etc., are handled

Left—Some shipments of a day ready for the express companies. The work is facilitated by placing packages for any one large center in one pile so that sorting will be simplified series of bins which are used for storing parts held for disposition instructions, and the bin in which any part is stored temporarily is indicated on the report slips, so that anyone can find it immediately should it be required.

With this comprehensive system, thousands of parts are shipped, or ready for shipment within an hour from the time received. Twenty-four hour service is the rule and, if a part cannot be shipped in that time, a letter of explanation is written to the customer. Occasionally there will be parts shortages over which the plant has no control. For example, suppose a steering spindle for a 1906 car is required. It might be that for 2 or 3 years only one or two of these has been called for, but orders may come in suddenly to the tune of ten or twenty, from all parts of the country. As this demand could not be foreseen, the plant has not looked for any such requirement and probably has not the number needed to supply all the orders. Then the factory writes telling the customer of the delay and why.

It makes a definite promise as to when the part will have been made and when it will be shipped, and it is a hard and fast rule that a part must go forward immediately when promised in cases of delay of this kind. This is done by means of stock chasers who get promises from each of the departments concerned in the production of the part and by figuring out the time each will be through with its part, can say definitely when shipment can be made. The departments are made to adhere to these promises, or they must give a good reason why. The manufacturing department, however, cooperates with the service department to satisfy the customer. It is obvious if the customer knows when to expect a part delayed in shipment he can make plans accordingly and feels better toward the company than if delays happened and there was no definite time set or reason given for them. However, the delay cases are said to be only 5 per cent. of the great mass of orders going ahead at all times.

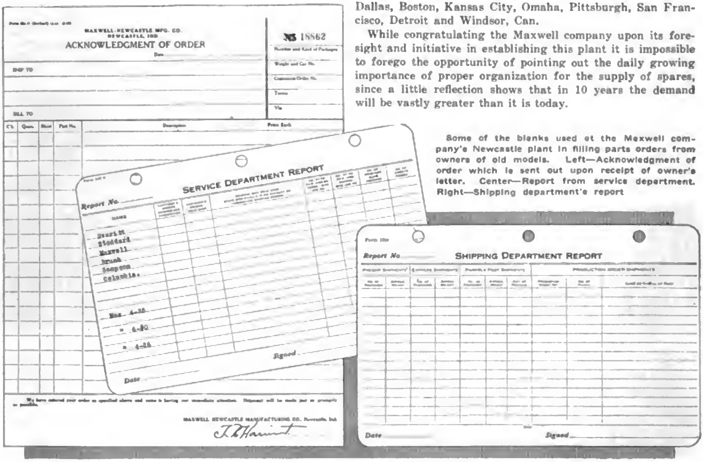
The shipping end of the Newcastle organization includes a traffic department which aids customers in routing shipments and tracing those which go astray. It runs down reasons for refusals of delivery and acts to get parts transported most expeditiously. Sometimes a customer orders a part sent by express when parcel post would be cheaper and vice versa, and the department looks into each case before letting it go out. An effort is made to get parts through as cheaply and at the same time as quickly as possible. Small shipments are made by express or parcel post and, as there are three express companies and three leading railroads serving the city, this makes facilities for prompt shipment ideal.

On an average day 600 to 800 parcels go forward, but since the Maxwell 25 parts have been taken to Newcastle also, it is expected that the shipments will increase to about 1000 per day. In an average week of the busy season last year the number of orders was 3500, of which 500 were telegraphic or by telephone. In the fall the number goes down somewhat.

The Maxwell company has recently perfected a service organization system covering the entire country, fourteen service stations having been established. The Newcastle plant is the supply station for these, in addition to supplying direct its own territory which embraces the middle central states.

This service system which has been in the process of formation for some time went into effect on Jan. 1 and it makes for a quicker supply of parts from the stocks in the fourteen cities, for each takes care of adjacent territory. They are all under the direction of the main service plant at Newcastle, and carry stocks for the present model and also for the four-25, the six-50 and the four-35 which were made up to a year ago by the present Maxwell company. These outlying stations do not attempt to have parts for the obsolete cars, for only the Newcastle plant and a supply station at San Francisco do that. Thirteen of the fourteen stations have been definitely established, being in the cities of Chicago, New York, Memphis, Atlanta, Minneapolis, Dallas, Boston, Kansas City, Omaha, Pittsburgh, San Francisco, Detroit and Windsor, Can.

While congratulating the Maxwell company upon its foresight and initiative in establishing this plant it is impossible to forego the opportunity of pointing out the daily growing importance of proper organization for the supply of spares, since a little reflection shows that in 10 years the demand will be vastly greater than it is today.



MAXWELL-NEWCASTLE MFG. CO.
NEWCASTLE, IND
ACKNOWLEDGMENT OF ORDER
Date
No 18862
Number and Kind of Packages
Weight and Car No.
Consumer Order No.
Terms
Via
SHIP TO
BILL TO

Ck	Quan.	Short	Part No.	Description	Price Each

MAXWELL NEWCASTLE MANUFACTURING CO. Newcastle, Ind.

SERVICE DEPARTMENT REPORT
Report No.
NAME
Everitt
Stoddard
Maxwell
Brush
Sampson
Columbia
Max. 4-25
" 4-40
" 4-35
Signed
Date

Form No.
Report No.
SHIPPING DEPARTMENT REPORT
Date
Signed

Some of the blanks used at the Maxwell company's Newcastle plant in filling parts orders from owners of old models. Left—Acknowledgment of order which is sent out upon receipt of owner's letter. Center—Report from service department. Right—Shipping department's report

The Improvement of Spring Systems—VII

By M. C. K.

(2)—Shocks and Movements of Vehicles Equipped with Springs and Rigid Tires

(Continued)

STILL some remarks which, on second thought, seem better disposed of now than later, on the tempering of horizontal shocks and the relations of an improvement of this kind to customary construction!

It was shown in last instalment that, so far as vehicles not equipped with air tires are concerned, the very considerable shock forces involved in retardations and accelerations remain uncushioned and are resisted by mere brute strength of materials, with the result that strong vibrations are the rule and fractures of radius rods, springs and shackles and of frail portions of the load are not uncommon; also that such uncushioned shocks of considerable severity must occur in all rough driving whenever a road obstacle rises somewhat sharply before the wheels and in lesser degree under other circumstances, always accompanying in some measure the vertical shocks which are cushioned by the springs. From the figures it appeared that the neglected horizontally-acting shocks probably are more severe, representing a greater kinetic energy, than the vertical shocks in the case of an obstacle 3 inches high encountered by wheels of 40 inch diameter at a speed of 35 miles per hour. A higher obstacle and a smaller wheel would of course increase the horizontal component of a shock more than the vertical component, while the effect of higher or lower speed in this respect may be more doubtful and subject to special inquiry.

Relief for Air Tires

The unavoidable inference to the effect that the most severe work required of air tires, where these are fitted, is that of absorbing the horizontal shocks, Fig. 15, which are not otherwise cushioned (most severe, unless the lateral shocks so far not considered at all should prove even worse) brings this side of the subject into sharp actuality for vehicles with air tires as well as for the commercial vehicles whose tires can do but little in absorbing or distributing shocks. It may be that air tires would last longer if they were relieved of the worst strains through the possibility of a spring-resisted horizontal movement of the wheel axles or by other equivalent provisions. It may also be that the degree of inflation which conduces to maximum durability would be more acceptable to the vehicle users, and therefore more commonly employed, if such additional provisions in the spring system assisted the tires in the horizontal cushioning and yielding. (In the special case of corded tires, in which there is not supposed to be any other horizontal yielding than that which appears as the horizontal component of radial yielding at the point of impact, the saving of fabric may be less pronounced, unless a shock is sharp enough to test the ultimate strength of the cords, but the saving of the rubber coating, on the other hand, should be so much more important, even if the radial yield with this tire construction may be greater for a given degree of inflation, but this matter belongs under the head of refinements).

Purposes of Flat Springs

It was also referred to that the prevailing use of semi-elliptic and cantilever springs of so small curvature as to be almost straight under normal load was evidently dictated by considerations inseparably associated with the use of air tires to absorb the horizontal shocks, as such flat springs in themselves tend to make these shocks worse. The purposes served by this style of springs, it was mentioned, are (1) to safeguard steering where a steering-rod extending lengthwise of the car is employed, (2) the avoidance of lengthwise sliding motion in the universal of shaft-drive cars, (3) permitting the driving thrust to be transmitted from the rear axle to the frame through the springs. It might have been added that the flat spring is also supposed (4) to resist the rolling of the car at turns better than the spring with considerable "open," on the principle indicated in Fig. 16, and that (5) the present design of brake control also makes it desirable to have as little fore-and-aft displacement of the rear axle as possible. With the exception of No. 4 these considerations are all identified with this idea that the axle movements should be confined to the respective vertical axle planes, and therefore with air tires because in practice only the use of air tires reconciles in a measure an exclusively vertical axle movement with the need of cushioning the horizontal shocks.

The moment air tires are no longer depended upon for relieving these shocks, it plainly becomes an open question how the purposes served by flat springs in cars with air tires may be attained in vehicles operated with solid tires—or even in vehicles with air tires if it is considered desirable to relieve the air tires of a large portion of the strains to which horizontal shocks subject them.

As said last week, No. 1 may practically be disposed of by using a steering-rod acting crosswise of the vehicle, No. 2 is inferior in importance to the avoidance of shock and merely involves a suitable redesigning of universal joints, No. 3 refers to a method for applying the thrust which was employed in the very early days of automobile construction, was thereafter generally abandoned and whose re-adoption has not yet been universally recognized as sound for any but light-weight and medium-weight vehicles equipped with long broad-leaved springs, and in their case only if they are supplemented by checks for the rebound or spring extensions; and the application of the method to cantilever springs is not very convenient or promising, so that it may be assumed that the flat horizontal spring will go out if cantilever springs come in.

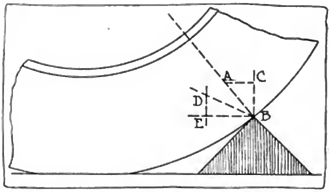


Fig. 15—Roughly illustrating the cushioning of horizontal shocks by air tires. If B yields radially as far as A, the axle will be cushioned horizontally for the distance AC. If the direction of the yield of the tire is BD, as with higher speed, the fabric is more severely deformed, but the cushioning of the horizontal shock extends over the distance BE. The distance AD represents the deformation of the fabric

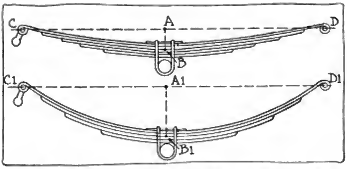


Fig. 16—Pressure acting at C and D, vertically upon the plane in which the springs normally work, has only AB as lever arm for twisting the spring, while it has the leverage A1 B1 when acting at C1 and D1

Interference with Brake Adjustment

With regard to No. 5, brake control linkage would probably long ago have been re-designed in such manner as to have the movement required of the brake pedal or lever for a given brake pressure completely independent of the relative position of the rear axle to the frame, rather than approximately independent, if the variations due to axle movement were not smaller than the lost motion due to needed clearance and to wear. With such linkage as is commonly employed, it may be figured that a deviation of the rear axle of 1 inch from its own initial vertical plane will cause a variation of only about 1 1-3 inch in the pedal movement needed for effecting a 45 degree turn of the brake cam, while clearance implies a 3 to 4 inch pedal movement, often increased to 6 inches by wear, before the brake begins to take hold.

A spring suspension providing for a relatively large but elastically resisted horizontal axle movement for the purpose of cushioning the horizontal shocks—either to replace the work done by air tires or to assist it and enlarge upon it—might call for a re-designed brake linkage, but the task of compensating for a 2-inch horizontal axle movement, for example, should scarcely deter a capable designer.

Lateral Shocks and Body Roll

Finally, with regard to No. 4, while the flat spring takes the lateral centrifugal thrust of the vehicle body at turns in the road without pronounced tendency to torsion of the leaves or wrenching of the clip—unless there is question of a cantilever spring whose tendency to cause rolling depends upon the securing of one of the thin ends of the spring to an independently movable part, namely the axle—its advantage at this point is again firmly bound with the concurrent use of air tires, since the flat spring takes the thrust without yielding and the needed cushioning of the lateral shock depends wholly upon the air tire action. Solid rubber tires, to be sure, can absorb lateral horizontal shocks much more efficiently than the longitudinal or the vertical ones, so long as they are new and extend 5 or 6 inches from the wheelrim, but when they wear down, as they must with present types of solid and cushion tires, this property is lost long before their usefulness otherwise is ended. And the general use of tire bands of sound-deadening material but without appreciable lateral or other elasticity from the beginning is among the near possibilities of the future for commercial vehicles if the cushioning of shocks can be managed independently of the tires.

In further consideration of No. 4 it is noticed that rolling of the vehicle body at turns depends mainly upon torsion of the springs only when the center of gravity of the body is very low—about the level of the pivots in the case of half-elliptic springs—but mainly upon other factors if their center of gravity lies much higher, as in all commercial vehicles. Here the action arises from the compression of the springs on the outside of the turn and the simultaneous extension of the springs on the inner side, which will force torsion of even a flat spring or, in the case of equipment with air tires, will force the axle out of parallelism with the ground by compressing the outside and relieving the inside tire. Considerable relief from the tendency to roll can be obtained now by the use of some of the spring checks in the market which retard spring extension and by overload springs on both sides of the vehicle, but the main point is that to obtain it by using a type of spring which prevents horizontal axle movement—and thereby the cushioning of horizontal shocks—incidentally implies either the acceptance of lateral shocks in all their severity, when air tires are not used, or the burdening of the air tires with the entire destructive influence of these shocks, which may be violent in the case of the vehicle skidding into ruts and under similar conditions. There is thus occasion to look for better expedients than the flat spring to obviate roll, and one of the best chances lies perhaps in building up the actuating levers of spring dampers or rebound checks as robust lateral springs, since it is becoming recognized that these devices at all events should be much heavier, stronger and wear-enduring than they generally have been in the past.

Dispensable Design Features

Altogether, none of the features in present construction which are inconsistent with the much needed cushioning of horizontal shocks, coming in the direction of or opposite to the movement of the vehicle, are in themselves indispensable or even only desirable for motor vehicles in general, but represent merely a simple and elegant constructive development wholly depending upon the use of air tires for its merits; a development which leans heavily on the air tires in subjecting them to extreme stresses, and one which becomes obstructive of progress in design when accepted for vehicles which must be operated with tires having no capacity for adequate cushioning of the most severe shocks which may occur.

Clashing Opinions

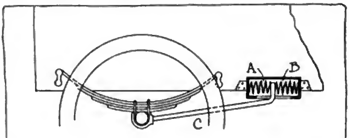
Though it is in itself rational that horizontal springing should be required in motor vehicles, on account of their higher speed, while the traditions received from vehicles drawn by animals recognized only vertical springing as necessary, doubts are freely expressed in automobile circles with regard to the practicability of getting relief from horizontal shocks in commercial vehicles without constructive complications whose cost would be out of proportion to the gains to be expected in the form of reduced maintenance expense and greater comfort, speed and safety, and many persons are inclined to think that the standard spring systems in some manner do take care of the horizontal shocks in a considerable measure without special provisions to that effect. Both views are contradicted through the acknowledged advantages of air tires for absorbing the shocks in question, both the longitudinal and the lateral horizontal shocks. Air tires constitute one practicable and not very complicated means for getting relief. But there are some objections to them; their cost, their unexpected deflations, their liability to injury when heavily loaded. And they are overworked. Additional practicable means for doing what they do in the matter of the horizontal shocks, whether better or not quite so well, would save the air tires where they are used and replace them where they cannot be used. The practicability of the additional means is the issue.

Practicability Discussed

This issue came up recently in a private discussion on the construction points involved in providing for metallic spring action to temper the horizontal components of road shocks. Five distinct questions were raised which for the sake of clearness have been left in abeyance in the foregoing or barely touched upon. It was doubted (1) if a special horizontally acting spring element was really required or a spring whose compression is accompanied by a horizontal movement could take care of vertical and horizontal shocks at the same time, and, in the latter case, (2) if the spring would need to be stronger and less flexible than one employed for vertical shocks alone. It was also held to be doubtful if (3) the driving thrust could be properly delivered from an axle capable of yielding horizontally, either through the spring, using it as a strut, or through a special thrust rod. And it was contended that, if provisions are made for absorbing the head-on shocks, it is illogical (4) not to provide similarly for the shocks of sudden accelerations, as at starts of the vehicle with heavy load on a grade, perhaps with insufficient gear reduction and the clutch inclined to grip—so much more as these shocks react upon the clutch and the motor. Lateral shocks, it was admitted, could probably be taken care of independently unless (5) the rest of the spring suspension interfered by its rigidity in the lateral directions. While not exhaustive, the talk on the subject furnished some results.

Combination Springs Impossible

Discussion of point 1 started with the suggestion that any combination-action of the vehicle spring for both kinds of shocks would be precarious, not only for fear of overloading a spring found suitable for the vertical action alone—as this might be obviated by different spring dimensions or progressive resistance to flexion, perhaps—but mainly because a severe horizontal shock, one of those that strain clips and shackles, would be insufficiently cushioned at the first moment of impact when only the small—necessarily small—movement of a spring flexible enough for the vertical cushioning were relied upon to this end. At all events a special resistance to the horizontal movement would have to be arranged, it was soon discovered, in order to get any appreciable benefit for the horizontal cushioning from the horizontal axle and spring movement. That lies in the very nature of the purely mental operation of resolving a shock which in reality is oblique into its vertical and horizontal components. But a separate spring acting, for example, upon the shackle at the rear of the main spring to prevent horizontal displacement would inavoidably act as a stiffener of the main spring for all vertical action. It was therefore concluded that the spring should be capable of horizontal movement during compression but not subject to it of necessity, and the spring resistance against the horizontal movement should be independent. In other words, the spring should be shackled both in front and at the rear. This disposed of point 2 as well.



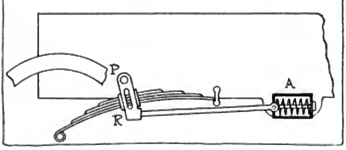
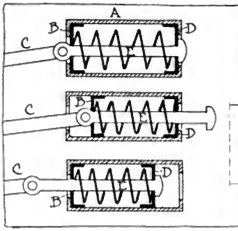


Fig. 17—Double-acting thrust rod as applied to half-elliptic springs. Spring may be flat if greater lateral rigidity is wanted
Fig. 19—Similar plan with cantilever springs, but two actions linked. Proportions and details in both cases merely diagrammatic



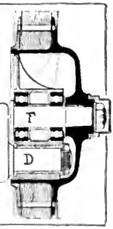


Fig. 18—A possible arrangement for taking thrust and pull from the axle by means of single double-acting spring. Fig. 20—The Genillon oscillating front wheel

Points 2 and 4 resolved themselves into the question whether a thrust rod capable of longitudinal yielding in both directions would act properly in conjunction with a double-shackled spring. Fig. 17 shows the combination in its principal elements, though the question of damper action for the recoil of the thrust rod springs might also be considered. If the two coil springs were independent of one another, A should have an initial tension (produced by compression within the confines of the cylindrical casing which is secured to the vehicle frame and contains both springs and the end of the thrust rod between them) equal to the pressure of the mildest horizontal shock deemed severe enough to require cushioning and B should have an initial tension equal to the normal full-load driving thrust on a level average road. But as one of the springs would influence the other, their tensions must be much higher—nearly doubled, at a rough estimate—and they must be equalized by compromising the two requirements, as otherwise they would tend to equalize themselves. It is possible, however, to use a single spring arranged to work in both directions, in both cases by compression. One such arrangement is shown in Fig. 19, in three different positions. C is the thrust rod, E the link with head F for transmitting the movement of the rod in either direction to the cups B and D which compress the spring and are capable of sliding on the link and in the cylindrical case A, which is secured to the vehicle frame. Probably many different devices could be made to serve the same purpose.

By applying this general principle to cantilever springs, the arrangement shown in Fig. 18 was suggested, the pivoting clip P at the middle of the spring being simply longer than usual and formed below the spring with a suitable abutment R for the thrust rod. The thrust rod spring is shown of the Fig. 19 type. The scheme was admittedly experimental.

Front Axle Problem Made Bothersome
By Complication with Steering

For front springs a construction meeting all requirements as well as this is done by air tires, appearance and safe steering during jolts fully considered, is not so easily or confidently outlined. The Büssing construction, which was shown last week in Fig. 14, is elaborate and gives but a scant yield horizontally. The Genillon "oscillating wheel," Fig. 20, was found operative and safe on French army trucks in 1912 but gives very little shock-relief, because elastic resistance to the oscillation is missing, while the driving momentum is also liable to place the axle spindle D in dead-center line between the wheel spindle F and the point of wheel impact with the

(*Continued on page* 337)

Inquiries

The purpose of the Rostrum department is primarily to aid in the solving of motorists' problems. Readers of THE AUTOMOBILE *are requested to allow our editorial staff aid in the solution of difficulties as they arise and perhaps through this assistance reduce the cost of upkeep of their cars and gain a useful knowledge in the economical phases of the vehicles which they use for recreation or business.*

Answers are made both through the mails and through these columns, the only requirements being that the letters are legibly written on one side of the paper, and are accompanied by the name and address of the sender in order that they may be taken care of through the mails should that be deemed advisable. A nom de plume will be used should the sender so desire.

The Rostrum

Wants Two Sparks from Single Magneto

EDITOR THE AUTOMOBILE:—I am desirous of getting a little better power and efficiency out of my Teetor 4 by 6 T-head motor with Dual magneto.

From the sketch, Fig. 1, you may be able to visualize what I wish to do; that is, to use the single wire from the distributer terminal on the magneto and to attach it permanently to a wire connecting the terminals of two spark plugs.

I have not tried it as yet, my motor being still in the shop undergoing a general overhaul; nor have I ever heard of anyone else trying it; so I ask your opinion in the matter.

Jacksonville, Fla. ROY W. CORBETT.

—The scheme you suggest for getting two sparks from a single magneto would not be practicable inasmuch as the two plugs are in parallel with the source. The current will always take the path of least resistance and will jump across this path only. Therefore, nothing will be gained over the single point installation. If you desire two-point ignition you will have to change to the double-point magneto.

Causes of Overheating Briefly Outlined

EDITOR THE AUTOMOBILE:—What is the cause of overheating the motor, or of the radiator boiling? Is it the fault of the radiator, or is it the fault of carelessness in operating the motor, by giving an uneven mixture of too much spark and too little gas, or giving too much gas and very little spark, or not having the engine properly oiled, or in general by racing the motor, or leaving the car running stationary?

Chicago, Ill. I. D. WHITE.

—The reasons for motor overheating can be divided into three general groups:—1, Faulty water circulating system. 2, Faulty motor condition. 3, Improper control of motor. These three conditions will be discussed briefly as separate units although it is always possible that the reasons for overheating come under more than one of these heads.

Taking up first the faulty water-circulating system, this harks back to the designer of the car. The problem is to conduct the heat units which would raise the temperature of the cylinder walls to too high a temperature, from these cylinder walls to the radiator. The medium used for conducting this heat is water. The water enters the cylinder water jackets at one temperature and the radiator at a higher temperature. The difference between these two temperatures, and the amount of water circulated are the two factors which determine how much heat is being carried away. Thus, since the specific heat of water is unity, if 100 pounds of circulating water are being carried through the system in a minute and the difference in temperature between the water going in and the water coming out is 10 degrees, 1,000 heat units, or British thermal units as they are called, are being carried away from the cylinders every minute.

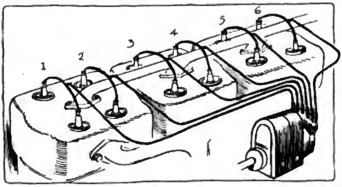


Fig. 1—Method of wiring to produce a double spark from a single magneto which is unsuccessful, because in each case the spark will choose the course of least resistance and will jump but one of the gaps

If, in order to cool this motor, it is necessary to carry away from the walls of the cylinders 1,500 B.T.U. per minute, it is evident that the cooling system is inadequate and must be corrected by either carrying more water through the system or by having a greater difference in temperature between the water going in and the water coming out.

To bring it down to the cooling system of the car as considered in general, the radiator must be great enough in area to keep the water leaving at a sufficient number of degrees cooler than the water entering the radiator. This would take care of one factor. To take care of the other factor, that is, the quantity of water passing through the cooling system, the water passages must be large enough to adequately contain the required volume and the water pumping or circulating methods must be efficient enough to be able to force this required amount of water through the circulating system.

In a word, all the elements of the cooling system must work together to carry the required amount of heat away from the engine cylinders, and should the motor heat due to a fault in the preliminary design, it can only be corrected by increasing the cooling efficiency through the use of a greater volume of water or a greater volume of cooling area.

Should the water circulation be correct, when it leaves the factory, but afterwards become faulty, it is generally due to either clogging or leakage. If clogging is the cause of overheating the trouble may be cured by washing out the cooling system and, if leakage, the cure is to renew the gaskets or packing or whatever may be the cause of the leak.

Poor motor condition, the second cause of overheating, is generally the fault of the driver of the car. When the cylinders become full of carbon or there is not sufficient water in the circulating system, the condition of the motor is not what it should be for general running. It prevents any of the systems of the car from acting properly and the cooling system is naturally affected. The remedies for troubles that come under this head are all simple and may be summed up under the general rule of keeping the motor clean and in proper condition.

Improper control of the motor will affect heating in two principal ways; traveling with a retarded spark is one and having the mixture too rich is another. When the spark is retarded the compression has already become less than it should be at the time of explosion and the explosion itself occurs later in the stroke with the result that, instead of the gas being cooled by expansion as much as it would be with the explosion point earlier in the stroke, it is much hotter at exhaust and hence the mean temperature is higher and the heat entering the cooling water greater.

With the rich mixture the charge is also slow burning and the result is that there is a higher mean temperature in the cylinder and overheating results. With the rich mixture also, there is a notable increase in carbon deposit which also acts as an agent in decreasing the cooling efficiency.

Wiring Headlights on a Ford

Editor THE AUTOMOBILE:—Will you please let me know how to wire the headlights for my Ford car, both from magneto and battery?

Buffalo, N. Y. R. KAYSER.

—The method used to wire the headlights of your car can be determined from the three accompanying wiring diagrams, Figs. 2 and 3, which show the connections both from the magneto and from the battery.

How to Lap Piston Rings

Editor THE AUTOMOBILE:—1—Will you explain fully the method of fitting and lapping in new piston rings?

2—Please explain whether there would be any advantage gained by fitting aluminum pistons?

Koszta, Iowa. WALL BROS.

—1—Place the cylinders on the bench, and apply some ground glass and oil to the interior. The ground glass should be very fine. Then place the piston in the cylinder and work it in and out until the rings are well polished and fit tight. Lapping is an operation which requires an experienced man. Furthermore, it is advisable to use an old cylinder wherever possible as there is danger of wearing the new cylinder.

2—Aluminum pistons are lighter and reduce the vibration, because of their light weight. The expansion of aluminum under heat is greater than that of cast iron giving great difficulty in determining clearance.

Effects of Back Pressure on Exhaust

Editor THE AUTOMOBILE:—1—Can you please tell me about what the pressure per square inch is on the piston of a motor at the time of firing? Also the pressure at the time the exhaust valve starts to open?

2—What pressure is counted good compression on a cylinder?

3—What would happen if a motor had a back pressure on the exhaust of 10 pounds, and the burned gases were not all expelled when the valve closed; the intake valve to be opened after the piston had moved down far enough to reduce the pressure in the cylinders. If it would not fire in that way do you think it would fire at a lower pressure?

B'klyn, Ind. C. McNEFF.

—1—The pressure per square inch at explosion depends upon the motor itself to a large extent, but on ordinary four-cycle gasoline engines, operating at a mean effective pressure of 90 pounds to the square inch and a terminal pressure of 40 pounds to the square inch, the combustion pressure on a good average card taken by the manograph would be about 300 pounds to the square inch.

2—Good average practice is about 70 pounds to the square inch.

3—If there were a continuous back pressure of 10 pounds on the exhaust, the pressure in the cylinder would not fall to atmospheric, but would fall to 10 pounds gauge pressure instead, approximately speaking. The result would be that all the dead gases possible would not have been expelled and the next incoming charge would be diluted to that amount. If the pressure in the exhaust passage remained constantly at 10 pounds, the piston would have to move downward on its stroke a distance necessary to produce a reduction in pressure of 10 pounds before there would be any suction on the intake. If the piston had not moved that far down when the intake valve opened, the motor would blow back through the intake manifold, giving rise to a wheezing sound or might even tend to blow the gasoline out of the float chamber on some carbureter designs. As a rule, the blowback would pass out through the air intake. All in all, this would be a very bad state of affairs and one which could not happen on a well-designed motor.

Communications

The editor of the Rostrum is anxious to secure from car users and others, communications dealing with the overcoming of difficulties in making repairs and in the numberless other phases of every-day automobiling. This department is mutual and is a common ground upon which an interchange of ideas and opinions can be made as freely as in the clubroom.

The ingenuity of the motorist who has his own garage and enjoys working upon his car is originally responsible for many of the improvements made by manufacturers. In fact, it is known that every maker is more than anxious to learn the opinions of the users of cars and is more than anxious to benefit from the experience gained by the mass of automobilists.

The Use of Thermo-Syphon Cooling

Editor THE AUTOMOBILE:—As a steady reader of your paper I would like to ask your opinion regarding the designing of motor cars. Will you tell me what you think is the reason why more manufacturers do not design their motors to be cooled by the thermo-syphon system which is so much more simple than having pumps to get out of order and a lot more places for the water to leak out. I have owned a

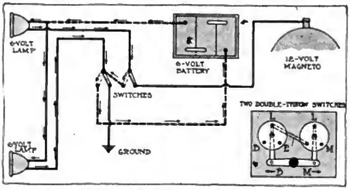


Fig. 2—Method of wiring Ford headlights with a 6-volt battery so that the lamps are in parallel when on the battery and in series when on the 12-volt magneto. The switch is arranged to be a two double-throw outfit to accomplish this result

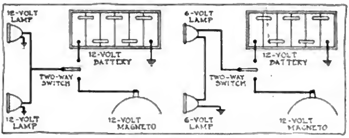


Fig. 3—Two methods of wiring Ford headlights with 12-volt batteries. Left—With lamps in parallel using 12-volt filaments, and right—with bulbs in series using 6-volt filaments

number of cars, only one of which was thermo-syphon cooled, but that one I have never been able to overheat regardless of weather or road conditions. I find that with this particular car, the motor always keeps at a temperature where it is most efficient; whereas with pump circulation the temperature is always varying.

From my observation it seems that the thermo-syphon has every advantage, but, if it has, why is it not more used?

Litchfield, Conn. F. L. Vanderpoel.

—This has been a matter of individual opinion on the part of engineers and it has varied greatly according to their personal ideas on the subject. Generally where cars have been made to sell at the lowest possible price the thermo-syphon system has been used for the reason that the expense of the pump was eliminated and the connections are more simple, while satisfactory results are at the same time obtained. On the other hand, others believe in the use of the centrifugal because it insures a positive water supply which will be renewed with a rapidity that is proportional to the speed of the motor.

Difference in Spur and Helical Gears

Editor The Automobile:—1—What is the gear ratio of the Everitt six, on high speed?

2—What is the horsepower rating of this car?

3—Where are spur or helical gears used on an automobile and what is the difference between them?

4—Does the driveshaft of the rear axle of an Everitt six carry the weight?

Bryan, Ohio. A Subscriber.

—1—The gear ratio of the Everitt six was 3.5 to 1.

2—The motor was 4 inches in bore and 4.75 inches stroke, giving a horsepower rating of 38.4.

3—Spur or helical gears are used for timing. The spur gears are those in which the teeth are cut radially about the periphery of the gear wheel and in which the teeth have been generated upon a circle which is in the same plane as the circle of the gear wheel with which it engages. The helical gears have teeth which would be generated upon the surface of a cylinder as cut by a spiral wound around it. Thus, instead of advancing from tooth to tooth as in the spur gears, with the helical gears the engagement is gradual as in a worm advancing spirally by having a movement axially as well as peripherally among the gear wheel.

4—The rear axle of the Everitt is semi-floating and hence carries a portion of the car weight.

Extracting Gasoline from Gas Well

Editor The Automobile:—Will you please give me such information as you have on the manufacture of gasoline. I own a gas well and want to start a plant to make gasoline. Can you advise me whether or not you think it a paying proposition? R. R. Price.

Jane Lew, W. Va.

—The most expensive part of the operation of extracting gasoline from a gas well is in the machinery. After this is once purchased it is only necessary to pass the gas through a compressor, compressing it to about 100 pounds to the square inch. After compression the gas is passed through coils of pipe under water and cooled, after which it passes in the form of gasoline through the exhausting end of the apparatus. The gas is then passed on to the consumer's line from this point. There are a number of manufacturers who supply outfits which would be suitable for your purpose, and you can get information as to the outfit which would be best suited for your individual needs by writing to an oil well supply company. It is impossible to tell without considerable correspondence as to the needs of each individual well, as they vary in their peculiarities. Some of them produce a very dry gas which is not worth compressing, while others carry enough liquid to make it commercially worth while to make the investment in machinery. It would probably be better to determine this by calling in an engineer who is acquainted with the business.

A Mysterious Single-Cylinder Motor

Editor The Automobile:—I have a single-cylinder gasoline water-cooled engine marked Pierce-8 and it weighs about 150 pounds. Will you please let me know through The Rostrum who the maker is and what it was used for?

The Pierce-Arrow company, Buffalo, N. Y., has no knowledge of such a motor. I would like to know how they crank this motor as there is no extension of shaft on either end of engine. On the front end of the crankshaft is the timer, and on the rear end is a yoke keyed on the shaft and almost touching the crankcase. Which was used for cranking it and what do you advise me to attach for that purpose?

2—Could this motor run a lathe 12 by 5, or anything similar requiring the same power?

3—Do you advise the use of tire savers, jacks, which are applied under the hub caps to raise the tires off the ground? I like to use them on my Pierce which has a double limousine. The car weighs 5,500 pounds. By lifting the car on the four hub caps I fear that the differential or some other part will be injured. Is there any saving on tires by doing this every night the car stands in the garage?

New York City. J. N. Liolios.

—We have been unable to find any record of a maker of this motor and are publishing this in the hope that one of our other readers will be able to give you the desired information.

2—If this motor has the power that may be assumed from its weight it should run your lathe.

3—If the car is to be left standing for any length of time it is always better to keep the weight of the car off the ground. As long as the axle housing of this car takes the weight there can be no fear of straining the differential.

Producing Oxygen Gas for Welding

Editor The Automobile:—1—Is the potassium-chlorate and manganese dioxide method the most economical for the production of oxygen gas in welding machines?

2—Describe the method of producing gas, the proportion those two ingredients should be mixed and the heat required to make the gas so as to use up the ingredients with the least loss.

3—What pressure should the oxygen be at when welding and should the pressure of acetylene be the same as the oxygen at the time of welding?

4—In what proportion is the caustic soda solution mixed and how far will a gallon of solution go?

5—How can the acetylene gas best be made, in a tank by itself, or are two tanks needed? What proportion of carbide to 1 pint of water?

6—What is the correct proportion of the two gases at the point of tip or nozzle?

7—What size hole is drilled in the tip commonly used?

8—What size are the tanks and what pressure do they have to withstand to be safe?

Webster, N. Dak. G. H.

—1—There are many processes more economical than the potassium-chlorate and manganese dioxide methods. There are several types of liquid air plants and several of electrolytic oxygen plants, but these are claimed to be expensive and only economical for large users. A method which is said to be inexpensive is to use an oxygen-generating outfit designed for the use of chlorate of potash. Prior to the outbreak of war in Europe the price of chlorate of potash was approximately 10 cents per pound in the New York market but, today it is about 20 cents per pound. When this is used a little manganese dioxide is mixed with the potash to retard its action in giving off the oxygen. The price of manganese has also been advanced by the war and hence this method which would ordinarily have been quite economical, at present is high. Bottled oxygen can be had at a much lower price and it is available at warehouses in most sections of the United States.

2—To fully describe this method would take more space than is available but the proportions, however, are given as 100 pounds of crystallized chlorate of potash mixed thoroughly with 13 pounds of best quality manganese dioxide.

3—A large variety of pressures of both the acetylene and oxygen are used for different purposes and, as this will vary with the nozzle, you should secure from the company from whom you purchase your apparatus a table showing the various pressures of oxygen and acetylene used in the different sized torch tips.

4—The caustic soda solution used in connection with the chlorate of potash method for making oxygen is placed in one of the three washers to remove common impurities. For a washer about the size of a common barrel, 2 pounds of caustic soda should be used and the solution should be frequently changed.

5—The insurance requirement is that the generating chamber should hold 1 gallon of water to each pound of carbide capacity. Acetylene generators should never be used until they are passed upon by the laboratories for the National Board of Fire Underwriters as the requirements of the board are very strict and it is positively dangerous to attempt to use a generator which does not have such approval.

6—This is covered under answer 3.

7—There are so many different sizes of tips that this question cannot be answered.

8—Acetylene tanks are filled with a chlorate substance such as asbestos disks thoroughly dried and compressed into tanks and which are saturated with acetone which dissolves the acetylene. The object of this is to exclude every particle of air. The acetone will absorb the acetylene and give it off when the pressure is released. Acetylene should never be compressed into an empty tank at more than 30 pounds pressure and the insurance laws require that generators have blow-offs which operate at 15 pounds pressure. These tanks are patented construction and are very carefully made to overcome the dangers which would surround them otherwise. Special generating in compressing plants is required and the gas should be chemically purified before being compressed into acetylene cylinders.

Calculating the Piston Displacement

Editor THE AUTOMOBILE:—1—Give me the S. A. E. formula for figuring the horsepower of a gasoline motor.

2—What is the meaning of piston displacement?

3—How is the piston displacement of a motor figured?

4—Give me the figures of the piston displacement of a six-cylinder motor, 5.75 bore and 6.5 stroke.

5—What would be the horsepower S. A. E. rating of a six-cylinder 5.75 bore and 6.5 stroke.

6—Which engine gives the most power with the same bore, a long or short stroke?

Akron, O. A. D. A.

—1—The S. A. E. formula for figuring the horsepower of a gasoline motor is $\frac{D^2N}{2.5}$ in which D is the diameter of the cylinder and N the number of cylinders.

2—The piston displacement of a motor is the volume through which the piston moves during a stroke, multiplied by the number of cylinders to determine the displacement for the whole motor.

3—Calculating the piston displacement of a motor consists in determining the volume of the cylinder generated by the top of the piston in passing through the distance of one stroke and then by multiplying this by the number of cylinders to get the total piston displacement. Hence, the displacement is obtained by multiplying the area of the cylinder cross section by the stroke. Where the diameter of the cylinder D is known, the piston displacement of a four-cylinder motor with a stroke S becomes $.7854\ D^2 \times S \times 4$ or $3.1416\ D^2S$; for a six-cylinder motor $4.7124\ D^2S$ would be the formula.

4—Piston displacement of a six-cylinder 5.75 by 6.5 motor is 506.4 cubic inches.

5—The S. A. E. horsepower rating of a motor of this size would be 79.5.

6—If the bore is the same the motor with the longer stroke would have more power because its piston displacement would be greater and hence the charge drawn into the cylinders would be larger. See Fig. 4.

Castile Soap for Mohair Tops

Editor THE AUTOMOBILE:—I have frequently heard persons ask what sort of dressing they should use to remove the spots from the mohair tops of their cars. In answer to these inquiries I think the safest information to give is that castile soap with luke-warm water will generally remove these spots. Many of the users of these tops employ gasoline which dissolves the rubber interlining.

Detroit, Mich. J. L. T.

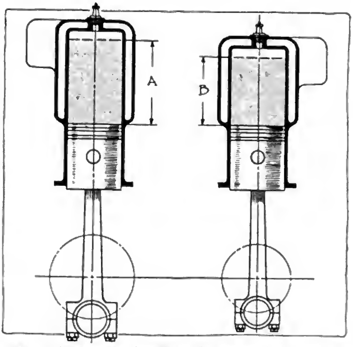


Fig. 4—Diagrammatic illustration showing why the motor with the longest stroke would have the greater horsepower when the bores are equal. It is evident that the piston displacement is greater with the longer stroke, and hence more gas is drawn into that cylinder

New A. C. A. Garage Uses Ramps

New garage of the Automobile Club of America on 72nd Street, New York City

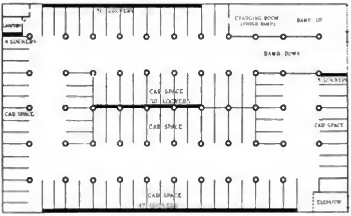
Inclined Planes Replace Elevators, Saving Space and Reducing Operating Expense—Doors Controlled by Compressed Air

BY the use of ramps in place of elevators in the new garage of the Automobile Club of America, an incalculable amount of time and upkeep expense has been saved without an appreciable loss of floorspace. These ramps, or inclined planes, allow the cars to be driven from floor to floor with the ease and freedom provided by a 10 per cent. incline, thus eliminating the inevitable delays which elevators always cause and at the same time allowing any number of cars to go upward and downward at the same time.

Besides incorporating these ramps in the new garage, which is located at Seventy-second street, overlooking the East River, New York City, many other features of interest have been included which not only tend to make this building a model of convenience for the car owner and driver, but also help to make it remarkable in its economical arrangement. For instance, due to the plan of construction this garage has the lowest insurance rate of any in New York City; instead of manually-operated doors the doors are raised and lowered by compressed air and at no time must a car wait for another before it is free to enter or leave the building.

Many New Ideas

While this garage is only available to members of the club, it still includes features which could be used to advantage in any of the new garages under construction. The idea of ramps, while not new, is one that has failed to be appreciated to the extent which the accompanying economy and convenience would justify. For the economy feature, it is only necessary to consider the concrete case of the ramps used in this one garage. Here are three floors devoted to live storage. At the entrance are two doors, one leading to a slight incline downward to the lowest floor, the other up a 10 per cent. incline to the second floor. From the second floor to the third there is another 10 per cent. grade which renders all three of these floors accessible to any car. It is possible to drive a car from the farthest corner of the third floor to the street at 20 miles an hour. The distance of this trip would be not over 600 feet and could be made at this rate in 21 seconds. At the safe speed of 15 miles an hour this 600 feet would be made in 28 seconds.



Plan of first floor, showing arrangement of car spaces, lockers, etc. Note the one elevator in the building

Two cars can pass comfortably on the ramps, thus avoiding any possibility of congestion on the up or down trip and the aisles on each floor are also wide enough to obtain the same condition. As will be noted from the illustration of the floor plan there are a number of pillars which form natural divisions for storage spaces, it being possible without any crowding to accommodate two cars between each pair. All cars face the aisles and hence it is only necessary to start the car, drive out into the aisle, and down the ramp, if on the second and third floors, and up the ramp, if on the lower floor, to reach the entrance to the building.

To get down to the figures of the installation, it is estimated that the ramps replace five elevators. Assuming the ramp to be half covered by the ceiling above, the length of the open space for the ramps totals about 150 feet and with the 20-foot width this would mean a floor area of 3,000 square feet and with a floor height of 12 feet the volume of the wedge-shaped space lost amounts to 18,000 cubic feet, the space under the slope being considered usable.

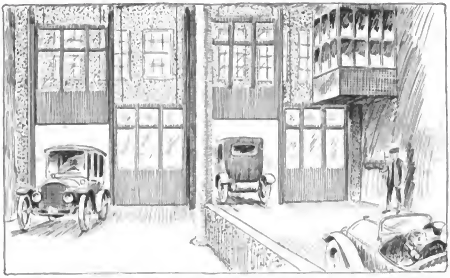
Space Saved by Ramps

With elevators the area on each floor would be 12 by 20, or 240 square feet. With five of these elevators on the three live floors the total floor area used would be 3,600 square feet and the total volume occupied as far as these three floors are concerned would be 43,200 cubic feet. This shows that, volume for volume, the ramps take up 7,200 cubic feet less than the elevators and area for area 1,400 square feet more. At the same time they are more efficient, quicker, have no upkeep expense, are not subject to mechanical break-downs, and do not require the expensive services of attendants.

Thus far the fourth floor of the garage has not been taken into consideration. This is for cars on dead storage and is accessible through the one elevator in the building. Cars which have been disabled or which are not supplied with fuel can be taken to this floor upon which are located the repair department and the paint-shop, besides the space for dead storage.

It is estimated that the annual expense necessary for five elevators is $6,240 for operators alone. Adding to this the maintenance in current consumption the cost runs into quite a large sum. With the ramps, after the installation has once been made, expense ceases. Thus it would seem that this form of construction is ideal for buildings where there is a large floor area and a sufficient length to permit of a slope of 15 per cent. or less.

Economy of car handling does not cease with the use of ramps. Another feature is the front door design which includes a compressed air feature for opening and closing these entrances to the building. The doors open by sliding upward and close by gravity. They have counterweights which are just slightly less in weight than the door itself and are operated by pistons in long cylinders. The air valves are controlled by solenoids which are set in operation by touching a switch located at the entrance or in the checker's office which overhangs the entrance. This installation has been made by the Burdett-Rowntree Mfg. Co.



Door arrangement. At the left a car is shown on its way from the street level to the second floor, while at the right two others are going from the street level down to the first floor. The doors themselves are operated by compressed air controlled by a switch

Automatic Gasoline Pump

Another new feature is the use of an automatic motor-driven pump which delivers gasoline to the different floors where it is distributed to the portable tanks. This is a two-cylinder pump geared to an electric motor and is located on the first floor. Beneath the building there are six 275-gallon tanks filled from a plug in the street. These tanks can be drawn upon from any floor at the central distributing station for that floor, by holding down a valve. The instant the hand is removed from the valve the pump ceases to operate. All the gasoline drawn is measured automatically on the first floor. Between the pump and the discharge valve is a filter, an air separator and the meter. Any of these devices can be cut out by means of by-passes. The gasoline drawn on each individual floor is also measured by automatic gauges on the respective floors.

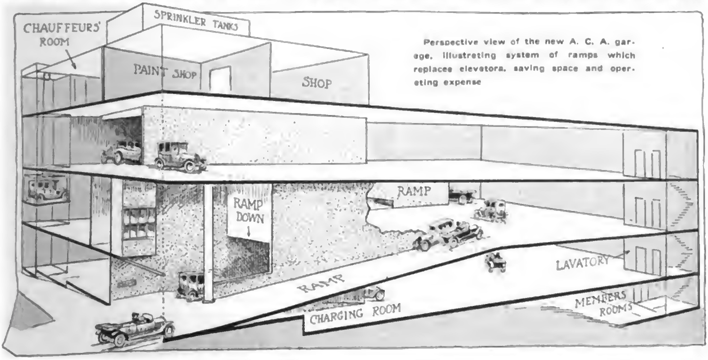
With the exception of the ramp arrangement the three live-storage floors are similar. Referring to the floor plan herewith an idea of the arrangement of these three floors may be gained. It will be noted that there are five lengthwise rows of concrete pillars which divide the garage into rectangles approximately 15 by 20 feet. The space between the first and second row of the pillars around the entire floor acts as an aisle. Around the walls are specially-designed steel lockers, one for each car. In each there is a hat shelf, robe rail and four coat hooks. The volume provided for storage in these lockers is sufficient for spare tires and other large accessories. The lockers are 3 feet wide, 2 feet deep and 5 feet high.

There are four wash spaces on each floor. All are situated in the aisles near the corners and, as the width of the aisle is 18 feet, there is still plenty of space for a car to pass. There is an electric light between adjacent cars and one on every other pillar as well as separate aisle lights. The lights between the cars are placed so as to illuminate the motor when the hood is lifted. A trouble lamp socket, compressed air outlet and vacuum cleaner connection are located on every other pillar in alternate rows.

Fire Protection Thorough

For fire protection there is an automatic sprinkler system, fire pails of sand, and Pyrene fire extinguishers placed short distances apart on each floor. In addition to these the entrance to each ramp and the elevator are provided with fireproof roll doors held open by fusible connections which will melt allowing the door to fall in case of fire.

The fourth floor extends only part of the way over the building. It contains the dead storage space and the chauffeurs' headquarters together with the paint and repair shop. The basement also is only a half floor, due to the fact that Seventy-second street is several feet above the level of Seventy-first. In this part of the building there is a dressing room for ladies, a members' room and a supply store. The boiler room, compressed air vacuum outfits and tire pump are are situated on this floor and separated from the remainder of the building by fireproof walls. In the basement is also a master clock which controls all the clocks in the building.



Perspective view of the new A. C. A. garage, illustrating system of ramps which replaces elevators, saving space and operating expense

Engine-Driven Tire Pumps for 1915

NO great development has taken place in the power tire pump field during the past year. Some models have been added and others discontinued but the same principles are employed. There has been practically no alteration in the materials or workmanship on any of the models. Reductions in prices have been made in some cases, however, and more concerns are producing Ford pumps.

The Brown company has reduced the price on its spark plug pumps and taken over the manufacture of the Sanford pump. The Advance company has brought out a two-cylinder model for Fords, Manzel has a one-cylinder design for Fords and so has Kellogg. A new Ford spark plug pump is made by Mayo. Kingston is making a new model with a 3-inch bore and a .75-inch stroke. Master is manufacturing a new one-cylinder type. Mayo valve cap pumps may also be considered new for 1915 although they were announced some weeks ago.

Development

¶ Tire pump situation is practically unchanged. No innovations in construction have been introduced. Some new models have been added, and others have been dropped, but the general indication is that the designs of last year are satisfactory and so are continued.

¶ The Brown company has reduced the price on spark plug pump. Kingston has a new model.

¶ New Ford pumps have been announced by Advance, Manzel, Kellogg and Mayo.

The Advance Machinery Co., Toledo, O., is specializing on two pumps, the Advance Toledo, a single-cylinder, engine-driven pump of 6 cubic inches piston displacement and the Advance Ford, a two-cylinder model for Fords only. The Aero models of two and three cylinders will be continued also. The Advance Toledo has a bore and stroke of 2.19 by 1.62 inches and the Advance Ford, 1.125 by 1 inch. The Aero pumps have cylinders 1.375 by 1.625 inches.

All of these pumps are designed to be driven at engine speed, giving their best service at 375 r.p.m., but having an operating range of 300 to 500. The Ford pump will inflate a Ford tire in 2 minutes at an engine speed of 500 to a pressure of 65 pounds.

The Advance Ford is the newest model. The cylinders are of special close-grained grey iron. The pump cylinder is of the double-end compression type with a single piston driven by a yoked connecting-rod with a straight line drive, thus eliminating the side thrust of the piston against the cylinder walls. The piston is packed with three rings at each end and these prevent oil from reaching the tires.

The ported type of intake has been adopted. Narrow ports are used. The cylinder heads are removable and are machined so that the clearance space is not over 1-32 inch. Quarter-inch ball valves retained by springs are used. The cylinder is lubricated by wicks located in the middle of the body. All other bearings are oiled direct.

Brown Prices Reduced

Price reductions have been made on the two Brown models, the Impulse spark-plug type tire pump selling for $12, instead of $15, and the Brown, Jr., for Fords, for $5.50 instead of $7.

The Lewis-Sanford Pump Works, Boston, Mass., has been purchased by the Brown company, which is located in Syracuse, N. Y., and a single-cylinder gear-driven pump will be made at this factory for $8.50 with gauge, hose and split gear for Ford installations. In addition, attachments will soon be ready for Overland, Buick and Maxwell cars. The equipment for these cars will list at $10.

The Sanford is air-cooled, the cylinder is made of grey iron and has a bore and stroke of 1 inch. The crankshaft is a drop-forging, machined and lapped, and runs in bronze bearings.

Dewey Spark Plug Pump Unchanged

No change is found in the Dewey power tire pump which is a spark-plug type and is capable of being operated by any multi-cylindered engine. When it is desired to inflate a tire, a spark-plug is removed from one of the cylinders, the pump is screwed in its place and the motor run idle on the remaining cylinders. The compression and suction of the cylinder to which the pump is attached furnishes the motive power for the tire pump. Bore and stroke are respectively, 1.312 by 3 inches.

The maker states that the pump works best when the motor is run at a speed of between 400 and 500 r.p.m.

By the use of a large breather valve, pure air is taken into the engine cylinder during the suction stroke, giving that particular cylinder the full compression so that a pressure of from 50 to 75 pounds is developed. The Dewey-Anderson Co., Toledo, O., makes this pump.

Folberth Operated by Motor Piston

The Folberth is unique in that there is a mechanical connection between the top of the piston of one cylinder with gasoline engine and the piston of the power tire pump. The pump piston rod extends down through the cylinder head and rests on the piston. The upward movement of the piston raises the pump piston and when the upper limit of the stroke is reached, the piston and rod are returned by the air pressure on the upper side of the pump piston and the suction on the lower side. The intake air valve is a poppet type and the exhaust valve is a ball.

The advantages claimed for this type of pump are that high capacity is obtained without racing the motor, there are a minimum of moving parts, silence of operation and the delivery of clean air, untainted with oil. The operating speed is 300 to 400 revolutions per minute.

The pump is manufactured in only one model, the bore being 1.5 inches and the stroke being equal to that of the motor on which it is installed. The speed should never exceed 500 revolutions per minute.

The pump has an outside diameter of 2.5 inches and the length is always 2 inches longer than the stroke of the motor. The weight is 5 pounds. It is made by the Folberth Auto Specialty Co., Cleveland, O.

Hert Makes Two Models

Single and two-cylinder air-cooled pumps are made under the name Purair by the Hert Mfg. Co., Indianapolis, Ind. The single type has a displacement of 3.5 cubic inches and the twin a displacement of 5.8 cubic inches. Both pumps are tested to 150 pounds pressure but will deliver up to 200 pounds. Brackets and fittings are furnished for about fifty different makes of cars so that either pump can be attached with a minimum amount of work. The single cylinder measures 7 by 3.5 by 3.5 inches, weighs 6 pounds and sells for $12.50, while the two-cylinder measures 7 by 3.5 by 6 inches, weighs 9.5 pounds and lists at $16.50.

There is an oil separator and relief valve at one side of the pump. The crankshaft is a drop forging and has long bearings. The piston has three eccentric rings and the connecting-rod is an I-beam section made of solid phosphor bronze.

Two Hanna Models

Hanna power tire pumps are built in two sizes, both twin-cylinder, air-cooled models. The maker is the Troy Auto Specialty Co., Troy, N. Y. The smaller pump, style C, has a bore and stroke of 1.5 inches and a normal speed of 500 r.p.m., and the D has the same bore but a stroke of 2 inches. Its normal speed is 650 r.p.m. The prices of these two models are $25 and $35, and they may be fitted to any machines having exposed shafts.

Gemco Spark Plug Pump

A spark plug pump is manufactured by the Garage Equipment Mfg. Co., Milwaukee, Wis., under the name of Gemco. This pump is screwed into a spark plug hole and the motor is run on the remaining cylinders. The compression of the cylinder in which the pump is installed operates a piston in the pump and thus pure air is delivered to the tires. In addition to the pump there is a gauge and 12 feet of rubber hose. The price is $12 and, without the gauge, $10.

Herz B. B. a Two-Cylinder

The twin-cylinder vertical pump made by Herz & Co., 245 West Fifty-fifth street, New York City, will be continued without change. It is known as the B. B. The cylinder dimensions are 1.375 by 2.5 inches and the overall dimensions 11 by 3.5 by 8.75 inches. The weight is 7 pounds and the price $30. Pressures up to 250 pounds can be obtained.

Lubrication is by splash. The intake and exhaust valves are contained within housing screwed into the cylinder heads and are therefore easily removable for inspection. A safety valve placed in the discharge line makes it impossible to pump to more than a predetermined pressure.

The drive is by coupling, gear or sprocket wheel, and chain and a clutch for starting and stopping the pump are furnished when desired. In attaching the pump it is necessary, in some cases, to fasten a strap or iron plate from the chassis to the motor base and attach the pump over the water pump shaft, drive being by means of silent chain. In other cases it is better to cut through the crankcase and drive the pump from the timing gears direct. Another method of mounting is on an iron plate in front of the gearset, the pump being driven from the clutch shaft by a silent chain.

Kellogg Has Complete Line

Seven motor-driven tire pumps constitute the line of the Kellogg Mfg. Co., Rochester, N. Y. The leaders are a single-cylinder pump of large bore and very short stroke, introduced a few weeks ago, and a brand new model for Fords. Other types are built with two, four and six cylinders.

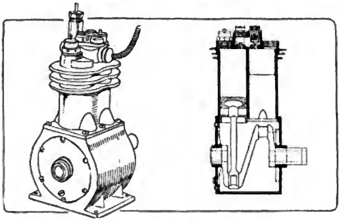
The new Ford machine is a single-cylinder design which is placed at the right of the motor, the drive being taken through the camshaft. A gear is attached to camshaft and the pump is bolted in place. The whole installation may be accomplished in one-half hour—there are no holes to drill and only two nuts to tighten. In case the timer is worn a new one is furnished.

The cylinder is of close-grained, grey iron and the piston is fitted with ground steel rings. The bearings are phosphor bronze.

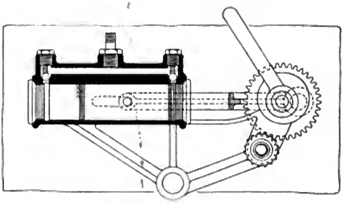
The large-bore, single-cylinder pump is made of metal throughout, no leather or rubber being used even for packing. The bore and stroke is 3 by .75 inches. The cylinder is grey iron and the piston is fitted with two metal piston rings which resemble those used in automobile motors. This is possible on account of the large diameter of the piston. Intake and exhaust valve are of comparatively large size and are of the poppet type.

The crankshaft is drop-forged and is supported at each end by two bronze bearings. Two connecting-rods are used, thus minimizing the wear and necessity for replacement, it is stated.

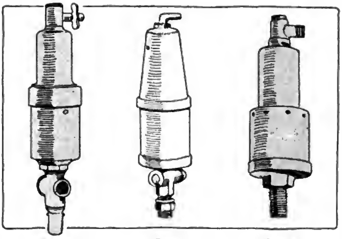
The construction of the piston is novel in that it is not guided by the cylinder walls but partly by the double connecting-rod arrangement and partly by a guide which slides over the crankshaft between the two connecting-rod eccentric bearings. Obviously since there are two connecting-rods, the piston is held solidly against tipping in one direction. Tipping in a direction at right angles is prevented by means



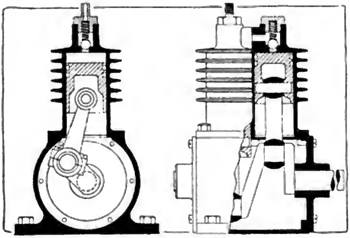
Exterior and section of Herz B. B.



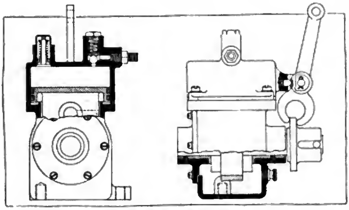
One of the Advance models



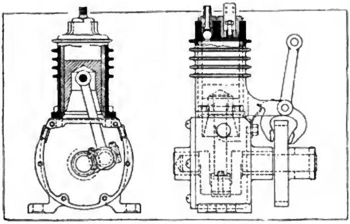
Brown Dewey Gemco



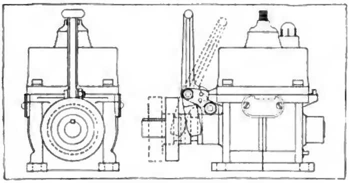
One of the two-cylinder Hanna types



New single-cylinder Kingston



New single-cylinder Master design



One of the seven Kellogg models

of the guide just mentioned which is a snug sliding fit over the center part of the crankshaft.

This construction permits the use of a baffle plate, which prevents all oil from reaching the cylinder wall or the under side of the piston, it is said. On the upper side of this baffle plate, is a felt washer which is supplied with oil from the reservoir in the crankcase of the pump. On each downstroke the piston compresses the felt, so that a certain amount of oil is supplied for piston lubrication. An overflow drain determines the level of oil in the crankcase.

The price of this pump with rubber tubing, gauge and attachments for installing on all the ordinary makes of cars is $15.

The two-cylinder pump has a bore and stroke of 1.5 by 1.44 inches and is designed to run at 600 to 700 r.p.m. The maximum working pressure is 200 pounds and the price is $21.50 complete with rubber tubing, gauge and metal attachments.

The four-cylinder pump is featured by having cylinders of hard brass tubing. A pump of similar appearance, but with a water-cooled head, is also made and is designed especially for use with compressed air starting systems. Another water-cooled model has cast-iron cylinders. A six-cylinder water-cooled pump capable of delivering 5.5 cubic feet of free-air per minute at 650 r.p.m. is made for heavy service where high pressure and large volume are desired. The cylinders are set V-shape, two pistons being operated by one throw of the crankshaft. Each piston is fitted with two metal rings. The crankshaft is supported by ball bearings and the lubrication is by splash.

Kingston Employs Large Bore

An entirely new type of pump has been brought out by the Kokomo Electric Co., Kokomo, Ind., maker of Kingston specialties. It has a single cylinder with 3-inch bore and .75-inch stroke. Two piston rings are used. The intake valve is a poppet type and the exhaust valve a spring-seated ball. Its normal speed is 500 r.p.m. It is capable of generating pressures up to 125 pounds. Price is $15.

Lipman Has New Model

A new design brought out by the Lipman Air Appliance Co., Beloit, Wis., is a single cylinder air-cooled model selling for $15. The bore and stroke are 2 by 1.25 inches. The pump is made of metal throughout, the cylinder is gray iron and the crankshaft a drop forging with two plain bearings. The piston is fitted with eight steel rings. Splash oiling is employed and there is an opening in the crank chamber to keep the level constant, the excess oil running out through this opening. The pump weighs 5.5 pounds and is brought into action by means of a sliding gear.

The four-cylinder pump is continued without change. Its cylinders are 1.25 inches square and it sells for $25. Cylinders and pistons are gray iron and crankshaft is a drop forging. The valves are situated in the head and are of the poppet valve type. The mechanism is completely inclosed.

Manzel Makes One-Cylinder Ford

A single-cylinder, air-cooled, gear-driven tire pump for Fords is the new feature of the line made by Manzel Bros. Co., Buffalo, N. Y. The two-cylinder model is continued.

The Ford model sells for $7.50 complete with steel gears, 12 feet of hose, gauge and everything for installation. It can be installed in 45 minutes. No machine work of any kind is required.

The pump is mounted at the left of the motor and just above the crankshaft. The fan pulley on the crankshaft is removed and the split gear put in its place and this drives the pump which is bolted to the crankcase. The split gear also incorporates the fan pulley. When the pump is not operated the gear is out of mesh.

The two-cylinder Manzel model has a gear drive and is made for all standard makes of cars for $20. The cylinders and pistons are grey iron and the piston rings are also of iron. Bronze connecting-rod bearings are employed and the crankshaft is drop-forged. The air inlet is screened and there is an air filter to eliminate oil and secure pure air for the tires.

Marvel Ford Spark Plug Pump

The Marvel tire pump, for Fords and other small cars, is of the type which screws into a spark plug hole and which operates through the compression of the motor. It is of compound design, there being a smaller cylinder above the main cylinder. A rod connects the pistons operating in these two cylinders and when the pressure within the engine forces the lower piston upward, compressing the air above it, the upper piston also moves upward, multiplying the pressure above it also which was partially compressed by the lower piston on its previous stroke. When the higher piston is at the top of its stroke, the air above it escapes to the tire. A breather at the bottom of the apparatus prevents any but pure air from entering. This pump is said to be capable of inflating a 37 by 5 in from 3 to 4 minutes. The Marvel is a product of the Marvel Auto Supply Co., Cleveland, O., and sells for $5.

New Single-Cylinder Master

Under the trade name of Master, the Hartford Machine Screw Co., Hartford, Conn., is producing two power tire pumps for 1915. One is a single-cylinder design and the other a two-cylinder one. The one-cylinder model is a new one while the two-cylinder is carried over from last year.

The new pump has a bore and stroke of 1.5 by 1.75 inches and runs at a speed of 600 r.p.m. The overall dimensions are 4.5 by 8.5 by 5.75 inches, and the weight 8 pounds.

The cylinders on the two-cylinder type measure 1.375 by 1.75 inches, the weight is 10.5 pounds and the overall dimensions 4.5 by 8.5 by 7.25 inches.

Master pumps are air-cooled and may be gear or clutch-driven. The pistons are steel, carefully hardened and ground to size. Lubrication is by splash. The inlet valves are a flat type, hardened and ground, and the discharge valves are of the ball type.

Mayo Valve Cap Pump

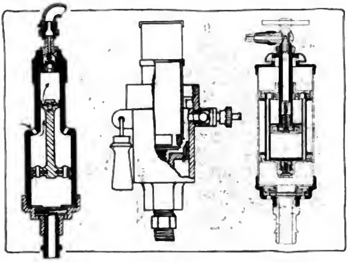
Two new models have been brought out recently by the Mayo Mfg. Co., Chicago, Ill. These are: the valve cap pump, which is similar to the spark plug pump in its principle of operation, the only difference being in the method of attachment, it being permanently fastened to the valve cap instead of screwing into the spark plug hole; and the other new model is the Mayo Ford pump, which is a spark plug type but smaller than the original spark plug pump which is continued.

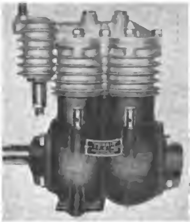
Upon finishing the inflation a quarter turn of a handle closes a ground poppet valve opening into the engine cylinder, cutting out the pump and allowing the motor to resume firing on this cylinder. The hose is removed and stored in the tool box. The outfit includes a gauge and 14 feet of hose and the price is $15. The obvious advantage of this type of pump is that it is not necessary to remove a spark plug and attach the pump every time air is wanted.

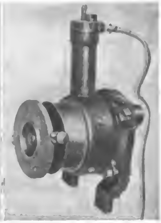
The large spark plug pump sells for $10 with 12 feet of hose and gauge, and the Ford outfit sells for $8 with 10 feet of hose, and gauge.

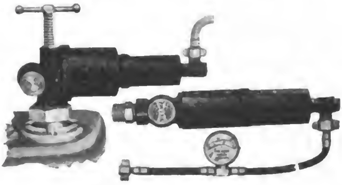
Medina Driven from Fan

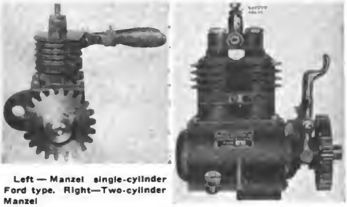
The Medina Machine Co., Medina, O., is making a single-cylinder pump which is driven by the fan belt, being mounted in the place of the fan shaft. No machine work is required to install it. The operation is simple, the regular fan together with the pulley is removed and a pulley furnished in connection with the pump is put in its place. The price of

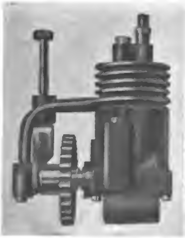

Marvel National Utility


Hert Purair

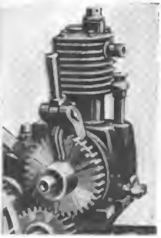

Medina


The two new Mayo models

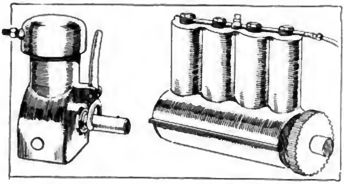

Left — Manzel single-cylinder Ford type. Right—Two-cylinder Manzel



Sanford



Advance



Peerless

this outfit complete with all the necessary brackets and attachments and with 12 feet of hose is $12.50. A plunger gauge which is used directly on the tires sells for $1 extra.

Mosco—Single-Cylinder Ford

A single-cylinder pump made for Ford cars is built by the Motor Specialties Co., Waltham, Mass., under the name of Mosco. It is mounted on the front cover of the timing gear case and driven by an eccentric. The price with 15 feet of hose is $7.50 and, with pressure gauge, $9.

National Spark Plug Pump

The National Telescope pump is a spark plug type. The outfit includes not only the pump itself, but a gauge and 12 feet of woven hose. The body of the pump is made from close-grained cylinder iron and the piston is machined from a steel bar. The piston rings are metal. It is about 5 inches high and weighs less than 6 pounds. The price is $8.50 and with gauge $9.50.

Peerless Pump a Four-Cylinder

One model of engine-driven pump is made by the Peerless Accessories Mfrs., Chicago, Ill., for the coming year. This is a four-cylinder design with 1.375 by 1.625-inch cylinders. It is run at a speed of 400 to 450 r.p.m. It can be attached without special fitting to any car with 1.25 inches of exposed magneto shafting and room for a 4.25-inch sprocket.

The cylinders are cast iron, and so are the pistons and rings. Bronze valves are used. The pump is mounted on a small steel bracket.

Stewart-Warner Makes Three Models

Three single-cylinder models are made by the Stewart-Warner Speedometer Corp., Chicago, Ill. The bore of all three is 1.44 inches, the stroke of two models is 2.5 inches and that of the third is 1.75 inches. The normal speed is 600 r.p.m. A maximum pressure of 400 pounds may be generated.

The cylinder is cast iron with vertical cooling fins on it. The base of the pump is aluminum and the piston is steel, hardened, ground and lapped. The connecting-rod is also hardened steel. Compression is maintained by making the piston a tight fit. There are no rings.

Air is taken in through an annular series of holes uncovered by the piston near the bottom of the stroke. The discharge is at the top, there being two spring-closed ball valves in series. The use of two valves eliminates all possibility of leakage.

The lubricating system is complete. The piston is oiled by means of an oil-soaked wick against which it rubs. This wick is supplied with lubricant through two filler holes which are conveniently reached from the outside. This method of oiling gives all the oil required and yet there is no excess to be carried over to injure the tires. There is but one main bearing and it is oiled by a ring oiler which is situated at the center of the bearing. The ring dips into a small well which is filled through an oil hole. The connecting-rod bearing is oiled through a hole in the end of the pump, this hole leading to a tube which rotates with the crank-pin and thus delivers its oil by centrifugal force. The bottom of the crankcase is open so that any free oil will immediately drop out.

The price complete with bracket and gears for immediate installation, 13 feet of hose and an air pressure gauge, is $15.

The dimensions of the different models are:

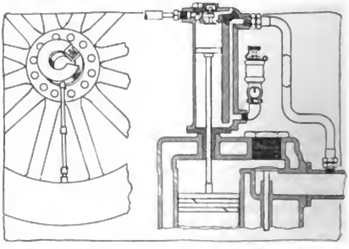
	Length	Height	Base Width	Base Length
Model 108-E..........	6.25	9.88	2.38	4.5
Model 108-D..........	6	8.25	2.38	4.5
Model 108-H..........	6	8.25	1.75	4.5

Davis Automatic Tire Inflator

To inflate tires while the car is in operation is the purpose of the Automatic Tire Inflater made by the D. L. Davis Mfg. Co., Chicago, Ill. The device consists of a pump which forces air through a tube to the axle whence it is passed to the wheel through a special joint consisting of two circular disks which revolve one upon the other, one disk being fixed to the hub of the wheel while the other is attached to the axle.

Taylor Noil Continues Diaphragm

The pump made by the Taylor Mfg. Co., Chicago, Ill., differs from other pumps on the market in that a diaphragm is used instead of a piston. The adoption of this construction effectually prevents oil from making its way into the tires as the diaphragm separates the air chamber from the rest of the pump. Compressed air is obtained by reciprocating the diaphragm in much the way a piston might be used.



Davis Automatic Folberth in section

The intake valve is a poppet and the exhaust valve a ball type.

This pump is designed to be installed under the hood and is to run at a speed of 550 r.p.m.

The improvements in the new model are in the plunger which now works straight up and down without any side motion and in the valve fittings which are now machined instead of being rough castings as heretofore.

The height of the pump is 7.25 inches and the width across the top is 5 inches.

Ten Eyck Has New Pump

An entirely new design of single-cylinder air pump is manufactured by the Auto Air-Rotar Co., Chicago, Ill. It is known as the Ten Eyck and has a bore and stroke of 1.75 by 2.25 inches. It operates at speeds of from 300 to 800 r.p.m. and is driven from the crankshaft or water pump shaft, whichever is more convenient.

The bed plate of the pump measures 2.5 by 4.25 inches and the pump is generally mounted on a small steel forging bent at right angles and bolted to the inside of the frame on a line with the front end of the motor. The pump measures 10 by 5 by 4.5 inches and weighs 10 pounds.

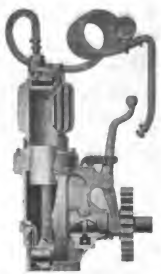
The price including 16 feet of rubber tubing, pressure gauge and tire connections is $15.

Two Utility Spark Plug Pumps

Two spark plug pumps are made by the Hill Pump Valve Co., Chicago, Ill. One is the Utility and the other the Utility Jr., the latter being for cars with tires of 3.5 inches and under, this class including Fords.

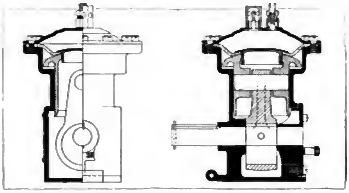
The large pump has cylinders 2.25 by 1.69 inches and measures 6.75 by 2.62 inches. It weighs 5 pounds. The small pump has a cylinder 2 by 1.25 inches, measures 6 by 2.25 inches and weighs 3.5 pounds.

These two pumps are furnished with a safety valve and gauge which is installed in the line running to the tires and which is known as a Pneu-Meter. The Utility pump complete with this safety device sells for $12 and the Utility Jr. $9.



Stewart

Ten Eyck



Taylor Noll in sectional views

New Eisemann Flexible Magneto Coupling

THE Eisemann Magneto Co., Brooklyn, N. Y., has developed a new type of flexible, adjustable and fully inclosed magneto coupling which has a number of unusual features. Its principal purpose is to allow of a certain amount of deviation in the driving and driven shafts and to protect the magneto bearings; at the same time, it cushions the driving power. It will fit any standard magneto.

The device is distinctive for three reasons: (1) It is inclosed and therefore dust and dirt proof while the housing is easily removable without the use of tools; (2) it has large, flat wearing surfaces; (3) the magneto timing may be adjusted over a range of some 40 degrees—plus 20 or minus 20—without dismounting either the coupling or the magneto.

There are five essential parts to the device, though the cover may be viewed as but one part. These are the driving member A, which is attached to the magneto driving shaft in the usual manner; the driven member B, which is attached to the magneto armature, and the casing which incloses the whole.

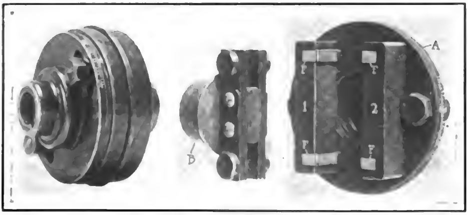
There are no moving parts in the driving member which consists of two metal plates, 1 and 2, which are attached to a face plate. This face plate bolts to a second plate which is keyed to the driving shaft. The bolts which hold the two plates together are fitted into slots, thus providing for a variation in the timing range. By simply loosening the bolts, it is possible to shift one driving member with relation to the other and thus to alter the magneto timing. On the outside of these members there is etched an adjustment scale.

To provide for ample wearing surface, large fiber plugs F are inserted in the plates 1 and 2 as shown. The driven member B consists of a number of laminations of thin spring steel riveted to the central part. This is inserted so that the round metal buttons bear against the fiber plugs.

The springs cushion the drive and whatever slight eccentricity or misalignment of the shafts may exist is allowed for by the sliding of the metal buttons over the fibre plugs. As these plugs are large and the contact surfaces flat wearing surface is ample.

One of the excellent features of the coupling is that it is possible to remove a magneto without the necessity for taking the coupling apart. The driving and driven members are simply placed vertically and after the bolts holding the magneto have been removed, the instrument may be lifted straight up, the driving member sliding off the driven member. It is not necessary to slide the magneto backward in removing it so that the use of dowel pins in the holding bracket do not interfere with the operation.

The covering which excludes dirt is a light metallic part held in place by a spring ring which fits into a groove. This casing may be removed, to inspect the coupling or for the removal of the magneto by simply taking off the spring ring and the casing, both of which can be slipped over the driveshaft.



Left—Eisemann coupling, showing adjustment scale. Center and Right—Driven and driving members, respectively. Note fiber plugs F for wearing surface

Kansas City—A Great Distributing Center

$39,000,000 Worth of Cars and Accessories Disposed of at Wholesale Prices in 1914—Farmers To Spend Big Crop Profits on Cars

By David Beecroft

KANSAS CITY, MO., Feb. 13—Farmers, automobiles, wheat and stock are the big four of this territory and the annual automobile show convention hall has served admirably to emphasize on the citizens in this part of the grain belt how dominating an influence the automobile is. The all-pervading influence of the car has assumed a new form in this city during the last 2 weeks since the invasion of the jitney car and jitney bus, there being already over 222 of such vehicles registered. At last the great middle class, nearly 45,000 of them at least, are daily making use of this new found means of locomotion, and thousands are daily imbibing the magnetism of the car, who, perhaps in their most optimistic moments had not hoped to ride to work in a real gasoline car for years to come. With this new movement another great missionary force for the car is set in action.

A Three-in-One Show

The Kansas City show is a dealers' show, a distributors' show and an owners' show. It is a three-in-one program. Convention hall when opened years ago was the target of ridicule for the city for then it was thought so big as to be useless. Now its 50,000 square feet of floorspace is but a tantalizing area for half a hundred or more distributors and dealers who have been showing their cars all week. This huge hall, nearly a smaller edition of Madison Square Garden, New York, in general design, is not half large enough for the automobile show, and its capacity is taxed nearly every month of the year. Such is the growth in the central west.

Estel Scott, president of the Kansas City Dealers' Assn., and also general manager of the G. M. C. truck interests here, reports forty-nine members in his association and every one is in the show, making a grand total of vehicles shown of 192, just one less than was shown at the Minneapolis show a week ago. Of this number 140 are gasoline passenger cars, seventeen electrics and one steam car. You must add thirty-two trucks and two tractors.

There were fifty-one different makes of gasoline cars, six of electrics, seven of gasoline trucks and two of tractors.

Territory in Kansas City is not so much a matter of geography as at Minneapolis, as this metropolis is more hedged in with such centers as Minneapolis, Omaha, Sioux City and Dallas on its confines.

Measured in square miles this zone is one of no mean proportions, and, while not embracing so many broad acres as served by the Twin Cities, it serves a zone studded with progressive farmers and stock raisers. The total area served is 204,700 square miles, an area practically equal to that of Germany, practically the same as that of France, yet one-half smaller than the distributing territory served by Minneapolis and St. Paul.

Into this zone last year Kansas City distributed $39,000,000 worth of automobiles and accessories—wholesale price figures. The Commercial Club of this city is responsible for the figures, and further subdivides these into automobiles to the value of $33,000,000 and accessories valued at $3,000,000.

As a motor car manufacturing center Kansas City is not ranked high. Local authorities speak in a rather subdued tone when referring to this. The estimate of manufactured automobile products is put at $200,000 per annum and this is all accessories. These are largely confined to Ford devices, embracing such parts as safety steering attachments, garage jacks, etc. One local firm has recently started the manufacture of trailers for motor truck use, which should bring the manufactured totals higher a year hence.

But, if not boastful of its status as an automobile manufacturing center, Kansas City is not slow in producing its statistics on live stock, crops, etc. This city is the second live stock market in the world, coming second only to Chicago, with Omaha ranking third. Last year the total receipts at the local stockyards totalled $192,500,000. Cattle make up $131,000,000 of this total, hogs $49,000,000 and sheep $12,000,000. As this stock all comes from the farms in this territory, and as farmers buy from 80 to 95 per cent. of the cars sold annually through this center, the value of stock yards to the car maker becomes at once apparent. Invest this alone in automobiles and you would absorb more than 200,000 annually of our more popular cars listing between $750 and $1,000.

But Kansas City has wheat and corn and oats. This week the grain dealers' association met here and bewailed the fact that of the 180,000,000, bushels of wheat grown in this state last year there yet remained 35,000,000 in the granaries of the farmers, who are boasting that they will hold it for $1.75 or $2 per bushel. Last July the farmer hoped to sell his wheat for 60 cents per bushel. Some did.

But what are the facts? The State of Kansas is going to have approximately $100,000,000 of unexpected money go into the hands of the farmers. Last July they did not even dream of this additional cash. Today it is partly in their hands and within a few months they have hopes of increasing the amount.

Farmers Buy Cars

And the Kansas farmer buys cars just as the Minnesota farmer, the Nebraska farmer and the Iowa farmer. The Ford dealer in Salina, Kan., a city of 10,000 in the center of the state, distributed 2,000 cars last year and is going higher for this year. So with Overland, Buick and Studebaker, with Ford the big four in motor parlance in the state. But Salina represents a part of the state that has not been on the crest of prosperity's wave. Local inhabitants say that they have had 4 poor years, but with the bumper wheat crop of 1914 the farmers have paid their old bills and have a little bank account remaining. But, better still, they are optimistic. The winter is most favorable, there being plenty of snow on the ground, which gives assurance that the subsoil will be well soaked and that in spite of dry weather a good crop for 1915 will be practically assured.

But farmers do not all buy Fords, Overlands, Buicks, Studebakers, Hups or Saxons, either fours or sixes. Primarily they want great power and with many the six is a synonym of power. The state has hills, clay roads and gumbo roads. These must be climbed preferably on high, à la Ford, and the six is attractive with not a few. One farmer this week signed his order for a $5,000 six, for seven passengers and painted white. He lives 9 miles in the country, and is the acknowledged social leader in his section. One company selling fours at over $2,500 puts 150 cars a year into the state.

For 1915 the farmer of Kansas is buying a slightly higher priced car. He is going up in the price scale. This does not mean fewer of the cheap cars but a widening of the medium-car market. Not a few with cheap cars last year are keeping these and buying cars listing at $1,000 or thereabouts. Some, and they are in considerable numbers, are buying $1,500 machines.

Kansas has 177,840 farmers, the average farm is 244 acres and the average value per acre $35.45. This means an average farm value of $8,649.80. This value per farm compares favorably with Illinois, where the average value of a farm is $12,267.08. Kansas outstrips the New York farmer, whose average land value is $283.68 per farm. Here are some illuminating figures on the average sizes of farms in some of the different states and their average value per acre:

State	Av. farm (acres)	Av. value per acre	Av. farm value
Kansas	244	$35.45	$8,649.80
Missouri	124.8	41.80	5,216.64
Oklahoma	151.7	22.49	3,411.73
Illinois	129.1	95.02	12,267.08
New York	102.2	32.13	3,283.68
Ohio	88.6	53.34	4,725.92
Connecticut ...	81.5	33.03	2,691.95
Nebraska	297.8	41.80	12,448.04
Iowa	156.3	82.58	12,907.25
Minnesota	177.3	36.82	6,528.19

But Missouri, and Oklahoma must not be overlooked as farmer states and also as car consuming centers. A dealer from Joplin, Mo., spoke with pride of over twenty farmers around that center who own farms of over 500 acres each, and each farmer financially able to own not one cheap car, but one or more cheap cars, one large car, a motor truck and a tractor for general farm work. Missouri has 276,578 farmers and this is how these divide up as to acreage:

Farms between 50 and 100 acres....	74,178
Farms between 100 and 175 acres....	80,120
Farms between 175 and 259 acres....	32,109
Farms between 260 and 500 acres....	19,812
Over 500 acres	3,971

Here we have a total of over 200,000 farmers the majority of whom are in the field for cars of one type or another and all of whom hope some day to own automobiles, perhaps farm tractors and motor trucks.

But pass on to farm totals in the Kansas City distributing territory and here we have:

Farmers in Kansas................	177,840
Missouri	276,578
Oklahoma	190,000
Part of Arkansas......	70,000
	714,278

Gasoline cars have not the entire field. the electrics, modest and lady-like as they are, are making a louder noise and now it is becoming customary to discard the old bell signal and install the electric horn. Kansas has 290 electrics throughout the state, add to this 120 in Oklahoma and 145 in rural Missouri and you have the electric totals outside of the three leading cities St. Louis, Kansas City and St. Joseph, Mo. Here are figures from registrations:

Kansas City	1,200
St. Louis	800
St. Joseph	40
State of Kansas	290
State of Missouri........................	145
State of Oklahoma........................	120
Total	2,595

In Kansas City the electric passenger car seems a paradox. Before getting off at the big new Union Station and you see the skyscrapers perched on the tops of the myriad hills, with macadam ribbons as streets forming roller coaster divisions, you imagine that the electric is not here, but you are pleasantly disappointed. Kansas City must be counted as a good electric town. Omaha with hills not the equal of those here does not pretend to use electrics. But here the electric has mastered the hills. Women drive them here and drive them summer and winter, up and down hill. The closed car is everywhere, in fact, the roadster or cabriolet type is not in demand. When asked why the electric had such a favorable hold here one dealer replied: "With our hills it is much more difficult for a lady to drive a gasoline car here than in Chicago or Minneapolis. The difficulty comes with stopping the gasoline cars going up hills and having to release the brakes and engage the clutch when starting. With the electric driving is much simpler. The excellent 350 miles of oiled macadam roads lying in the surrounding country has had much to do with the increasing popularity of electrics.

During the last year the cheaper coupé type of gasoline car has been the biggest rival of the electric. This promises to continue and each week sees some user of an electric buy a gasoline coupé and vice versa some gasoline car user discontinue it and adopt the electric.

Throughout the State of Kansas and also in Missouri the electric is invading the smaller cities and towns. Thus Topeka, the capital city, has fifty electrics, Wichita has over 100, and Independence sixty-seven. In Missouri the same holds true. There are sixty in Springfield and in Kirksville, a town of 2,000 without a single paved street, there are four electrics.

The Improvement of Spring Systems—VII

(*Continued from page* 323)

obstacle. Schemes for a tire capable of moving on the wheel rim against a frictional resistance seem fantastic. To shackle the ordinary spring at the front only has, curiously enough, been repeatedly tried, but it results only in snapping leaves in the rear half of the spring. Moreover, it could not be expected to give shock-relief unless the rear half were formed with a yielding scroll. The scroll might better be in front with the shackle in the rear, and this might give acceptable results if a crosswise steering-rod is used, especially in connection with air tires, which could then be strongly inflated—a desideratum now sacrificed for comfort.

A Solution Worth Trying

A better solution may be found by adopting an obliquely receding spring movement, with all extension of the spring sharply checked beyond its initial position. Fig. 21 shows that a design of this nature could be made to agree with the steering requirements even if a lengthwise-acting steering-rod is used. By having the front end of the spring longer and more flexible than the rear, the axle would follow the path BP instead of CA, which would permit the steering-rod to follow its natural curve CS without forcing it out of any adjustment given it before or during the shock. The lower portions of CA and CS would be annulled by the rebound check D. Devices checking spring extension with exact reference to the initial static position of the spring, irrespective of changes caused in this position by load changes, can easily be made, though they are not in the open market.

Two Universals Needed

Point 5, relating to lateral cushioning of some kind not conducive to rolling of the vehicle body, was left open, and the same may be done here, for two reasons: First, when springs are shackled at both ends they can be flat or curved and give horizontal movement in either case, and torsion of the spring may therefore be enlisted in any desired degree. Secondly, the movements demanded for lateral cushioning are so small that materials and workmanship will determine results as much as design.

Any special arrangement for preventing the axle from skewing under the influence of a shock affecting only one of a pair of wheels, and thereby perhaps wrenching the differential or the worm gear, would be superfluous, it was understood, as any momentary skewing in the horizontal axle plane would mean only an emphasized need of two universals on the drive-shaft, and this is now the preferred construction. The need is shown in an exaggerated way in Fig. 22, where A is the front universal and B the rear one which becomes indispensable when thrust rod springs permit one wheel to be momentarily a trifle in advance of the other.

(*To be Continued*)

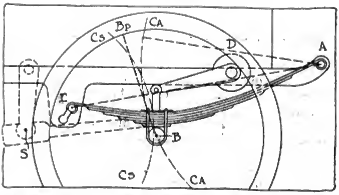


Fig. 21—Front axle spring suspension, with rebound check of special type; arranged obliquely on line AE to absorb both vertical and horizontal shock components directly. Proportions diagrammatic. Longer steering rod would help straighten Cs

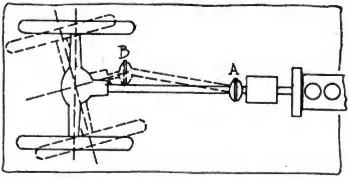


Fig. 22—Sketch showing need of two universal joints on drive shafts when axle can yield unevenly in horizontal plane

The Automobile

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, February 18, 1915 No. 7

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Distributors vs. Dealers

FROM present problems entering into the merchandising of automobiles it seems probable that a clearer line of demarcation will be drawn between the field of the distributor and that of the dealer in the near future. In many large distributing centers the car representative is a combination of distributor and dealer; a part of his product he wholesales to his dealers in the surrounding counties and states, and the remaining fraction he sells at retail in his own city. It is in combining these two functions that the possible rift lies. In older mercantile lines the wholesale house and the retail house are separated. If the same money controls a large wholesale and retail business in the same city, they are in separate buildings, the wholesale one in the jobbers' section and the retail store in the shopping center.

In the automobile field in certain cities abuses are creeping in where wholesale and retail business are combined in one store. One is that the distributor, or the wholesaler, cuts prices on much of his retail business, the advanced reason being that he prefers the distributing end to the retailing one, and in his retail trade he is content if his profit is little greater than on his wholesale business. Such a condition makes it very difficult for the other dealer in that city having only a local territory and being only a retailer. He is brought face to face with cuts in prices and long allowances on trades.

If the distributor were only a distributor he would carry on his business in a different city location from the retailer, in streets where rents and overhead are much lower. This would also result in smaller places for the retailer, who would not have to carry so many cars in stock and would have other advantages.

Service

SERVICE has ceased to be a form of charity on the part of the maker. It has become openly a part of the business organization as much as the selling of the car itself. The automobile salesman has been drilled by his company and has been led by the inquiries of the buying public to talk service. But it is only a recent development which allows the maker to come out frankly and state that he is in the parts-making business as well as in the car-selling business.

To put the parts department on a business basis it must be a complete organization within itself. It must have a head. Its work must be departmentized and systematized so that when the order comes for a given part it must not cause a scurrying to and fro of people who happen to come in touch with the order but, on the contrary, must pass through the same orderly channel of administrative and productive organization that occurs when an order comes for a finished car. The machinery for the work must be adequate and must not conflict with that of the regular production. Costs must be kept down to the limit and fixed duty for fixed machines, for fixed areas and for fixed men are the only way in which this can be done. Recognizing this, the separate plant is the best solution, although if the organization itself is kept away from the regular manufacturing end, the main requirements will be successfully met.

The men in control of service work must concentrate on that if the best results are to be obtained. It is as bad for a man to be adjusted for a fresh line of duty to meet momentary changes in conditions as it is to alter the entire set-up on a machine to meet the fluctuations from standard production to parts production. Organization and systematized control are the necessities for preventing the price list in the parts book from assuming uncouth proportions.

The Farmer

IT seems a far cry from the farmer to the designing engineer but it is the farmer who is making the engineer bend his best efforts towards the production of a powerful and reliable car at $1,000.

Returns from the Minneapolis and Kansas shows illustrate this fact emphatically. Estimates based on careful observations indicate that 37,000 cars will be sold in the Minneapolis territory. During 1914 $39,000,000 worth of cars and accessories were disposed of through the territory centering in Kansas.

The farmer wants a powerful car for $2,000 at the utmost and $1,200 is closer to his purse. This, then, is the problem which the farmer puts to the automobile designer.

Zimmerschied Is Chairman of S. A. E. Standards Committee

Metallurgist Accepts Appointment by the Council and Succeeds Henry Souther—Committee Personnel To Be Announced Shortly

NEW YORK CITY, Feb. 16—K. W. Zimmerschied, Chief Metallurgist of the General Motors Co., has been elected chairman of the Standards Committee of the Society of Automobile Engineers. Mr. Zimmerschied has accepted his appointment by the council and will immediately preside over the activities of this important branch of the Society. Mr. Zimmerschied succeeds in office Henry Souther who resigned at the last winter session in order to devote himself to the Ferro organization of which he is a member.

Mr. Zimmerschied has been active in the affairs of the Society for a number of years having been during the year of 1914 a member of the Iron and Steel Division of the Standards Committee and holding the office of second vice-president during that year. The work of the Standards Committee will be actively pushed and the policies developed under Mr. Souther's administration will doubtlessly be continued. It is the aim of the organization to bring the members of the Standards Committee together at least four times a year and the mileage expenses of the members of the committee are paid. The work in hand is far reaching and the committee has under consideration many standards that will cut cost of manufacture in several branches of the industry. The new personnel of the committee will be announced shortly.

K. W. Zimmerschied, new chairman of the Standards Committee of the Society of Automobile Engineers.

Australian Trade Recovering—Trucks Scarce

NEW YORK CITY, Feb. 8—Throughout Australia, with the exception of South Australia, the automobile trade is improving; stock values have recovered greatly since the reopening of the Exchange and, though the position is by no means the same as previous to the war, still people are beginning to spend money once more. Naturally the demand for high-priced cars is very small, not only because of the stringency of the times, but because the new taxation which lately came into force taxes individuals more highly. Added to general taxes that have the effect of raising the cost of living, there are special automobile imposts varying from $10 to $50 according to size. The most popular pleasure car just now should be the medium and low-priced four which is inexpensive to run as well as to purchase. It is not expected that the Australian public will take a strong liking for the eight cylinder.

In the truck field things are particularly bright, since the large number of users who have lost their vehicles to the government—for despatch to the seat of war—will buy anything capable of doing the work. Several American makers are already on the spot and are doing good business with trucks of medium size.

To give some idea of the wealth of the district from Ballina to the Tweed River which takes in 60 miles of coastline and averages about 20 miles inland, the amount paid by the butter factories to the farmers in that district for butter last month was over $1,000,000. The demand from these factories is the same the whole year round. Of course, it does not include pigs, cattle, horses, hides, sugar-cane, poultry and eggs, and also it does not include the Byron Bay butter factory, which is the largest in the world. This factory turns out over 1,000 tons of butter a month.

The wealth of Queensland is precisely the same, and more in the Charters Towers and Townsville district on account of the huge meat preserving and exporting works erected there.

As Queensland is a wealthy country, and not due to manufacturing business, it can be plainly seen that the whole of the wealth comes from the worker on the land, and this is the man who buys cars and forms a large proportion of the 79 per cent. of the cars that go into the country districts.

S. D. Waldon Goes to Cadillac

DETROIT, MICH., Feb. 16—Sidney D. Waldon, vice-president in charge of forework and current engineering of the Packard Motor Car Co., has severed his connection with that company to join the Cadillac Motor Car Co., where his duties largely will be in an advisory capacity in the engineering department as well as in assisting the management in a general way. Jesse G. Vincent, chief engineer of the Packard company, has been appointed vice-president for engineering to succeed Mr. Waldon. Associated with the Packard organization practically since its inception, having joined it in 1902, when the concern was still in Warren, O., Mr. Waldon advanced from almost the bottom of the ladder to sales manager, general manager and vice-president in turn. He is today one of the big figures in the industry. Mr. Vincent came to the Packard company in 1912, having previously been associated with the engineering work of the Hudson Motor Car Co.

Automobile Insurance Rates Reduced

NEW YORK CITY, Feb. 15—The automobile committee of the Workmen's Compensation Service Bureau has completed the work of revising the automobile experience, furnished by individual companies, and as a result new schedules of liability rates for pleasure cars will be issued at once and will become effective March 1. These will be effective throughout the country, except in Chicago where new rates went into effect Monday of this week. These are the same as the old rates for cars up to 20 horsepower and on higher horsepowers reductions of from $1 to $10 from the former manual have been made. New rates for commercial vehicles for the whole country, except the following cities, will be issued later: New York, Chicago, Boston, Providence and St. Louis. Property damage and collision insurance rates are unchanged.

Croxton Plant Sold for $25,500

WASHINGTON, PA., Feb. 13—The plant and property of the Croxton Motor Car Co., were sold at sheriff's sale today for $25,500 to J. I. Brownson, A. M. Linn and J. D. Bigger, trustees of the guarantee fund of the Washington Board of Trade.

Overland Plant is Rushed to Capacity

Full Force of 8,600 Men Works 24 Hours a Day—Unfilled Orders Increase

TOLEDO, O., Feb. 13—The Willys-Overland Co. reports that the week ending February 13 was the largest single week the company has ever experienced. The Toledo factory is operating 24 hours a day with a full force of 8,600 men.

The unfilled orders in the hands of the Overland sales department on February 6 were larger by 26 per cent. than those on hand on the same date of last year.

In New York City 145 per cent. more Overlands have been required to meet the demand since the start of the fiscal year on July 1. In Washington the increase is 125 per cent.; in Boston, 110 per cent. and in Philadelphia 70 per cent.

A little farther to the west Cleveland shows a healthy increase of 130 per cent.; Pittsburgh follows with 80 per cent., and Toledo 60 per cent. In the middle west, Chicago, which ranks as the third largest of the 4,000 Overland dealers, shows a growth in sales of 64 per cent. Kansas City, the second largest Overland distributing point, is using half again as many cars as it did during the same period of last year. Milwaukee is running one-third ahead of its record of a year ago.

NEW YORK CITY, Feb. 15—The Willys-Overland Co. reports to the New York Stock Exchange for the 5 months ended November 30, 1914, as follows:

Profits for period after deducting maintenance, depreciation, etc.	$3,308,255
Interest..	126,582
Net income	3,181,672
Preferred dividends	82,618
Common dividends	600,000
Retirement of preferred stock	83,333
Surplus	2,415,722

Moon's Jan. Business Gains 28.24 Per Cent.

ST. LOUIS, MO., Feb. 15—The Moon Motor Car Co. reports a gain of 28.24 per cent. during the month of January just passed, with the corresponding month last year. The shipments of 1915 models during the first month of this year were valued at $347,912.07 as against $271,278.47 during the same month in 1914, which is a gain of $76,633.60.

Buffalo Concerns Increase Working Force

BUFFALO, N. Y., Feb. 16—The Pierce-Arrow Motor Car Co., which ordinarily employs about 5,000 workmen when running at full capacity now again is running full time and the force of workmen gradually is being increased. Local selling agents for various motor companies now are reporting constantly increasing sales. The American Automobile Body Co., of Buffalo, has received a contract to construct for the Franklin company 3,000 automobile bodies. This contract is one of the largest made this year and in order to execute the contract a large force of workmen will have to be maintained for about 1 year.

SYRACUSE, N. Y., Feb. 15—A great increase in orders and business generally is reported by the Brown-Lipe Chapin Co., whose bevel gear and differential plants are very active at present. The Brown-Lipe Gear Co. also reports an increase in demand for complete transmissions. Both concerns anticipate a busy season.

National Carbon's Income $2,215,880

NEW YORK CITY, Feb. 15—The National Carbon Co., which closed its fiscal year on December 31, 1914, reports a net income of $2,215,880.18. Out of this income the company disposed of $372,750 on preferred stock dividends; $582,930 on common stock dividends; charges for depreciation, $389,872.70; reserve for bonus to employes, subscribers to common capital stock, $25,000; customers' accounts written off, $19,708.78; and a balance credited to the profit and loss account amounting to $825,618.70.

The company now has ten factories in operation which are manufacturing lighting carbons, carbon brushes, carbon electrodes, carbon specialties, wet batteries, flashlights and flashlight batteries, standard dry batteries, storage batteries, electric starters, automobile accessories and specialties. The company is completing a large new factory in Long Island City, which will furnish for the American Ever Ready branch increased facilities.

Under the authority of a resolution adopted by the stockholders at their meeting on February 16, 1914, the executive committee offered to the company's employes the 5,000 shares of common capital stock set aside for that purpose. The plan of distribution provides that faithful employes are entitled to subscribe for the stock at par, and that they shall be given from 3 to 5 years in which to complete their payments. A bonus of $5 per share per year will be credited to the accounts of employes who are subscribers, for service during the 5 years over which the profit sharing plan extends. Subscriptions have been accepted from 1,264 employes.

Automobile Securities Quotations

NEW YORK CITY, Feb. 16—The general tone of the automobile securities market during the past week was considerably stronger than that which prevailed during the preceding period, only a few of the stocks showing a decline in value. Kelly-Springfield Tire and Maxwell were both strong while many other gains were recorded. Some of these might be mentioned as follows: Kelly-Springfield Tire common, 1 point first preferred, 2, second preferred, 5; Maxwell common, 5 1-4, first preferred, 3-4, second preferred, 1 3-4; Portage rubber common, 4, preferred, 5; and Packard preferred, 2.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	200	..	250	..	..
Ajax-Grieb Rubber Co. pfd	99	102	100	..	..
Aluminum Castings pfd	97	100	95	100	..
J. I. Case pfd	..	..	..	85	..
Chalmers Motor Co. com	85	90	..	94	..
Chalmers Motor Co. pfd	92	94	91	94	..
Electric Storage Battery Co	..	..	48	49	+ ½
Firestone Tire & Rubber Co. com	270	276	370	376	..
Firestone Tire & Rubber Co. pfd	109	110½	108	110	—1
General Motors Co. com	60¼	64¾	94½	95	+1
General Motors Co. pfd	89½	90	95	96	+ ½
B. F. Goodrich Co. com	23½	24	31	32	—1½
B. F. Goodrich Co. pfd	88	90	96	97	+ ⅜
Goodyear Tire & Rubber Co. com	210	218	191	194	+1
Goodyear Tire & Rubber Co. pfd	96½	98	101	102	..
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	..	..	..
International Motor Co. pfd	..	15	..	..	..
Kelly-Springfield Tire Co. com	..	..	108	110	+1
Kelly-Springfield Tire Co. 1st pfd	..	..	84	85	+2
Kelly-Springfield Tire Co. 2d pfd	..	..	122	127	+5
Maxwell Motor Co. com	5	5½	22½	23½	+5¼
Maxwell Motor Co. 1st pfd	27	27½	59	60	+ ¾
Maxwell Motor Co. 2d pfd	8½	9	24	25	+1¾
Miller Rubber Co. com	..	..	150	156	—8
Miller Rubber Co. pfd	..	..	101	103	..
New Departure Mfg. Co. com	120	124	118	123	+1
New Departure Mfg. Co. pd	103	106	105½	106½	+ ½
Packard Motor Car Co. com	..	..	..	99	..
Packard Motor Car Co. pfd	94	98	95	..	+2
Peerless Motor Car Co. com	15	25	13	20	..
Peerless Motor Car Co. pfd	75	80	..	55	..
Portage Rubber Co. com	..	40	34	36	+4
Portage Rubber Co. pfd	..	90	85	95	+5
*Reo Motor Truck Co	7½	8½	11¼	12½	+ ½
*Reo Motor Car Co	17¾	18½	24¼	25½	+ ¼
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	55	56	51½	53½	+2
Stewart-Warner Speed. Corp. pfd	98	99½	101	103	+ ½
Studebaker Corporation com	26½	27½	45	46	—1⅜
Studebaker Corporation pfd	84½	86½	95	96	+1
Swinehart Tire & Rubber Co	70	72	71	73½	+2
Texas Company	..	..	132	133	+1
U. S. Rubber Co. com	59½	59¾	56	57	+ ½
U. S. Rubber Co. pfd	101½	102	103	104	+ ¼
Vacuum Oil Co	214	218	188	192	—4
White Company pfd	105	110	103	110	—5
Willys-Overland Co. com	64	66	95	97	—1½
Willys-Overland Co. pfd	92	95	95	96	..

*Par value $10; all others $100 par value.

Uninterrupted Service for Krit Owners

DETROIT, MICH., Feb. 15—Within the next 10 days Samuel Winternitz & Co., Chicago, who purchased the assets of the bankrupt Krit Motor Car Co., and of the Krit Sales Co., will announce the new officers of the re-organized Krit Motor Car Co., the business of which will be continued in the present plant. A letter has been sent to the dealers which reads partly as follows:

"We are not in a position just yet to advise you the exact plans regarding the marketing of cars for 1915. We hope, however, to be able to give you definite information very shortly. In the meantime, the service department will be carried on the same as before the receivership Krit dealers will receive the same discounts and in every way will be taken care of the same as before the period of reorganization. The terms of cash in advance, which have governed

Market Reports for the Week

NEW YORK CITY, Feb. 17—Market prices this week were more or less steady. There were, however, a few changes which were of importance. Kansas petroleum came down from $0.55 to $0.40 a barrel and antimony and lead went up $0.01 1-2 and $0.05, respectively. Tin closed at $36.13 per 100 pounds at a gain of $0.38. The rest of the metals and oils and lubricants experienced no changes. The copper demand was light in both the domestic and foreign markets, with prices, except for jobbing lots, almost entirely nominal. Rubber continues firm with an increased demand reported from the manufacturers. The market retained a firm tone and prices were in all instances apparently well maintained.

Material	Wed.	Thurs.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.17	.17	.17	.18	.18½	+.01½
Beams & Channels, 100 lbs.	1.21	1.21	1.21	1.21	1.21	......
Bessemer Steel, ton	18.50	18.50	18.50	18.50	18.50	......
Copper, Elec., lb	.14½	.14½	.14½	.14½	.14½	......
Copper, Lake, lb	.14⅝	.14⅝	.14⅝	.14⅝	.14⅝	......
Cottonseed Oil, bbl	7.05	7.12	7.11	7.10	7.15	+.10
Cyanide Potash, lb	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl	.12	.12	.12	.12	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	......
Lead, 100 lbs	3.80	3.80	3.80	3.80	3.85	+.05
Linseed Oil	.60	.60	.60	.60	.60	......
Open Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.55	.45	.45	.45	.40	—.15
Petroleum, bbl., Pa., crude	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.75	.75	.75	.75	.75	......
Rubber, Fine Up-River, Para	.58	.58	.58	.58	.58	......
Silk, raw, Ital	..	3.90	..	3.90	3.90	......
Silk, raw, Japan	..	3.37½	..	3.72½	3.35	—.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	......
Tin, 100 lb	35.75	36.25	36.25	36.25	36.13	+.38
Tire Scrap	.05	.05	.05	.05	.05	......

all the shipments for the past 6 weeks have been lifted. In the future; all shipments will be made on a C.O.D. basis."

American Steel Foundries Enter Field

CHICAGO, ILL., Feb. 15—The American Steel Foundries have established a department especially for handling the business of automobile builders in connection with the general steel castings used in construction, and especially their new types of steel wheels.

H. K. Gilbert, Fisher Bldg., Chicago, has been appointed special sales agent for this department.

English Dealer Here for Car Agencies

NEW YORK CITY, Feb. 16—Guy Lewin, head of Guy Lewin, Ltd., London, landed here today. He will proceed at once to Buffalo, where he will be the guest of George Houk, the wire wheel manufacturer. He will then journey to Detroit where he will stay at the Hotel Statler. It is understood that Mr. Lewin is confident of his ability to do good business in England with American cars and accessories, and the immediate object of his visit to this country is to find new agencies for a car or cars selling for less than $1,000.

One of the first big dealers in the British automobile trade was Sir Charles Friswell who established a large depot in London and made from his business a considerable fortune. Some time ago on his retirement the concern passed into the hands of Guy Lewin, who was Sir Charles' chief of staff, and more recently on a reorganization of the whole business it became Guy Lewin, Ltd., instead of Friswells.

Diamond and Lee Reduce Tire Prices

NEW YORK CITY, Feb. 13—The revision of tire lists still continues though not all manufacturers have as yet been heard from. Since last week, two more makers have announced revised lists, these being Lee and Diamond. The new lists, together with the old ones on some of the more popular sizes are given herewith.

The list of makers who have revised their schedules following the revision made by Goodrich now includes Braender, Firestone, Fisk, United States, Goodyear, Kelly-Springfield, Ajax and Pennsylvania. The companies which have not yet made formal announcement include Batavia, Federal, Miller, Republic and some others. Lee and Diamond changes are given in the table, both former and present prices being given:

Iowa Registration Doubles in 2 Years

Increase of 34,000 Cars Made Over 1913—Big Crops Predict 1915 Will Be Banner Year

DES MOINES, IA., Feb. 15—Statistics of Iowa's automobile growth, just issued by the state insurance department, show that the automobile population of the state has almost quadrupled in 3 years, that it has more than doubled in 2 years, and that the increase of 1914 over 1913 was more than 34,000. Following this period of remarkable growth, it is predicted that the present year will be the greatest automobile year in the history of the state because of uniformly favorable conditions, an excellent financial situation, and the universal interest in the automobile.

The automobile registration for Iowa in 1911 was 28,131; in 1912, 44,628; in 1913, 71,717; in 1914, 106,087.

Every indication points to larger automobile sales in Iowa in 1915 than in any previous year. Iowa people never had so much money in their pockets as now. Last year's crops, which, according to the Iowa Dept. of Agriculture, were worth $357,819,300, are $50,000,000 more in value than the crops of 1913 and $89,000,000 in value over the crops of 1912. Much of last year's crops is still on hand and moving at war time prices.

War conditions have had no bad effect on Iowa. The increasing prices of food stuffs are just what the Iowa farmers want for it is food stuffs that they have to sell and the result is that Iowa prosperity is greater, perhaps, now than at any previous time in the history of the state.

Ky. 1914 Registrations Increase 64 Per Cent.

LOUISVILLE, KY., Feb. 15—During 1914, the automobile experienced its most prosperous year in Kentucky, the registrations in the office of the Commissioner of Motor Vehicles showing an increase over 1913 of automobiles alone of 62 per cent. and if motorcycles are included the increase is 73 per cent. According to Hugh Ramsey, deputy commissioner of Motor Vehicles, there will be 20,000 machines registered in this state by January 1, 1916.

15,000 Pennsylvania Farmers Own Cars

YORK, PA., Feb. 13—Seven per cent. of the farmers of Pennsylvania own automobiles according to the figures compiled by L. H. Wible, chief of statistics of the Pennsylvania Department of Agriculture, from reports made to him from every county in the state. It is estimated by him that at least 15,000 automobiles are owned on farms and they are employed not only for getting about to make purchases and for pleasure, to go to church and meetings, but for marketing and hauling purposes. It is his belief that this year will see a big increase in the number of automobiles owned by farmers, who are getting good prices now and for whose use many makes of cars are being manufactured.

CHICAGO, ILL., Feb. 15—Registrations in the state of Illinois during 1914 amounted in number of 131,140. There were 18,000 licenses granted to chauffeurs.

Fisk Adds $500,000 Preferred Stock

CHICOPEE FALLS, MASS., Feb. 12—The stockholders of the Fisk Rubber Co., at a meeting held on February 10 in this city, authorized an additional lot of $500,000 preferred stock, which will be sold for the company on commission by a Boston banking house. The proceeds of the new stock will be used for additional working capital.

		30 x 3		32 x 3½		34 x 4		36 x 4½	
Lee	Plain	$9.45	$12.40	$14.05	$17.75	$20.40	$25.85	$28.80	$37.10
	Non-skid	13.15	16.60	20.40	24.70	27.40	33.10	40.20	50.20
	Plain P. P.	18.45	20.15	25.50	28.35	34.45	38.25	44.80	49.75
	Non-skid P. P.	22.15	25.15	31.85	36.30	41.45	47.00	56.20	64.95
	Tube	2.75	3.25	3.30	4.55	4.70	5.75	6.10	7.60
Diamond	Plain	9.00	11.70	13.35	16.75	19.40	24.35	27.35	35.00
	Non-skid	9.45	12.65	14.00	18.10	20.35	26.05	28.70	37.10
	Tube	2.35	2.80	2.80	3.70	4.00	4.90	5.20	6.45

France Our Best Customer in December

Buys 969 Motor Vehicles—United Kingdom Second with 850—No Cars Shipped to Germany or Italy in That Month—Detailed Export Statistics

WASHINGTON, D. C., Feb. 13—Supplementing the general figures of exports of motor cars during December and the calendar year ending that month, as published in last week's issue of THE AUTOMOBILE the following detailed figures will be found of interest to the automobile trade.

The feature of the month's export business was the large number of trucks shipped abroad, the number being 1,279 and the value $3,387,729. For the 12 months' period the number of commercial cars exported was 3,430, the value of which was $8,985,756. This was a tremendous increase over the corresponding figures for 1913, which showed that during December of that year eighty-eight commercial cars were exported, the value being $100,660, while during the calendar year the number was 1,009 and the value $1,686,807.

On the other hand exports of pleasure cars showed a marked decrease. In December, 1913, the number shipped abroad was 2,301, valued at $2,052,484, while in December last the number had fallen to 1,297 and the value to $998,698. During the calendar year the shipments dropped from 25,880, valued at $25,343,644, in 1913, to 22,335, valued at $19,521,708, in 1914.

France was the largest purchaser of cars from this country during December, that country taking 969, valued at $2,588,622. The United Kingdom was second with 850 cars, valued at $1,097,007, while third place was taken by British Oceania, with 285 cars, valued at $222,975. No cars were shipped to either Germany or Italy during December, while in December a year ago Germany imported 58 cars from this country, the value of which was $45,810, while Italy's purchases amounted to 12 cars, valued at $11,236. The war conditions are also reflected in Mexico's purchases of cars from this country, only 7 being shipped to that country in December last, the value of which was $9,660, while in December a year ago the number was 14, and the value $21,254.

Looking over the year's export business the figures show that the United Kingdom was our largest purchaser of cars, taking 6,799 machines, valued at $6,891,511 during the 12 months of 1914. Other large buyers of American cars during the year were Canada, with 4,214 cars, valued at $5,347,547; France, 2,816 cars, valued at $5,099,425; British Oceania, 3,475 cars, valued at $2,955,825, various European countries not separately enumerated, 2,785 cars, valued at $3,411,100; Asia and other Oceania, 1,454 cars, valued at $1,425,556.

The detailed figures of exports for the periods under consideration are given in the accompanying table.

German Bearing Embargo Reported

NEW YORK CITY, Feb. 15—It is reported that Germany has placed a total embargo on the exportation of ball bearings. If this be true, that this will seriously affect the business of importers in this country is the opinion of the majority of those engaged in this business. It is stated by several that considerable difficulty is had even at the present time in securing bearings of certain sizes from the countries at war. These are generally the larger bearings and according to one importer, notably in the sizes having an internal bore of .75 or 1.5-inch. With this situation, as it stands and considering the probable effect of the embargo, it is certain that American makers or those dealing in bearings imported from other neutral nations will secure some of this business.

According to the Barthel and Daly company, the embargo is not likely to last long enough to seriously affect the stock of those who have prepared themselves for a shortage. The J. S. Bretz Co. states that it had heard nothing of such an embargo. Marburg Bros. are of the opinion that such an embargo would seriously affect the companies that are importing from the affected area with, of course, a corresponding rise in the business of those securing their bearings in America or unaffected countries. The Norma com-

Exports and Imports of Automobiles, Trucks and Accessories in December and Preceding 12 Months

	December				12 months ending December			
	1913		1914		1913		1914	
EXPORTS	Number	Value	Number	Value	Number	Value	Number	Value
Automobiles:								
France	120	$100,418	969	$2,588,622	921	$710,149	2,816	$5,099,452
Germany	58	45,810	.....	....	1,017	857,103	1,063	799,552
Italy	12	11,236	.....	....	314	270,315	235	160,058
United Kingdom	648	484,299	850	1,097,007	5,152	3,966,600	6,799	6,891,511
Other Europe	160	136,183	27	29,436	1,846	1,571,678	2,785	3,411,100
Canada	227	307,170	128	189,466	6,051	8,177,256	4,214	5,347,547
Mexico	14	21,254	7	9,660	227	408,148	88	111,344
West Indies and Bermuda	72	70,166	96	67,716	527	515,762	646	525,062
South America	239	234,905	86	40,476	2,713	3,008,045	1,149	863,360
British Oceania	495	431,530	285	222,975	3,564	3,286,860	3,475	2,955,825
Asia and other Oceania	137	134,891	92	115,792	2,367	2,353,788	1,454	1,425,556
Other countries	207	175,282	36	25,277	2,190	1,904,747	1,041	917,097
Total	2,389	$2,153,144	2,576	$4,386,427	26,889	$27,030,451	25,765	$28,507,464
Tires:								
Belgium	...	....	.....	....	......	$99,061	......	$301
Germany	..	$16,022	.....	....	......	441,795	......	81,917
England	...	162,113	.....	$182,852	......	1,392,907	......	1,458,777
Canada	...	44,053	.....	14,526	......	1,134,110	......	866,999
Mexico	...	4,936	.....	6,341	......	148,258	......	76,581
Philippine Islands	...	14,717	.....	16,366	......	143,724	......	156,235
Other countries	...	53,633	.....	80,811	......	550,833	......	674,306
Total	...	$295,474	.....	$300,896	......	$3,910,688	......	$3,315,116
IMPORTS								
Automobiles:								
France	22	$56,187	7	$16,107	196	$467,167	71	$150,600
Germany	1	3,570	.....	....	81	214,701	12	21,979
Italy	5	9,240	.....	....	85	153,039	106	115,718
United Kingdom	6	16,990	5	16,107	54	161,667	60	153,413
Other countries	4	7,668	4	6,358	76	158,299	47	51,595
Total	38	$93,655	16	$38,572	492	$1,154,873	296	$493,305
Rubber, etc. Unmanufactured:								
Balata ....lbs..free.	194,304	$96,566	200,002	$74,712	1,508,946	$792,543	2,015,158	$880,214
Guayule gum...lbs..free.	37,981	23,057	742,169	215,904	4,870,203	2,129,681	2,275,540	789,560
Gutta-joolatong.lbs..free.	1,550,562	74,186	1,192,567	50,787	36,420,921	1,765,816	18,663,898	856,976
Gutta-percha ..lbs..free.	133,005	22,811	46,461	9,564	872,595	199,808	1,923,138	337,128
India rubber...lbs..free.	10,480,701	5,437,668	11,583,797	5,138,953	115,880,641	76,820,739	143,065,161	70,472,704
India-rubber scrap or refuse, fit only for remanufacture .lbs..free.	851,549	67,430	559,613	28,975	36,737,977	3,193,013	19,118,966	1,356,750
Total unmanufactured.	....	$5,721,718	....	$5,518,895	....	$84,901,600	....	$74,693,332

pany states that the larger bearings are scarce but that no trouble, relatively speaking, has been had in bringing the smaller bearings into this country. According to this company, there is little doubt but that Germany will continue to allow the exportation of small bearings. The Riebe company states that, while certain sizes are missing, it is because the manufacturer has not been able to secure the raw material from the German mills because this material has been used for purposes other than the manufacture of bearings. This situation, it is expected, will be shortly relieved by supplies from the mills which will furnish their regular customers with chrome-nickel steel. The S. K. F. company states that there seems to be a shortage in the three-quarter and 1¼-inch internal bore bearings.

The Rhineland Machine Works, who received a cablegram from Germany to the effect that this embargo had been declared, is of the opinion that no more ball bearings will be exported from that country, with the effect that German dealers here will be troubled by a shortage and the extra demand on the domestic makers will cause a rise in price. The Hess-Bright company had not as yet heard of the embargo, but owing to a large stock added to the bearings that are made in America, does not believe that the consequences will be serious.

Rubber Control Committee Appointed

New York City, Feb. 16—The Rubber Club of America has opened rooms in the Whitehall Bldg., 17 Battery Place, this city, to handle imports of rubber more readily. Sir Richard Crawford, the official representative of the British Government sent to the United States to handle the situation arising out of the various embargoes, recently called upon the club to aid in enforcing the agreements.

Immediately upon receipt of this information the executive committee of the club appointed a special committee to be known as the rubber control committee, which is constituted as follows: C. T. Wilson, chairman, C. T. Wilson Co., crude rubber importers; W. J. Kelly, Arnold & Ziess, 277 Broadway, crude rubber importers; B. G. Work, president of the B. F. Goodrich Co., Akron, O.; Henry Spjadone, president of the Gutta Percha & Rubber Mfg. Co., New York City; G. B. Hodgman, president of the Rubber Club of America and president of the Hodgman Rubber Co. of New York; W. E. Bruyn, president of the Rubber Trade Assn. of New York, of L. Littlejohn & Co., crude rubber importers, 129 Front street, New York.

In regard to shipments of rubber, it is reported that there is a great improvement since the lifting of the embargo. The first substantial shipment of plantation rubber from Great Britain since the lifting of the embargo was on the Menominee, which arrived last week with 22,000 cases, approximately 2,250,000 pounds, the greater part of which will be immediately put to use.

New Record in Petroleum Exports

New York City, Feb. 15—The United States exported in Great Britain in the last 3 months of 1914, 96,400,000 gallons of petroleum, or about 85 per cent. of the total which amounted to 103,000,000 gallons.

A new record was reached, total imports of petroleum products into the United Kingdom amounting to approximately 460,000,000 gallons, an increase of 35,000,000 gallons over the previous year and 105,000,000 above the 1912 figures. Of motor gasoline there were imported 120,500,000 gallons, nearly 20,000,000 more than in 1913, and of this quantity 57,000,000 gallons came from the far East and 43,000,000 from the United States.

In normal times England draws its petroleum supplies from four principal sources, America, East Indies, Russia and Roumania. In 1913 the United States and Mexico supplied 67 per cent., the far East 14 per cent. and Russia and Roumania 8 per cent. each. During the last 3 months of 1914 the United Kingdom drew practically all her supplies from America. Up to the end of September, England had received from the United States 229,000,000 gallons of petroleum products, and at the end of the year this figure had increased to 317,700,000 gallons, while from the far East only 5,000,000 gallons were imported during the last 3 months.

Petroleum production in the United States during 1914 amounted to 292,000,000 barrels, a gain of 13 per cent. over 1913, the production in that year amounting to 248,446,230 barrels.

New York City, Feb. 16—The officers and directors of the Electric Vehicle Assn. of America gave a dinner at Delmonico's last night to their past president, F. W. Smith. At the conclusion of the dinner, a surprise to Mr. Smith, an address was made by J. F. Gilchrist, of the Commonwealth Edison Co., Chicago, Ill., who succeeds Mr. Smith as president. J. H. McGraw, of the McGraw Publishing Co., and J. W. Lieb, vice-president of the New York Edison Co., made addresses, both speaking on the relation of the central station to electric vehicle development.

Sparks-Withington Wins Horn Suit

Court of Appeals Rules That Sparton Horn Does Not Infringe Hutchinson Patents

NEW YORK CITY, Feb. 12—Affirming the decision of the lower court, and dismissing the bill of complaint with costs, Judge Coxe of the U. S. court of appeals for the second circuit has handed down a decision in favor of the Garland Automobile Co. on the appeal made by the Lovell-McConnell Mfg. Co. It will be remembered that the Lovell-McConnell company brought suit against the Garland concern in the U. S. district court for the southern district of New York, charging infringement of three patents granted to Miller Reese Hutchinson covering horn construction, by the sale of cars equipped with the Sparton horn. The decision handed down in this court in favor of the Garland company was appealed by Lovell-McConnell.

In the appeal five claims were involved, three of patent No. 923,048, being claimed 17, 24 and 27, claim 22 of patent 923,049 and claim 47 of patent 923,122, all of which have to do with the construction and operation of the diaphragm and other elements in a horn, the frequency in amplitude of vibration of the diaphragm and the resulting alarm note being a feature.

In his decision Judge Coxe said, referring to the decision handed down last June against the Lovell-McConnell company and in favor of the Automobile Supply Mfg. Co., "All of these claims were in issue in the former action. In that case we reach the conclusion that 'the broad claims in controversy of the Hutchinson patents are invalid and the claims that cover specific details, if valid, are not infringed." Other statements made by Judge Coxe in his decision are:

"The only new evidence is a series of experiments by Professor Webster tending to show that the vibrations of the Klaxon diaphragm are different than those of the Pierman diaphragm. (Referring to the Pierman horn produced in evidence in the previous suits.) . . . These experiments show learning and ingenuity and are interesting from a scientific point of view but are too technical and refined for practical application to the peresent controversy. . . . In short, we think the test proposed . . . . . too technical for a practical adoption in patent cases. It would, if permitted, enable the patentee to contend successfully, that, although his combination is shown in the prior art, he is entitled to a monopoly because he uses better material, because his machine is on a much larger scale and is more scientifically constructed than the one which preceded it. Conceding all that Professor Webster says to be true, we do not think it requires a modification of our former decision. If all the new testimony had been in the former records the result would have been the same."

In accordance with its announcement in February, 1913, to the effect that it would shield its clients in any suits brought against them because of using or selling Sparton horns, the Sparks-Withington Co., Jackson, Mich., fought the case for the Garland company.

Trenton, N. J., Feb. 16—An amendment to the "Seven Sisters" anti-trust laws, designed to permit corporations to hold stock in other corporations for investment purposes only has been passed by the Senate.

Trenton, N. J., Feb. 15—The bill which was introduced in the Legislature at Trenton by Assemblyman Peacock, seeking to repeal the present motor vehicle reciprocity law, was defeated by a vote of 11 to 44 on February 9. Assemblyman Oliphant, who was one who favored the bill, stated that the New Jersey roads cost the taxpayers of the State approximately $3,000 a year per mile to maintain.

Master to Pass on Carbureter Damages

Detroit, Mich., Feb. 15—The statement made in the last issue of The Automobile in the report of the decision in the Stromberg-Zenith patent suit to the effect that the former company can collect a royalty on the two models of Zenith carbureters which Judge Sanborn held were infringements is misleading to a certain extent. The Zenith company points out that the matter has been referred to a master, who will pass upon the question of damages which the Stromberg company may have sustained by reason of this infringement and that not until such damages shall have been ascertained can the Chicago concern collect.

Orders Filed for 130 Army Trucks

Four Wheel Drive Increases Force—1,000 Motors Ordered—A Sleeve-Valve Eight

CLINTONVILLE, WIS., Feb. 15—The Four Wheel Drive Auto Co., Clintonville, Wis., has booked orders for 130 four-wheel-drive army cars for immediate delivery and is working its plant with increased forces. The company has placed an order with the Prime Steel Co., Milwaukee, for crucible steel castings which is the largest single order the Milwaukee concern has ever booked. The exact source of the big orders recently booked is not revealed, but is supposed to be both for American and foreign army account.

PORT HURON, MICH., Feb. 10—An order for 1,000 four-cylinder motors, 3 3-8 by 3 3-4, has been received by the Port Huron Construction Co., from the Regal Motor Car Co., Detroit. Another order for a large number of eight-cylinder motors for the same company has also been received. Both motors were designed by Sidney G. Jenks, general manager of the local manufacturing concern.

Pilliod Is First Sleeve-Valve Eight

TOLEDO, O., Feb. 12—The Pilliod eight-cylinder car which was shown for the first time in public at the opening of the recent annual local automobile show, in the Terminal building, is designed by C. J. Pilliod, a local mechanical engineer known as a designer of internal combustion engines and also as a railroad engineer.

The cylinders are cast in two blocks of fours, at an angle of 90 degrees and have a 3-inch bore and 5-inch stroke. The motor is of the sleeve type and there are no push rods or rocker arms. The bearings are adjustable. The carbureter is a Rayfield. The clutch is a cone. Water circulation is of the thermo-syphon type. The lubrication is non-circulating splash. The Atwater Kent ignition system is used. The starting system is the U. S. L. The Warner transmission is being used. Steering is on the left side with center control. The axles are Timken, full floating in rear. Semi-elliptic springs are used both on the front and rear. The wood wheels are fitted with 34 by 4 Congress tires. The frame is overslung in front and underslung in rear. The wheelbase is 120 inches and the tread standard.

For the present only one model will be made, a touring car for 5 or 7 passengers which will be listed at about $1,800, the price not having as yet been finally decided. The Pilliod Motor Co., which will build the cars, is located at 1212 Oakwood avenue.

Announce an Eight from Elwood

ELWOOD, IND., Feb. 12—Eight cylinders is the feature of the new Bailey-Klapp car, announced by the Elwood Iron Works Co., here. The price of the car and the complete details of the specifications have not been made public as yet, but it may be stated that the motor is a V-type, 3 by 4 inches in cylinder dimensions, A disk clutch, three-speed gearset and 54 inch rear springs are other features of the chassis. Upon the 116-inch wheelbase is fitted either a five or seven-passenger body, with one-man top and divided front seats. The manufacturer of the new eight also is making a four-cylinder car called the Elco 30.

A New Four-Cylinder Alter

PLYMOUTH, O., Feb. 12—The Alter car which has not been shown at the national shows and which is made by the Alter Motor Car Co., has a four-cylinder Golden, Belknap & Swartz motor, cast in pairs, with 3 3-4-inch bore and 4 1-4-inch stroke. Water cooling is per thermo-syphon system, the lubrication of the splash-pressure system. The Splitdorf ignition system has been adopted. The carbureter is a Holley, the clutch is of the disk in oil type. The front axle is a Timken, the rear axle a Walker-Weis semi-floating, the front springs are semi-elliptic, the rear springs three-quarter scroll elliptic. The wheelbase is 106 inches, the tread 56 inches. The wood wheels have 30 by 3 1-2 inches tires. Steering is on the left side with center control.

With regular stock equipment consisting of one man top, windshield, horn, speedometer, etc., and with the Remy starting and lighting system the price of either the two passenger roadster or of the five passenger touring car is $685. Without this system the price is $600.

BOSTON, MASS., Feb. 17—Plans have been made for a 2-day convention of electric car and truck manufacturers, agents, battery and lighting station officials during the Boston Automobile show. The first session will open on March 10, and headquarters will be established at the Boston City Club. Invitations have been sent to all companies identified with the electric vehicle interests and the officials of all the branches of The Electric Vehicle Assn. of America.

Another Synthetic Gasoline Announced

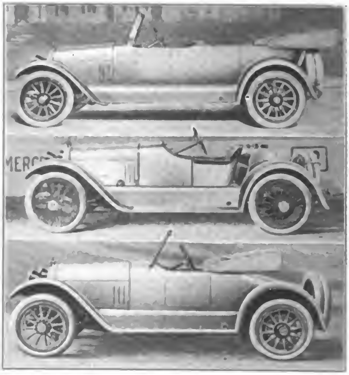
NEW YORK CITY, Feb. 16—Synthetic gasoline is again in evidence. A process for making gasoline out of "synthetic crude oil" has been discovered by Dr. W. O. Snellings, a research chemist of Pittsburgh, who was for many years in charge of explosive experiments for the United States Government. Announcement of the discovery was made at the 110th meeting of the American Institute of Mining Engineers, in the Engineering Bldg., 29 West Thirty-ninth street. Dr. Snelling has been experimenting for the last 5 years. It is not yet determined whether or not artificial fuel will undersell the natural.

NEW YORK CITY, Feb. 15—A new process for the extraction of gasoline from so-called "wet" gas, which is derived from the lower strata of oil wells, is reported as being in successful operation in California. This process, which may be described as fractional refrigeration, is the reverse of that employed in the distillation of petroleum, and consists in refrigerating the gas to a graduated scale of temperatures, the vaporized hydrocarbons with which it is saturated liquifying in rotation exactly as they are vaporized by heating the heavier oils. The temperatures can be closely regulated, and held at those points at which the various grades of gasoline will be condensed.

To Sell Automobiles at Auction

NEW YORK CITY, Feb. 13—The Motor Sales Corp., this city, and the Boston Auto Auction & Sales Co., Boston, Mass., will establish auction sales of automobiles, motorcycles, and accessories on an annual basis in their respective cities.

The local concern will hold a 3-day auction at Madison Square



THREE OF THE NEW MERCER 22-70 MODELS

Top—Six-passenger touring car. Note low effect. Middle—Two-passenger raceabout. Unlike most cars of this type, the upholstery is designed for comfort in everyday driving. The car has a guaranteed speed of a mile in 48 seconds. Bottom—Two-passenger roadster fitted with all the comfortable features of the larger models

Garden, starting March 22, having leased the building for the 3 days with an option of the same dates for the next 3 years. The Boston concern will hold auction sales every Tuesday, starting February 9, at 1105 Commonwealth avenue.

At the local auction, only individual owners of automobiles will be solicited to present their vehicles for sale, the management discouraging the entry of second-hand dealers into the conduct of the sale as much as possible.

An incline and running track will be built in the Garden and a demonstration will be given before such car is put on the block.

It is said that an option has been taken on the Chicago Coliseum by the management of the New York City corporation, and the same sale will be conducted in the West 1 week later. The names of the engineers and managers of the plan will be announced in a short time.

Denver, Del., Feb. 15—A charter has been filed by the Missosan Tire Corp., capitalized at $3,000,000, to manufacture automobile tires. The incorporators are: S. S. Howard and H. O. Coughlin, both of New York.

Meetings and Elections of Officers and Directors

New York City, Feb. 17—At the annual election of officers of the Motor Contest Dealers Assn., held in this city, today, all the old officers were re-elected. They are as follows: W. C. Poertner, president; E. Lascaris, first vice-president; E. C. J. McShane, second vice-president; treasurer, J. P. Nichols; and E. F. Korbel, secretary. Five new directors were elected to serve with the ten as follows: Horace De Lisser, I. M. Uppercu, W. P. Poertner, David Beecroft and S. S. Toback. The ten directors for 1915 are: E. F. Korbel, James Carpels, C. S. Wells, E. C. J. McShane, C. H. Larson, E Lascaris, J. C. Nichols, George Robertson, A. B. Cordner and W. J. Morgan.

New York City, Feb. 16—The board of directors of the Automobile Trade Credit Assn. of this city has been re-elected to serve for the coming year. Carl Kaufman, of the U. S. Horn Mfg. Co. has been re-elected to the presidency and Franz Neilson as counsel and secretary-treasurer. The organization is devoted to the protection of the trade and credit interests of the local concerns in the accessory and other allied trades. During the past year, according to officers of the association, the complaint bureau has adjusted without recourse to law, 1,500 cases out of 3,000 who were not following the practices dictated by business ethics. The board consists of:

Carl Kaufman, U. S. Horn Mfg. Co., New York City; U. S. Kolby, American Ever Ready Works, New York City; D. D. Martin, Martin-Evans Co., Brooklyn, N. Y.; E. V. Nathan, Nathan Novelty Mfg. Co., New York City; F. B. Barnes, N. Y. & N. J. Lubricant Co., New York City; A. Waterman, Hartford Suspension Co., Jersey City, N. J., W. O. Turner, Lovell-McConnell Mfg. Co., Newark, N. J.

Barbour Pres. Ohio Electric Car Co.

Toledo, O., Feb. 15—Several changes among the officials of the Ohio Electric Car Co., were recently made. M. V. Barbour is now president of the company; and C. M. Foster, vice-president and general manager. Herman H. Brand, is secretary-treasurer. The board of directors is composed of the officers and J. F. Vogel, of the Gendron Wheel Co.; A. E. Baker, of Baker Bros.; Rathbun Fuller, attorney and H. E. Marvin, of Walding, Kinnan & Marvin, attorneys.

Hartford, Conn., Feb. 13—The Hartford Auto Parts Co. has been reorganized insofar as its management is concerned, the following officers having been elected: President, Cyrus C. Chamberlain, treasurer of the Blakeslee Forging Co., Southington; vice-president and treasurer, James M. Carney; secretary and assistant treasurer, Harry W. Bigelow. These men, together with Edward D. Redfield, president of the City Bank of Hartford, Horace N. Ensworth, and John H. Trumbull, president of the Trumbull Electric Co., form the new board of directors. The company now has a large amount of business on hand and is operating day and night.

Detroit, Mich., Feb., 9—Officers of the United States Tire Co., and all the branch managers, all told thirty-two high officials, met in conference at the local offices of the company and at the plant of Morgan & Wright, to discuss business conditions, to outline the policy for the year and exchange views and ideas. From the views expressed by several branch managers from different parts of the country the general outlook for business is good and the indications are that this will be a big year for the automobile trade. Besides discussing business matters, the visitors spent a day at the Morgan & Wright plant to familiarize themselves more closely with all matters pertaining to the manufacturing end of the business.

Among those reported as in attendance were. E. S. Williams, president of the United States Tire Co.; M. Tucker, secretary to the president, George Shugart and O. S. Tweedy, western sales managers; Edward McMaster, manager manufacturing department; C. J. Butler, president Morgan & Wright; Joseph Weston, sales manager Charles Case, from the general offices, New York; William McMahan, factory manager, of Morgan & Wright, and the following branch managers: Colburn Standish, Detroit; F. B. Godloe, New York; Samuel Poor, Philadelphia; Edward Kidder, Boston; E. W. Tozier, Chicago; L. A. Brown, Kansas City; P. C. Anderson, Memphis; C. C. Gehring, Pittsburgh, P. Goodhall, Cleveland; Charles Gilbert, San Francisco; F. R. Burton, Atlanta; H. H. Hubbard, St. Louis; J. M. Ward, Indianapolis.

Indianapolis, Ind., Feb. 15—At the annual meeting of the Indiana Automobile Manufacturers' Assn. held at the Claypool Hotel, Indianapolis, on the evening of February 12, the following were elected directors: H. C. Campbell of the Stutz Motor Car Co.; Frank E. Smith, receiver for the Premier Motor Mfg. Co. and J. M. Ward of the United States Tire Co. It was decided to reduce the number of directors from nine to three.

Findlay, O., Feb. 15—At the recent annual meeting of the Grant Motor Co., this city, the following officers were elected: D. A. Shaw, president; G. D. Grant, vice-president; G. S. Salzman, vice-president; and G. S. Waite, secretary.

The board of directors for the coming year will consist of D. A. Shaw, G. S. Waite, G. S. Salzman, G. D. Grant, C. A. Grant, R. R. Hall, A. E. Dorsey and J. M. Howe.

Ardmore, Pa., Feb. 15—At the annual meeting of the Autocar Co., last week, the former board of directors was re-elected. W. W. Norton, who has been for several years superintendent of the factory, was elected a vice-president and will hold the position of production manager. The officers of the company who were re-elected are D. S. Ludlum, president; J. S. Clarke, vice-president; L. S. Clarke, vice-president; E. A. Fitts, secretary and treasurer, and F. C. Lewin, assistant secretary and treasurer.

Louisville, Ky., Feb. 11—At their annual meeting the stockholders of the Kentucky Wagon Mfg. Co., makers of the Urban and Old Hickory trucks, re-elected R. V. Board president, continued the present board of directors without change and heard gratifying reports on the volume of business during the past year.

Detroit, Mich., Feb. 15—At the annual meeting of the stockholders of the Detroit-Wyandotte Motor Co., manufacturer of the Horner trucks, Frank Marx was elected president; Herman Woelmer, treasurer; W. J. Seitz, secretary and George A. Horner, general manager. The business during the past year was declared to have been very satisfactory and it was decided to greatly increase the production this year.

Detroit, Mich., Feb. 9—District managers of the Chalmers Motor Co., will be here for a week or longer and will discuss all matters pertaining to the Chalmers business and the automobile business in general. They will be addressed by the heads of all the departments of the Chalmers organization and an exchange of ideas, suggestions and propositions will take place.

Detroit, Mich., Feb. 12—A first dividend of 10 per cent. has been ordered paid to the creditors of A. H. Kling & Co., automobile supply dealers, whose liabilities amount to $12,658.88. A second dividend also of 10 per cent. will probably be paid.

The creditors of the S. & M. Motor Co. will soon receive a dividend of 8 per cent., making 18 per cent. all told. The liabilities of the concern amounted to $12,570.02.

Both dividends were ordered paid by referee in bankruptcy Lee E. Joslyn.

Utica, N. Y., Feb. 13—The Divine Tire Co., Inc., at Utica, has filed a petition in bankruptcy in the U. S. court, this city. The concern owes $33,254, most of which is unsecured. Assets are placed at $162,663.

Jitneys Carry 45,000 Daily in Kansas City

Both Touring Cars and Buses Prove Practicability of 5-Cent Fare—Travel Is Found Uniform

KANSAS CITY, MO., Feb. 13—Kansas City is rapidly being jitneyized. After 3 weeks over 222 were registered this morning, this not including fifty or sixty that have already found the nickle pace too trying and have withdrawn. Yesterday 45,000 people were carried on jitneys, today that figure has been passed, and by the middle of next week conservatives say 50,000 a day will be carried in the four-, five- six- and seven-passenger cars, and the eighteen to thirty-passenger buses that carry the jitney sign on the windshield and on each side.

Stand at the headquarters of the Jitney Transportation Co. near the heart of the city for 5 minutes. Each minute from six to ten jitneys roll up to the curb, each loaded with five to seven passengers. The approach of each is heralded by the megaphone man who calls out the route and the destination. Each pauses for a few seconds, two or three get out, others take their place and the jitney is off on railroad schedule. Minute after minute, and hour after hour this caravan comes and goes, starting at 6.30 in the morning and stopping at 7.30 in the evening. After that hour all service is by special arrangement.

Jitneys Are Touring Cars

And these jitneys are just touring cars. Cars with a sign on the windshield "Grand Ave. and 12th to Prospect and 27th," or of other streets. There is a big 5 somewhere on the windshield and perhaps others on the doors. Within a week the jitney association hopes to have a standard street sign that will be illumined at night and which can be readily attached to any car. In addition to the designation of the route it will contain a large 5 and a serial number as registered by the jitney association, in order to facilitate checking at different depots.

Anyone with a car can become a jitney operator. A dollar a week is needed. You pay that to the jitney association in order to get the privilege of being announced at the various dispatching depots and to get reduced rates on gasoline, oil, tires and other supplies. A little later a big garage will be conducted and every registered jitney will get repairs slightly above cost.

To register you present yourself and car at 1133 Grand avenue and talk routes, etc., with E. K. Carnes, the general traffic manager of the company. You select a route you would like to travel. If too many jitneys are on it the suggestion is made that you take another route, but the final act rests with the car owner and operator.

Once registered each car is put on a schedule. Some routes have 2-minute service both ways, others 2.5 and others 5 or 10 minutes, according to the demands. This schedule is maintained and it rarely happens that one car passes another, in general the rotation of a trolley system being maintained.

"How can you make money by carrying a passenger for a nickle—a jitney?" is the question heard on every corner. The proof of the pudding is in the eating. A five-passenger car working on a route 2 or 2.5 miles from end to end is making $7 to $12 per day. These cars make the circuit in 20 to 30 minutes and are generally on streets with trolley lines. With the jitney you can save 10 to 15 minutes on the trolley trip. That is why they are so popular. The jitney company claims that it costs approximately $2.50 per day to run a Ford five-passenger car. It costs very little more for Overlands, Buicks, Studebakers, Hups, Maxwells, etc. One-half the jitneys here are Fords, but in addition to other makes mentioned there are several seven-passenger cars including Packard, Peerless, Oldsmobile, Stoddard-Dayton, Imperial, etc.

Five-passenger cars are possible in jitney service where the ride one way does not exceed 2.5 miles. This is the maximum. The minimum is slightly under 2 miles.

The Seven-Passenger Express

When you get over 2.5 miles and up to 4 miles the seven-passenger car giving an express service beyond the 2.5-mile limit is possible. Over 4 miles the jitney bus offers the only possible conveyance. Some of these buses carry twelve passengers and others twenty. They are single-deckers, entirely inclosed and with glass windows all around. There is generally one side entrance on the right, immediately back of the driver, who sits on a revolving seat, so that when he stops he swings partly around, opening the door and collecting the jitney as the passenger enters. When driving the seat obstructs the door, preventing passengers leaving. Some of these buses are averaging between $20 and $30 per day.

New buses are being registered every day, many of them preferring the 2.5 to 4-mile zone. These buses are generally built on old touring car chassis. A typical example is that of using an Oldsmobile chassis and adding a bus body seating fourteen and costing $200. When a bus has to go beyond the 6-mile zone the single-decker does not pay, but double-deckers will have to be introduced. None has been started yet.

The jitney company reports that all day there is relatively uniform travel. In the early morning the workers going to the factory, the store, or the business office are passengers; a little later the professional man uses the jitney; and later in the forenoon the women shoppers are the majority of the passengers. At lunch time many people are going home, who find this possible with the quick service, but which was impossible with the trolley schedule. During the afternoon shoppers go home and later the workers line the corners in thousands waiting for the jitneys.

31 Entries for Vanderbilt Cup

SAN FRANCISCO, CAL., Feb. 16—Entries this week of the Tomasini car driven by T. A. Tomasini, the Erwin Special, which is scheduled to be driven by Bergdoll, R. C. Durant in a Chevrolet, Ralph DePalma in a Mercedes, Burman and Hearne in Case Cars, McKelvey in an Overland, Klein's King, and Hall's Hercules, has brought the complete list of cars for the Vanderbilt Cup up to thirty-one. A. H. Wooladcoot of Los Angeles, Cal., also has entered an Alco in the Grand Prix.

With the Vanderbilt race but 5 days off, drivers have not been able to practice on the course. It is doubtful if there will be more than 2 days practice at the outside. All drivers entered for the Vanderbilt are here and the city is crowded with automobile and accessory men from all over the country. Many claim that it would be impossible to run the race if it rains later than Wednesday noon, but race and exposition officials say that it will be run on schedule time. Most of the course is paved and will dry quickly, but there is a 1-mile stretch of dirt to be used which is very muddy. Last week 200 laborers worked night and day, but their work was undone by storm which broke up practice. Another heavy storm occurred Tuesday, and while laborers are now working on the course burning oil to drain off the water, it was stated tonight that there would be no practice until Thursday.

As announced in THE AUTOMOBILE for February 11, Resta will drive only Peugeot cars. Parts did not arrive for McCarthy's car and the machine is now in Los Angeles being prepared for the Venice race. Cadwell was unable to get his Marmon in condition for the Vanderbilt, and D'Alene scored a cylinder in his Marmon in the 100-mile Ascot Park race, making it impossible to start in the Vanderbilt. He will be ready for the Grand Prix, however.

Barney Oldfield says that he will not drive for less than all expenses and all winnings after the Grand Prix. His mechanic, George Hill, is now in the east and it is rumored that he is looking for a foreign car in New York. Harry Goetz will ride with Oldfield.

The complete entry list follows. These entries are those in both Vanderbilt and Grand Prix:

Car	Driver	Entrant
Stutz	Gil Anderson	Stutz Motor Car Co.
Stutz	Earl Cooper	Earl Cooper.
Stutz	Howard Wilcox	Stutz Motor Car Co.
Peugeot	Dario Resta	Peugeot Auto Import Co.
Mercer	Eddie Pullen	Mercer Automobile Co
Mercer	G. E. Ruckstell	Mercer Automobile Co
Mercer	Louis Nikrent	Mercer Automobile Co.
Simplex	Louis Disbrow	Simplex Automobile Co
Chevrolet	Jack LeCain	Chevrolet Motor Co.
Chevrolet	R. C. Durant	Chevrolet Motor Co.
Maxwell	Barney Oldfield	Maxwell Motor Sales Corp
Maxwell	William Carlson	Maxwell Motor Sales Corp
Maxwell	Ed. Rickenbacker	Maxwell Motor Sales Corp
Duesenberg	Edward O'Donnell	F. S. Duesenberg.
Duesenberg	Tom Alley	F. S. Duesenberg.
Delage	C. T. Newhouse	W. E. Wilson.
Tahis	Jack Gable	Fred'k. Robinson.
Edwards Special	Gandy	J. Paulding Edwards
Edwards Special	Kennedy	J. Paulding Edwards
Californian	Caleb Bragg	Geo. R. Bentel.
Bugatti	Marquis	J. B. Marquis.
Parsons Special	Jim Parsons	Jim Parsons.
Mercedes	Ralph De Palma	E. C. Patterson.
Gordon Special	Huntley Gordon	Huntley Gordon.
Case	Robert Burman	J. I. Case Co.
Case	E. A. Hearne	J. I. Case Co.
Tomasini	Tomasini	T. A. Tomasini.
Hercules	Hall	Harold Hall.
Overland	T. McKelvey	Thomas McKelvey.
King	Klein	Arthur Klein.
Erwin Special	Bergdoll	G. C. Bergdoll.

Rajah Offers $300 Race Prize

NEW YORK CITY, Feb. 16—The Rajah Auto Supply Co., Bloomfield, N. J., is offering a prize of $300 in gold to the driver making the best time for first 100 miles of the Grand Prize race, February 27. This is a sporting proposition on the part of the Rajah company as no restriction is placed on the car being equipped with its product.

NEW YORK CITY, Feb. 17—Through an error in copy submitted for the advertising pages of THE AUTOMOBILE for January 14 and February 11 the price of the Rajah Giant plug was given as $1.25 instead of $1.50 which is the correct price.

Factory Miscellany

GOODYEAR'S New Presses—The Goodyear Tire & Rubber Co., Akron, O., recently purchased fifty 150-ton tire applying presses and is planning to increase this order in the immediate future. The presses will be located in all cities where the Goodyear company has branches and in many other cities the machines will be placed with the truck tire dealers. It is to give application service on its S. V. tires that will equal the application service on demountable tires that the company is installing these machines, whose value runs into the tens of thousands of dollars.

To Mfr. Metal Specialties—The Prentiss-Weaver Mfg. Co., Grand Rapids, Wis., has been organized at Grand Rapids, Wis., and incorporated with $20,000 capital, to manufacture a line of metal motor car and farm specialties, including a gasoline gauge, metal auxiliary seats, campers' cookstoves, etc. The incorporators are T. A. Taylor, D. B. Phillo and G. O. Babcock, all of Grand Rapids. This is the concern which G. N. Prentiss of Racine, Wis., inventor and patentee of the devices, has been forming at Grand Rapids for some time.

U. S. Wheel Perfects Organization—The United States Wheel & Tire Co. of Rockton, Wis., south of Beloit, Wis., has perfected its organization by the election of these officers: President, E. S. Gleasman; vice-president, G. W. Shaw; secretary, N. M. Wilcox; treasurer, J. Roy Atwood. The company has been given a donation of a 4-acre factory site in Rockton and is preparing for the erection of a brick and concrete factory, 100 by 100 feet in size, equipped for the manufacture of an elastic or flexible wheel for motor cars and trucks. The resiliency is obtained by means of a series of flat elliptical springs so arranged that the tire proper is able to withstand an even greater side stress than the spokes of the wheels themselves. Frank Denny has been appointed sales manager.

Samson May Move—Additional capital of $50,000 for the Samson Engineering Co., Louisville, Ky., which manufactures a single unit starting, lighting and ignition system for motor cars, has been pledged by an Eastern man, provided another $50,000 is otherwise subscribed to enable the company to so extend its facilities and be able to handle large orders. An offer from Eastern interests to move the plant, now located in the Snead manufacturing building to Plainfield, N. J., is under consideration, and the Louisville Commercial Club is trying to interest local capital in order to retain the industry. The company plans to widen the scope of its business, employ more men and purchase additional machinery. The system is the invention of J. K. Delano, Jr., and it is said that large manufacturing concerns have given assurances of their interest in the local concern's product.

Trenton Plants Busy—A number of the large factories in Trenton, N. J., report increased business and a few of them are operating night and day. Several of the tire concerns have increased their forces. F. W. Roebling, Sr., secretary and treasurer of the J. A. Roebling Sons' Co., states that this company will begin rebuilding as soon as possible that part of its plant destroyed by fire a few weeks ago. When it is finished an extra force of men will be put to work at night, so that part of the factory will be running night and day. Every manufacturer of automobile tires is doing a good business and orders are increasing. One concern has doubled its output. Another is so pressed that the men are working in three shifts of 8 hours each. The Empire Rubber Co. is employing 1,000 men, an increase over a month ago. Gen. C. E. Murray, the treasurer of the company, states that the company's business is just double what it was. The Acme Rubber Co. is employing 500 men and is working full time. The Ajax Rubber Co. has 500 men working in three shifts of 8 hours each, which means night and day, 6 days in the week. The trade of the company is entirely domestic. No war orders are being filled. The Globe Rubber Co. is getting ready to double its capacity. The works have not been running full time, but probably within 2 weeks 300 men will be drawing pay for full time. Among other rubber factories that are beginning to show renewed activity are the Essex Co., Lighthead Bros., Thermoid Rubber Co., Home Rubber Co., and the Crescent, which is controlled by the Empire.

The Automobile Calendar

Feb. 15-20	Grand Rapids, Mich., Show, Klingman Furniture Exposition Bldg., Grand Rapids *Herald*; C. L. Merriman.
Feb. 15-20	Omaha, Neb., Show, Auditorium, C. G. Powell
Feb. 15-20	Bridgeport, Conn., Show, State Armory; B. B. Sterber.
Feb. 17-20	York, Pa., Show, Coliseum.
Feb. 18-20	Racine, Wis., Show, Lakeside Auditorium, Racine Auto Show Assn.
Feb. 22	Newark, N. J., Light Car Club of N. J., Hillclimb at Teaneck.
Feb. 22	San Francisco, Cal., Vanderbilt Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Feb. 22-25	Allentown, Pa., Show.
Feb. 22-27	Duluth, Minn., Show, Auditorium.
Feb. 22-27	New Haven, Conn., Show, Second Regiment Armory; W. N. Lindsay.
Feb. 22-28	South Bethlehem, Pa., Show, Coliseum; J. L. Elliott.
Feb. 23-27	York, Pa., Show, Coliseum Hall.
Feb. 23-27	Syracuse, N. Y., Show, Armory, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27	Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 24-27	Freeport, Ill., Show, Freeport Automobile Show Co.
Feb. 25	New York City, S. A. E., Metropolitan Sec. Meeting; Report of Research Committee on Kerosene Carbureters. Research Com. Report on Non-Electric Continuous-Torque Transmission.
Feb. 27	San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 1-5	Wilkesbarre, Pa., Show. Vehicle Trades Assn.
Mar. 1-6	Fargo, N. D., Show, Armory.
Mar.	Benton Harbor, Mich., Show, St. Joseph and Benton Harbor, St. Joseph Garage, St. Joseph.
Mar.	Charlotte, Mich., Show.
Mar. 2-9	Brooklyn, N. Y., Show, Motor Dealers' Assn., 23rd Regiment Armory.
Mar 3	Albany, N. Y., Associated Garages of America, General Convention.
Mar. 3-4-5-6	St. Joseph, Mich., Show, St. Joseph Auto Co. Bldg.
Mar. 4-6	Springfield, Mass., Show; J. H. Graham.
Mar. 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13	New York City, Made in the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13	Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13	Canton, O., Show, Auditorium, Stark Co. Auto Show and Electrical Exposition.
Mar. 8-13	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 8-13	Utica, N. Y., Utica Automobile Trade Assn.
Mar. 13-20	Harrisburg, Pa., Show Arena, Harrisburg Dealers' Assn.
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
Mar. 22-27	Bangor, Me., Show, Bangor Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
Apr. 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., Two-mile Track Meet.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
June 25	Sioux City, Ia., Track Meet.
July 4-5	Tacoma, Wash., Road Race.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

CORE Sparton Advertising Mgr.—G. C. Core has been appointed advertising manager of the Sparks-Withington Co., Jackson, Mich., Mr. Core is a former Chicago newspaper man and for the last 3 years has been connected with the automobile department of the *Chicago Daily Journal.*

Harmon Dort District Mgr.—Kenton Harmon has been appointed Metropolitan district manager of the Dort Motor Car Co., 1790 Broadway, New York City.

Travis King Agency Sales Mgr.—J. T. Travis has been appointed sales manager of the Carpenter Motor Vehicle Co., Brooklyn, N. Y., agent for the King car.

Henderson Sales Mgr.—R. H. Henderson is now the sales manager of the Pacific Metal Products Co., Los Angeles, distributor for the Moore and Commerce trucks.

Bowman Federal Sales Mgr.—J. F. Bowman, assistant to the secretary and treasurer of the Federal Motor Truck Co., Detroit, Mich., has been appointed director of sales.

Towne Makes Change.—W. M. Towne, formerly with the Ajax-Grieb Rubber Co., Detroit. Mich., is now a general sales representative of the F. E. Castle Co., manufacturers representatives.

Liston Thermoid Mgr.—J. H. Liston has been appointed manager of the Detroit, Mich., offices of the Thermoid Rubber Co., which has recently been opened in the Dime Savings Bank Bldg.

Perrett Republic Branch Mgr.—W. M. Perrett has been appointed branch manager of the Republic Rubber Co., Youngstown, O. His headquarters will be at 1001 Woodward avenue, Detroit, Mich.

Davis Penn Spring Mgr.—Offices will be opened soon in Detroit, Mich., in the Whitney Bldg., Woodward avenue, by the Penn Spring Works, of Baldwinsville, N. Y. Robert Davis will be the manager.

Bailey Mgr.—The Toledo-Mercer Co., Toledo, O., has been formed with L. C. Bailey, as manager. The company will sell the Mercer cars. Headquarters are located at the Twenty-first street Garage.

Schmunk Peerless Mgr. — W. G. Schmunk has been appointed manager of the Ohio branch of the Peerless Motor Car Co., Cleveland. He has been connected with that organization for the last 5 years.

Bushong Joins Ostlund Co. — J. H. Bushong, for 12 years in the service of the John-Deere implement organizations, has resigned to take a half interest in the automobile business of A. J. Ostlund of Moline, Ill.

Trudell Located in Jackson—W. J. Trudell traveling representative for the Goodyear Tire & Rubber Co., Akron, O., has taken up headquarters in the Adams Hotel, Jackson, Mich., and will be located there permanently.

Pearne Used Car Mgr.—W. A. Pearne, formerly of Vancouver. B. C. and Spokane, Wash., with the Winton, has been engaged as manager of Geo. W. Miller's used parts and supply department at 714 East Pike street, Seattle.

Roberts Sales Mgr.—H. R. Roberts, former head of the Winton branch in Portland, Ore., has been made sales manager for the Frank C. Riggs Co. in that city, distributor of Packard cars. Mr. Roberts is president of the Portland Automobile Dealers' Assn.

Buhr Elected President.—The capital stock of the American Pattern Works, Dubois and Clay streets, Detroit, Mich., has been increased from $10,000 to $50,000. J. F. Buhr has been elected president, William Blanck vice-president, and Edward Stephens secretary.

Orman Heads Premier Dept.—Frank E. Smith, receiver for the Premier Motor Mfg. Co., Indianapolis, Ind., has announced the appointment of J. B. Orman to have charge of the funeral equipment department. Mr. Orman was advertising director of the company before it went into the hands of a receiver.

Stokes Leaves for Cuba.—J. O. Stokes, president of the Thermoid Rubber Co., Trenton, N. J., is making a trip to the South touching on Cuba and going up to the coast to study conditions. The Thermoid company recently opened offices and a service department in the Dime Savings Bank Bldg., Detroit, Mich.

Smith N. Y. Maxwell Mgr.—L. F. Smith, district manager in Columbus, O., for the Maxwell Motor Car Co. has been promoted to the management of the New York City branch and will have territory in Connecticut, Rhode Island, New Jersey, Long Island and part of New York State. He will assume charge about March 1.

Garage Co. Elects Officers—At the annual meeting of the Auto Garage Co., Manistee, Mich.. a dividend of 4 per cent. was declared and paid. Henry Brugman was elected president, Dr. A. S. Payne, vice-president; T. J. Elton, secretary-treasurer. These officers and Otto Brugman and Alexander Smith form the Board of Directors.

Sell Heads Assn.—The Independent Automobile Assn. met in the offices of the Penn Motor Sales Co., Greensburg, Pa., and effected a permanent organization. The following officers were elected: President, J. B. Sell; vice-president, L. L. Lowe. Youngwood; secretary, J. A. Eisaman, Greensburg; treasurer, W. M. Pletcher, Penn Motor Sales Co.

Recent Cincinnati Changes—Chick Radcliffe, formerly connected with the sales department of the Leyman-Buick Co., Cincinnati, O., has been made manager of the Leyman Motor Co. A. H. MacDonell has been promoted from the position of sales manager to the office of district manager. with headquarters there and with jurisdiction over all Buick agencies and also over Buick agencies in Indiana counties touching the Ohio river.

Zaring Indianapolis Maxwell Mgr.—The Indianapolis, Ind. Maxwell distributors, the Maxwell Motor Corp., has opened a new salesroom and service station at 541 North Capitol avenue. E. C. Zaring is manager of the retail sales department, and R. L. Malcom of the wholesale department. The local service department is in charge of J. F. Requarth, and the out of town service will be looked after by C. E. Troutman.

Ehnts Makes Change—F. H. Ehnts, connected with the Dorris Motor Car Co., St. Louis, Mo., for nearly 8 years has resigned his position as sales manager to embark in another line—sales manager of the Superior Oxygen Co. Mr. Ehnts has been in the automobile business for many years being at different times connected with the American Mors. then built in St. Louis. and with the Carter Carbureter Co. No successor has been named thus far.

Recent Smalley Daniels Changes—W. B. Dean who was several years purchasing agent of Hearsey-Willis Co., automobile supply jobbers of Indianapolis, Ind., has joined Smalley Daniels, 870 Woodward avenue, Detroit. Mich., in the exploitation of New Era Spring & Specialty Co.'s lines and will have direct charge of the jobber's department. J. K. Taylor of Detroit. has become office manager at Detroit, and A. B. Camis of Chicago has become Chicago sales representative.

Garage and Dealers' Field

Lancia-Sheffield Agency Moves—The Lancia and Sheffield Simplex salesrooms have been moved to larger quarters in 59th street, just east of Broadway, New York City.

Thos. J. Hay Moves—Thos. J. Hay, Hupmobile and Chandler dealer in Chicago. Ill., has moved to 2519 and 2521 Michigan Boulevard. The floor space of the new building is 30,000 square feet.

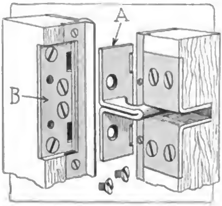
Fire Damages Grand Rapids Bldg.—Fire in the Benham building, Library street, Grand Rapids, Mich.. caused damage to the extent of $60,000 it was stated, much of which was sustained by automobile accessory concerns having their quarters in the building.

Takes Philadelphia Exide Distribution—Patton Fleming & Co., 2039 Ranstead street, Philadelphia, Pa., manufacturers' representatives, have been commissioned by the Electric Storage Battery Co., manufacturer of the Exide battery, to act as distributors and battery service depot in that section.

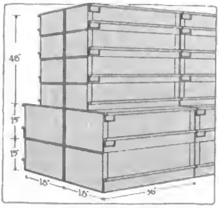
N. Y. City's Municipal Garage—New York City will have its own garage and a municipal taxicab service within a very short time. Plans are being completed and as soon as possible the city automobile service will be started. There are in all about 200 automobiles in the service of that city. It is the plan of the Mayor to establish municipal garages in both Manhattan and Brooklyn. A rate schedule is to be devised for the use of the cars, and when one is taken out. it is to be charged to the department using it. City taxis are to be of a uniform color and are to be marked with the name of the city in large letters.

ACCESSORIES

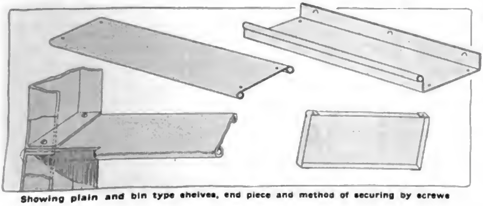
STOCKROOM SHELVING—Everyone is familiar with the unit system of construction as applied to bookcases; the so-called expanding bookcase which is built up of numbers of interchangeable sections, sometimes each of the same size and sometimes of different sizes, but always so fitting together as to make a complete whole which can always be enlarged by adding a fresh unit. In order to carry this system to stockroom shelving several matters must be taken into account that do not appear in the library field, for instance much greater strength is required, waste space is even more important and cheapness must be considered very carefully indeed. The Fouts unit system of steel shelving has been introduced lately, and seems to meet practically every requirement of stockroom organization while it has the great advantage over ordinary steel construction that it can always be altered in height, depth or length to suit the needs of the articles at that time mostly in use. The fundamental part of the shelving is the end, which is a steel pressing in the form of a shallow box. These end pieces are made in a wide variety of sizes the largest being 24 in. high by 36 in. deep and the smallest 6 in. high by 12 in. deep. The shelves are made of a standard length of 36 in. and in widths to suit the range of sizes of the end pieces; each edge of a shelf is rolled into a bead so doing away with sharp edges. Besides plain shelving, box form pressings can be had that make up into bins when attached to the standard end pieces, and partitions are also procurable for dividing either bins or shelves. It is usual so to arrange the built up shelving that there are two open sides, but if it is desired to divide the whole structure lengthwise, back plates which clip into place are added and two piles of shelves built up back to back. The various members are secured to each other by short screws and nuts as shown in the illustration. It is claimed that the shelving can support a very considerable weight, and the parts are made in different gauges of sheet to suit goods of different degrees of weight. For automobile parts it is probable that the heaviest gauge would be the most suitable. Obviously the case built up in this way is more durable than wooden bins, besides being incombustible, and the small number of screws needed means that erection would be very quick. It should be quicker than nailing together ready shaped pieces of wood.—C. C. Fouts Co., Middletown, O.



Concealed door hinge



Steel bins as built up

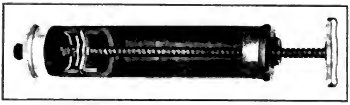


Showing plain and bin type shelves, end piece and method of securing by screws

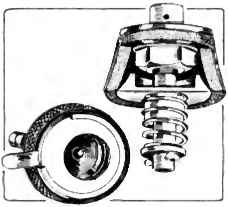
Detachable Concealed Hinge—A very neat door hinge with the feature that it allows for easy detachment of the door is known as the Anchor. It is a common experience to find that doors have to be removed for trimming after they have been mounted by the body frame builders and it is obviously likely to cause damage to the finish if wood screws have to be removed after painting is completed. To overcome this possible trouble the Anchor hinge is fitted in the door post, as shown in the sketch, and the door itself is provided with the fixed plate B in which there are two locating slots and two tapped screw holes. On the plate A of the hinge are two lugs to fit the locating slots in B, and a pair of short machine screws secure the hinge to the door plate; so attachment or removal of the door are quick and easy operations.—Metal Specialties Mfg. Co., Chicago, Ill.

Tire Pump—A hand tire pump with a special type of plunger and hose clamp, which makes it very easy to attach the end of the hose to the tire valve, is the "Bell." The end of the plunger rod is threaded and this provides for the holding of the plunger leather between two washers by a nut. Underneath the plunger leather a bevel-edged brass spreader disk is sleeved upon the plunger rod and held to it at all times by a spring, which is in turn held in place by a cottered washer on the rod end. When the plunger is forced down, the back pressure of the air in the pump barrel forces the spreader disk up strongly against the plunger leather and holds it closely to the walls of the barrel. On the up-stroke, the steel spring maintains the close contact of the leather against the walls of the barrel. A ball-check valve at the base prevents back pressure into the pump. To replace the ordinary rubber socket at the tire valve end of the hose connection, the "Bell" has a special form of eccentric clamp. This has a rubber socket, but in addition, it has a threaded internal eccentric which operates internally upon the threaded part of the tire valve tube. After engaging the rubber socket with the valve tube in the usual way, the eccentric lever is pushed over, whereupon the threaded eccentric inside the clamp engages the external threads of the valve tube in the same manner as a nut would, making a rigid connection which will stay until the lever is thrown to the releasing position again.—Bell Pump Co., Detroit, Mich.

Grease Gun—Oil and grease guns are automobile accessories which the average motorist looks upon as standard; however, this particular one seems to be a combination which is a step in advance. Referring to the illustration, the gun in-

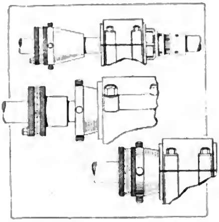


Bell grease gun and details of Bell pump plunger and valve connection



corporates a modification of the Bell plunger as used in tire pumps of this make. The leather plunger is secured to the plunger rod and is cup-shaped. Below the leather is a disk which is beveled at its outer edge. This fits inside the leather cup and is held to it at all times by a spring. Above the main leather cup there is another in reversed position. On the down stroke, the pressure of the oil or grease forces the disk against the cup, and thus makes the latter closely adhere to the walls of the gun so as to prevent leakage. On the up-stroke the spring acts to force the metal disk against the leather which must therefore maintain the same close contact with the walls. This prevents leakage in this direction, and it is assisted by the reversed leather plunger. It is said that with this feature, the gun has a vacuum which will readily draw a No. 2 grease. Heavier greases are packed by hand. To empty the gun, an eccentric ring is fitted to the top of the gun. By the quarter turning of a lever, an eccentric disk fits into the square thread of the plunger rod, and makes a nut on which the thread can operate. Then by turning the handle, the grease is expelled. Thus, the gun is a combination, for, with the eccentric off, it acts similarly to any plunger gun, and is readily converted into a screw type.—Bell Pump Co., Detroit, Mich.

Fitting Crankshaft Bearings.—It is an accepted fact that it is far from easy properly to scrape and fit the bearings of a crankshaft so that they are all in line and all an equally tight fit. In the best factories all cranks are scraped in by hand and many hours spent on getting the bearings as near perfect as possible, but it is well known that when the car eventually comes to a repairer for wear to be taken up the re-scraped bearing seldom last so long as they did originally. There is only one reason for this, and it is that the average mechanic is not skilled in the class of work required to make a proper job of crankshaft bearings; it is a kind of work that really calls for special practice and is best done by a man who has no other sort of work. It is with the idea of enabling the better kinds of repair shops to do really good work with a smaller expenditure of time that the tool here described has been made. Given a crankshaft and its bushings it is a foregone conclusion that they will not wear evenly, that means one or more of the bearings will be out of line when the time comes to take up slack. Now the important thing is to get the nearest possible approach to correct aligning and it is also important to locate the shaft so that the timing gears mesh to the proper depth. In using the apparatus described it is the timing gear which forms the basic point; the front bearing is reamed to suit the meshing of the gears and the other bearings to suit the front one. The Martell aligning reamer consists of an accurately straight shaft capable of carrying and sliding within taper bushings by means of which it can be set up and adjusted in the crankcase. When adjusted to proper centers a reamer head on the same shaft can be drawn through the bushings, cutting them one after the other till they are accurately in line within very fine limits. Free to slide on the shaft is a number of eccentric bushings outside which the taper portions are located. Thus suppose the shaft is held in the end bearings by the taper bushes pushed into the bearing mouths and then locked in place, we can set the shaft several thousandths out of line one way, or the other by turning the inner eccentric portions. In this way the timing gear can be located in proper mesh, since a special mounting is provided for the shaft of the reamer which will hold the pinion just as though it were upon the crankshaft. The adjusting edges of the eccentrics are graduated so as to show how many thousandths the shaft is out of line with the bearing and, speaking broadly, the operation before starting to ream, consists in adjusting the shaft by means of the taper bushings relative to each crankshaft bearing so as to get the best average position consistent with proper timing gear position. When this adjustment is finished the reamer head is locked to the shaft at any convenient point by its clamping grip ring, and the bearings are scraped out by the reamer one at a time, the bushings being replaced, set back to zero eccentricity, and each bearing reamed before the next bearing is begun upon. The process as thus described sounds a little complicated perhaps, but it must be infinitely simpler than hand scraping, and actually better in final effect if the workman is only capable of understanding what he is trying to do. The tool should find a place in most high-class shops and should enable the charge for refitting bearings to be reduced—as well as giving better results.—Martell Distributing Co., Boston, Mass.



Taper bushings of Martell aligning reamer showing eccentric adjustment and locking screws, also grip lock for reamer

Automobile Washing Apparatus.—A variety of dusting and washing brushes of strong and simple construction are garage essentials. A recent list shows that the Fuller range is exceptionally complete. The Fuller auto-washer, fountain type, consists of a large brush that is fitted to the end of the hose nozzle, and it is to be noted that it does not need a special nozzle, clipping readily to any ordinary hose end.—Fuller Brush Co., Hartford, Conn.

Graphite Lubrication.—This subject has been dealt with most ably in many pamphlets issued by the Dixon company, but they have just issued another containing detail recommendations for the use of each brand of graphite product applicable to the automobile.—Joseph Dixon Crucible Co., Jersey City, N. J.

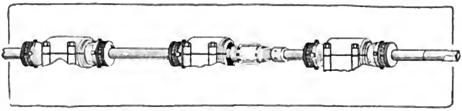


Diagram of reaming shaft ready for reaming operation in crankcase

"It
Hangs
Everywhere"

Free to Ford Dealers

On April 20th
The Automobile Trade Directory
will issue a Directory of

FORD SPECIALTIES

THIS Directory will be complete and authentic in every detail—on a par with the service that has made The Automobile Trade Directory the Standard Buyers' Reference of the American Automobile Industry.

Each and every Ford Dealer, from the big metropolitan distributor to the rural sub-agent, will receive a copy of this book with our compliments.

FORD DEALERS

To ensure receiving your copy fill out and send us the coupon with your *BUSINESS CARD* or *LETTER HEAD*. The book will be sent to you absolutely free of charge. It will be worth many dollars to you in the saving of time and trouble.

THE AUTOMOBILE TRADE DIRECTORY
243-249 W. 39th St., New York

Enclosed find *business card* or *letter head*. Send me free of charge a copy of your Directory of Ford Specialties. We have the $\left\{\begin{array}{l}\text{agency}\\\text{sub-agency}\end{array}\right\}$ for the Ford car.

Name ....

Address ....

City ....State...............

T.A.

TO THE TRADE

The UNITED STATES COURT of APPEALS for the SECOND CIRCUIT in giving decision from the appeal of the Lovell-McConnell Mfg. Co. from the final decree of the District Court for the Southern District of New York, dismissing the bill which charged the infringement of three patents controlled by the Lovell-McConnell Mfg. Co.

AFFIRM THE LOWER COURT DECREE WITH COSTS

This last decision in which the Court of Appeals approves the decision of the District Court adds ONE MORE "SPARTON" VICTORY and PROVES our contention that "SPARTON" Warning Signals DO NOT INFRINGE.

In giving final decision and in referring to the NEW TESTIMONY on which the appeal was made the decree reads—

> "If all the new testimony had been in the former record the result would have been the same."

In the beginning we stated publicly that WE EXPECTED suits for infringement to be brought against "SPARTON" construction, not that we believed for one instant that it DID INFRINGE, but to retard the sale of our product, which had PROVEN better than competition in repeated factory tests made by Engineers of national reputation.

Even in the face of this sweeping victory we anticipate additional suits will be started, indirectly perhaps, but with the same intent. We welcome any expedient to eliminate for all time the "effect" and "methods" calculated to blind the trade and create other than the TRUE IMPRESSION.

In the meantime we have increased our present capacity to 2,000 "SPARTON" Warning Signals every twenty-four hours. Our factory is running twenty-three hours each working day and MORE "SPARTONS" are sold for 1915 factory equipment than all other makes of motor-driven electric signals combined.

IF YOU NEED FURTHER EVIDENCE OF "SPARTON"
SUPREMACY, SEND FOR OUR FACTS

The Sparks-Withington Company

JACKSON **MICHIGAN**

FEBRUARY 25, 1915

10¢ A COPY

The AUTOMOBILE

MAGAZINE LOAN COLLECTION

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

Price and Quality Must Balance

The quality of the brake lining you sell must be consistent with the price you charge for it, or you will not be able to hold your trade.

This is so—and nobody knows it better than you. That Price and Quality must balance is just as true with respect to net prices as it is with list prices.

What is the Quality of brake linings which list the same as RAYBESTOS—and in some cases higher—but which often are offered you at a lower net price?

What do you suppose is the lowest net price you could get?

How do you know when you get it?

How long before juggled discount prices will affect you?

RAYBESTOS schedule of prices—both net and list—are fixed—uniform to all—and at all times consistent with RAYBESTOS Quality.

TRADE Raybestos MARK
REG. U.S. PAT. OFF.
"THE ORIGINAL AND BEST ASBESTOS BRAKE LINING"

The Royal Equipment Company

1354 Bostwick Avenue Bridgeport, Conn.

Vol. XXXII New York—Thursday, February 25, 1915—Chicago No. 8

The AUTOMOBILE

Tungsten—The Hardener

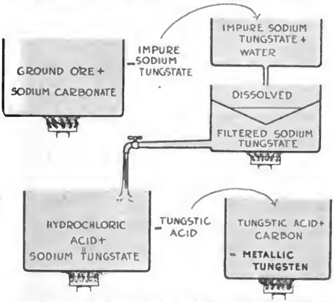
Resists Heat and Retains Magnetism—Valuable for High-Speed Tools, Valves, Lamp Filaments and Magnets—Can Be Drawn to .0002 Inch Diameter

By J. Edward Schipper

TUNGSTEN has three qualities that have rendered it of high value to the automobile and other industries. It is a great hardening element, it is a resister of heat and it increases the retentivity of magnets. These, with the many other qualifications, render this element one of our most important alloying substances.

Tungsten was once classed among the tin ores and in its mineral form was known as heavy stone, due to its great weight. Next to platinum, iridium and gold it is the heaviest metal, having a specific gravity of 17.3 as compared to 11.3 for lead, 7.85 for steel, 22.3 for iridium and 19.2 for gold. A cubic foot of tungsten weighs 1,078.7 pounds. A cubic foot of iridium, the heaviest metal, weighs 1,396 pounds. A cubic foot of gold weighs 1,200.9 pounds and a cubic foot of lead weighs 709.7 pounds.

In 1781 Scheele proved that a tungsten ore was composed of lime, combined with a peculiar acid and 2 years later Spanish chemists succeeded in producing metallic tungsten. The mineral tungsten or the ores containing the element are principally found in the form of what are known as Wolframite, after its discoverer, Wolfram; and Scheelite after its discoverer Scheele. The Wolframite is chemically known as a tungstate of iron and manganese, and Scheelite is a calcium tungstate.


GROUND ORE + SODIUM CARBONATE
IMPURE SODIUM TUNGSTATE
IMPURE SODIUM TUNGSTATE + WATER
DISSOLVED
FILTERED SODIUM TUNGSTATE
HYDROCHLORIC ACID + SODIUM TUNGSTATE
TUNGSTIC ACID
TUNGSTIC ACID + CARBON
= METALLIC TUNGSTEN

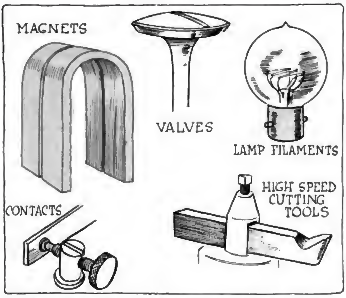
Diagrammatic representation of the process by which metallic tungsten is derived from Wolframite, the ore in which it is most commonly found

Tungsten is a great hardener of steels. By incorporating simultaneously carbon and tungsten it is possible to obtain a much harder steel than with carbon alone and at the same time eliminate the danger of increasing the brittleness to a dangerous extent. This is the element which was perhaps unconsciously, incorporated in the famous oriental Damascus steel, the making of which was at one time classed as a lost art. It is one of the elements of what is known as high-speed steel.

Tungsten is a metallic element and, when used in conjunction with the elements chromium and carbon it raises the temperature to which steel can be brought without losing hardness. This quality makes it of use where high-speed cutting is desired because the heat due to cutting does not soften the edge of the tool until it has reached a much higher temperature than with the ordinary tool steels. A typical composition of a chrome-tungsten or high-speed steel is carbon .68 to .67 per cent. manganese .07 to .11, chromium 5.95 to 5.47, tungsten 17.81 to 18.19. Many variations of this formula are used for tools for different purposes.

Often Alloyed with Cobalt

In producing a cutting metal tungsten is often alloyed with cobalt. Ellwood Haynes, who is known in the automobile industry as a pioneer car builder, has marketed a non-ferrous



Some of the articles which are made from either metallic tungsten or steel alloyed with tungsten

metal which he has termed stellite, a combination of tungsten and cobalt with other alloys in which the only iron present is an impurity and in which the iron is therefore kept to the lowest possible percentage. Thus, although the name is somewhat deceptive, it is not a steel.

Another field in which tungsten has been of great use in the automobile industry is for the manufacture of poppet valves. Here the same qualifications, namely, those of heat resistance and hardness, have rendered it of great use in eliminating, to a large degree, the necessity of grinding. The effect which tungsten has in rendering steel free from the influences of heat at ordinary temperature may be guessed when it is known that tungsten is not fusible in a common forge. Chromium possesses this same quality and both these metals, instead of melting at forge heat merely soften. The melting point of tungsten is 3,002 degrees.

A feature that makes tungsten of great use for magnetos is that when added to a magnet steel in a ratio of from 5 to 8 per cent. it increases the retentivity of the magnet to a great degree. For instance, in magneto work it is possible to charge the magnets to more than 100 per cent. complete saturation and then after the charging circuit has been removed these magnets will drop to but slightly below 100 per cent., saturation and retain this great degree of magnetism for a remarkable length of time.

Can Be Drawn Into Fine Wire

One of the most spectacular achievements with tungsten is the success which has been attained in rendering it ductile. By super-refining the metal with secret methods, the big electric companies have succeeded in rendering a metal which is harder than glass, so ductile that it can be drawn into wire of less than .0002-inch in diameter. This wire can be used for lamp filaments up to considerably more than 2,000 candlepower. While millions of tungsten filament lamps are used in households throughout the world resulting in a saving of hundreds of millions of dollars a year by using only approximately half the current consumed by the carbon filament lamp, filaments do not take up a very large percentage of the total tungsten output. It is stated that 1 pound of tungsten will produce the filaments necessary for 40,000 electric bulbs of the size commonly used for household purposes, or the ordinary 25-watt size.

Besides the uses which have been mentioned, tungsten is one of the important factors in electric furnace work, it is often employed for the manufacture of surgical wire, for use as targets in Roentgen tubes, for weights and it has even been suggested as a good material for the jackets on rifle bullets due to its heat-resisting and non-stripping qualities.

Tungsten Ore Scattered Over Earth

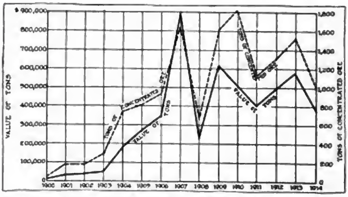
While tungsten ore is found practically in all parts of the world, it is stated that its mining is so hazardous commercially that it would not pay any company to specialize on this ore. Considerable pockets may be found and mined and give rise to optimistic hopes in the mind of the mine-owner only to be shattered by finding that when the end of the pocket has been reached there will be no more tungsten ore in sight. Hence it is that the tungsten ore is more or less of a mining by-product. When the prospectors hit upon it they are glad to mine it taking what they find and treating it more as a prospector's than a miner's enterprise.

Some of the countries which have been most productive of tungsten ore during the last 10 years are Japan, New South Wales, Queensland, England, France, Germany, Portugal, Argentine Republic, United States, South Africa and Burma. The accompanying tabulation shows the production in short tons of each of these countries between the years of 1905 and 1912. The curve on page 353 shows the number of tons of concentrated tungsten ore produced in the United States between the years of 1912 and 1914, with the value of these ores. The treacherous nature of the ore deposit can be readily seen from the quick yearly fluctuation in the amounts produced by these different countries. This is instanced by the case of Burma which did not produce any until 1910, when 407 tons were mined. Two years later the production was 2,095 tons, the largest recorded in any country up to that year. The production in the United States started with 46 tons in 1900 having a value of $11,040, gradually increasing up to the year 1910, when the value was $832,992. This represented a production of 1,821 tons. The tons referred to are short tons of 2,000 pounds and the ore is concentrated and contains 60 per cent. of tungsten trioxide.

High-Speed Steel Created Demand

The use of high-speed tool steel which took a quick rise in 1912 caused a corresponding jump in the demand for tungsten. It was also responsible for the introduction of the use of cobalt. The demand for the metal was so great that in addition to our own supply in 1 year 323 short tons of tungsten valued at $323,872 and 824 tons of ore in miscellaneous forms were imported. Wolframite and Scheelite were the principal components of the ore imports. Considerable interest was aroused in 1913 by the discovery of deposits of a tungsten ore known as Ferberite in the boulder fields of Colorado and during this year 953 tons of concentrated ore were removed from these fields. This was more than half the production of the entire United States which totaled 1,537 tons for that year.

While the tungsten deposits have been unreliable there



Production of tungsten ore in the United States and the value of the ore for each year has always been enough produced throughout the world to meet the demands, and consequently there has been no sharp rise of price except for a momentary panic at the time of the outbreak of war. The 1914 price as quoted by one authority was $6.50 to $9 per unit, or 1 per cent. of 1 ton, that is, 20 pounds. A further idea of the value of the ore may be gained by the fact that during 1914 a total of 267 tons valued at $139,697 were imported and during 1913, imports were 401 tons, valued at $213,122. This would give a value of $523 per ton for the imported ore in 1914 and $532 in 1913. The imports of the metallic tungsten for 1914 and 1913 respectively were 192 tons and 661 tons. The values of these were $219,506 and $835,212. This would give a valuation on the metal of $1,142 for 1914 and $1,262 for 1913.

Extraction by Threefold Method

The metallic tungsten can be abstracted from the ore by a three-fold chemical reduction process. The first stage is to secure sodium tungstate by heating together a mixture of the ground ore and sodium carbonate in a reverberatory furnace. When this operation is carried out under proper conditions the extraction is complete and at the same time any silica present is left insoluble. The sodium tungstate thus formed is dissolved in water and separated from the oxide of iron, aluminum, manganese, tin and silicon by filtration. From the filtered tungstate, tungstic acid is then precipitated by adding another acid.

The tungstic acid is washed free of soda salts and dried, and the resulting tungstic oxide is mixed with carbonaceous materials and submitted to a high temperature in crucibles for a reduction to metal. This is the method used by the fathers of tungsten refining, Oaxland, 1847 and Mushet, 1859. This process is known as the Oaxland process and is said to be the basis of that now used, although the manufacturers of tungsten guard the secrets of their individual methods with great care.

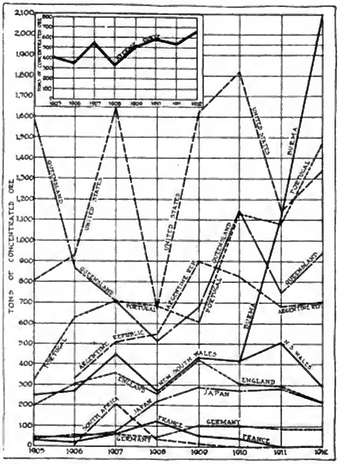
Generally Sold as a Powder

Metallic tungsten is generally sold in powdered form, but a considerable quantity of ferro-tungsten or tungsten with iron is manufactured with the electric furnace and alloys with manganese and other metals can be obtained by reducing a mixture of the oxides with aluminum. In 1903 it was stated that the purest forms of tungsten at that time obtainable were not ductile but since this time the work of scientists has been rewarded wih the results that are so clearly shown in the use of the tungsten lamp filament. The tungsten powder as sold to the steel makers consists of about 98 per cent. tungsten, .5 per cent. iron, .5 per cent. silicon, and .5 per cent. carbon. It is stated that 100 parts of tungsten can be obtained from 127 parts of good Wolframite and it is estimated that it costs $400 to refine 1 ton of ore. The method by which the selling price of the tungsten is arrived at can very readily be estimated from the fact that ore can be bought at about $450 per ton and since the refining costs $400 with allowances for shipping and other overhead the selling price will be somewhat over $1,000, as previously estimated.

Tungsten Ore Production to 1913 by Different Countries

Country	1905	1906	1907	1908	1909	1910	1911	1912
Japan	47	47	71	220	292	275	287	215
N. S. Wales	251	270	451	269	431	413	512	298
Queensland	1,582	865	703	516	679	1,145	750	944
England	193	304	361	261	421	307	298	216
France	28	20	67	124	55	33	0	0
Germany	42	57	68	46	106	105	89	89
Portugal	320	629	702	684	609	1,132	1,078	1,466
U. S	803	928	1,640	671	1,619	1,821	1,139	1,330
Argentine	...	326	507	548	900	826	683	702
South Africa	...	9	211	40	16	0	0	0
Burma	...	....	....	....	....	407	1,119	2,093

Sold in units of 20 pounds, 1 per cent. of a short ton



Production of tungsten in the leading countries of the world, showing the rapid fluctuation due to the ore being found in pockets and not generally in long veins. Note the sensational rise of the production in Burma. Note average curve at upper left

Ductile tungsten is a bright, tough steel-colored metal. Its physical characteristics are unique in that the tensile strength will vary materially per unit of cross sectional area with the amount to which it is drawn. Tungsten wire .0012-inch in diameter will have a tensile strength carrying from 580,000 to 610,000 pounds per square inch. Steel piano wire has a tensile strength of 340,000 pounds per square inch. It is stated that with the tungsten tool steel the amount by which the work done can be increased sometimes runs as high as five times that which can be accomplished with carbon steel. This will of course vary to such an extent that no figure can be fixed but that the cutting speeds have been greatly increased due to the introduction of high-speed tool steel is the principal reason for the adoption of the tungsten alloy.

Steel That Resisted Blowpipe

An interesting example of what may be done with tungsten is furnished by a steel alloyed with this metal which was exhibited by Dr. Carl Duisberg at the Eighth International Congress of Applied Chemistry. This steel resisted the flame of an oxy-acetylene blow-pipe. The exact composition of this has been kept a secret.

The form in which the steel manufacturers secure the tungsten for use as an alloy varies with the class of steel for which it is intended. For the lower grades ferro-tungsten is used while for the higher grades the pure metal is bought. The ferro-tungsten can be produced much more cheaply than the pure metal by reduction in the electric furnace. The purest form of tungsten in practical use is perhaps that employed for lamp filaments. The process for manufacture gained its first definite step when Turner D. Bottome, an American, took out his patent No. 401,120 dated April 9, 1889. This was one of the original processes for producing the tungsten wire filament.

Some authorities state that the tungsten filament is not a pure metal as is tantalum, but is, in the majority of instances, a filament of minute particles of metal sintered into coherence by the passage of an electrical current after the filament has been squirted and dried. For all practical purposes, however, the filament of a tungsten lamp is generally considered as an example of the highest refinement of tungsten metal.

It might be thought that owing to the fact that tungsten does not melt until above 3,000 degrees it would be difficult to alloy it with other metals owing to the dangers of burning these before amalgamation took place. This is not the case, however, as tungsten has the quality of dissolving in other molten metals, thus rendering the process of mixing the alloy quite simple. It is estimated that 95 per cent. of the tungsten produced is so used, being consumed by the steel manufacturers throughout the world. The Sheffield Steel Works in England are said to use 1,500 tons of tungsten powder annually. This is a value of $1,650,000 if the value per ton be taken as $1,100.

High Speeds Bring Out Value

While the great value of tungsten or high-speed steel for cutting tools cannot be doubted, it is a fact that these steels do not have a value until high cutting speeds are reached. Experiments which have been made in England have shown that every tool that has yet been tested without the use of a cooling agent has very little durability at the lowest cutting speeds and a much greater durability at higher speeds. For instance, at 20 feet per minute every tool tested was rapidly worn away. Another rather unexpected result which was arrived at from the same series of tests is that at low speeds a carbon steel tool properly hardened has greater durability than the best high speed steel. At high speeds great durability is shown by high speed steels properly hardened, and it is claimed that some of the vanadium tool steels show this to a high degree.

War Sends Up Price of Manganese

NEW YORK Feb. 24—Considerable concern is being felt in steel centers over the fluctuation in the prices of ferro-manganese. This is due to the fact that about half the manganese used in this country for alloying is imported from Great Britain and Germany. Owing to the embargo on this alloy established by the former country, and the difficulties in shipping from the latter, the supply has been curtailed to almost the entire extent of the importation.

A nominal price is now being quoted as $68 per ton for ferro-manganese at the seaboard, that is, Baltimore or Boston. This does not represent, however, the true prices that are being paid as sales at $100 per ton are frequently reported. Before the war broke out the price of ferro-manganese was $38 per ton.

The remaining 50 per cent. of the manganese used in this country is made by the Carnegie Steel Co. and this concern uses practically all that it manufactures, hence very little can be secured from the Carnegie company for outside use. Now that the German blockade against England has been declared, it is feared that the shipments which were previously finding their way to this country at scattered intervals will be checked altogether.

Bought as Ferro-Manganese

The ferro-manganese as received by the purchaser consists of about 80 per cent. manganese and nearly 20 per cent. iron, the remainder being silicon and other impurities. Its use in ordinary steel work is of a medicinal nature. Manganese when taken alone decreases rather than increases the general merit of the steel to which it is added. It shows its effect principally in reducing the malleability but it is added intentionally in quantities as high as 1.5 per cent. to palliate the effect of sulphur and oxygen.

With sulphur, it forms a sulphide which draws together into almost harmless drops, instead of incasing the grains of iron and thereby weakening the structure of the metal as sulphur would alone. With oxygen it forms a manganous oxide which is less harmful to the general structure of the metal than would be the ferrous oxide that would be present were not the manganese added. As actually made manganese steel is said by most authorities to contain about 1.2 per cent. of manganese and 1.5 per cent. carbon. According to S. A. E. specifications ordinary carbon steel averages between .50 and .80 manganese. The preferred percentage of manganese generally ranges very close to .65. The defects of the manganese steel such as Hadfield's for general use, are its hardness and low elastic limit.

Manganese is a metallic chemical element. At one time it was taken to be a magnetic oxide of iron but in 1740 J. H. Pott showed that it did not contain iron and in 1774 C. Scheele proved that it was the oxide of a distinct metal. The metal was first isolated by J. G. Gahn in 1774. It is part of the atmosphere of the sun and is found in sea water and in many mineral waters. Commercially it finds its biggest use in the manufacture of special steel.

Corrects Effects of Impurities

Spiegeleisen, in which form the manganese is generally added to the steel to correct the effects of the sulphur and oxygen impurities and to counteract the hardening influence of silicon is a combination of iron with from 10 to 30 per cent. manganese. Spiegeleisen generally contains about 5 per cent. carbon. It is the shortage of spiegeleisen which in turn means a shortage of manganese that would most bother the steel makers in case they were not able to secure an adequate supply.

Manganese steel is used for such purposes as parts of crushing machinery and similar machines where great strength combined with hardness and resistance to wear are demanded. The well known Hadfield's manganese steel contains about 13 per cent. of manganese and 1 per cent. of carbon. It is very strong, tough and hard and is used generally in a cast condition. It is somewhat softened by quenching from a yellow heat, and is hardened again by reheating and allowing it to cool slowly. The reason that it is used in the cast condition is that it is exceedingly difficult, and, in fact, practically impossible to machine.

Vail Is Rutenber General Manager

Marion, Ind., Feb. 22—R. A. Vail has been made vice-president and general manager, S. R. Chenoweth, treasurer, and P. A. Watson, director of the Rutenber Motor Co., this city. These changes were made necessary owing to the retirement of R. O. Berger from the office of vice-president and director and of J. W. Stephenson as treasurer and general manager. J. W. Stephenson retains his interests in the company and his membership in the board of directors.

Omaha—Distributor for the Grain Belt

$16,026,750 Worth of Cars, Trucks and Accessories Sold in 1914—Bright Prospects for Coming Year

By David Beecroft

OMAHA, NEB., Feb. 20—Last year Omaha distributors and dealers in automobiles and accessories sold $16,026,750 worth of merchandise through the Omaha territory, a good round sum for this city with a population of 200,000 made up by counting in Council Bluffs and such other suburbs as Benson, South Omaha, Florence and Dundee.

Omaha is not seriously considered by many as a car distributing center in comparison with Minneapolis, Kansas City or Dallas, yet figures speak eloquently in proving this to be a center of proud proportions, a city that lies nestled in the heart of the grain belt and a city whose motor jobbing business of slightly over $16,000,000 per annum compares favorably with Kansas City, whose annual jobbing trade reaches $39,000,000.

Spend a few hours with Omaha car dealers and finish up with half a day at the Commercial club in this city and you will be started on the road to conviction that Omaha is being heard from and will make a louder noise in the future.

Omaha's Importance

Omaha ranks as the third live stock and packing center of the country, being led only by Chicago and Kansas City.

Omaha is the fourth primary grain market in the United States and is second as a corn market.

Omaha leads all other cities as the greatest dairy city in the country.

Omaha has one of the largest gold and silver smelters in the land.

Last, but not least, the annual grain report shows that the State of Nebraska stands fifth in total value of crops for 1914. The figures are:

COMPARATIVE CROP VALUES

State	Crop Value
Iowa	$351,450,000
Illinois	319,656,000
Texas	290,335,000
Kansas	287,662,000
Nebraska	210,099,000
Missouri	192,981,000
Minnesota	180,432,000
South Dakota	106,488,000

Is there any reason why the proud citizens of Omaha, during last week when the automobile show held the boards at the auditorium, should not laud the value of this city in the retail automobile field? For 10 consecutive years the show has been held in the same hall and under the same management. Clarke F. Powell, of the Powell Supply Co., managed the first show and still wears the crown of perennial management. The first show had six exhibitors but this week there were forty-five, thirty-three showing passenger cars on the main floor and twelve others exhibiting commercial vehicles in the basement. Fifty different makes of passenger cars were shown and sixteen makes of motor trucks. There were no accessories.

Omaha holds a closed show. You must be a bona-fide dealer, located in this city and with a real salesroom and a legitimate leasehold before you can get on the exhibition floor. This is due to the constitution of the Omaha Automobile Show Assn., a $50,000 corporation which sells stock at $50 per share to bona fide dealers. One share of stock entitles you to exhibit privileges. Forty dealers are members and all were in the show this week. Manager Powell says that not in 10 years of Omaha show history has more than one of the members of the association been absent from the show. Outsider makers were here this week trying to pick up last-minute space, but they found the bars up. No salesroom, no space, is the cast-iron rule of the show. Here the outsider who would like to wait till the show week to launch his cars before the public, is not welcome, but let him take up his residence here, open his show room, conduct a real business and at once he becomes part and parcel of the show organization.

Like Minneapolis and Kansas City, the Omaha show is largely a dealers' show. There are over 4,000 automobile dealers in this territory, and of these almost 2,000 registered. A year ago 1,400 attended. Next year we may look for 3,000. Many of the dealers attending this week brought two or three prospects with them. Some paid their railway fares, others did not. Many of these dealers closed two or more sales before closing hour tonight.

Great Potential Buying Power

Locally the 200,000 population of Greater Omaha is a potential buying power and many retail sales were closed during the week. This is not the opportune time for retail sales. It is a little early, November, December, January and February being the dead months for delivery. Deliveries start March 1, almost a month earlier than Minneapolis, and continue until the end of October.

Before endeavoring to analyze the Omaha selling field it is necessary to appreciate the territory served by this city. This territory embraces the entire State of Nebraska, the western tier of counties in Iowa, and with some dealers the lower half of South Dakota. This is an agricultural zone of no mean proportions. It aggregates a total area of 100,000 square miles, all the best farming land of the country. This area is one-half greater than all of New England. It is double the area of New York State. You could place a dozen New Jerseys in this zone. It is a little greater than Illinois and Indiana combined.

The potential buying ability of this zone is appreciated when you recall that Nebraska stands fifth as a grain-producing state, that Iowa is first, and that one-quarter of Iowa comes in the Omaha zone.

Pause and analyze the crop status of Nebraska for the past year, bearing in mind the high grain prices now prevailing and also the fact that the surplus crop money is largely going to be spent for automobiles and farm implements. Last year the Nebraska wheat crop was 142 per cent. normal, or 42 per cent. above the average crop for the last 5 years.

The oat crop was 130 per cent. of the 5-year average; corn was below normal, being only 82 per cent. of the average for the last 5 years; alfalfa was 130 per cent.; and hay fell below the 5-year average being a 90 per cent. crop. Here are the figures:

1914 NEBRASKA GRAIN CROPS

	Average Crop 5 Years, Bushels	1914 Crop, Bushels	Per Cent
Wheat	49,079,400	69,732,953	142
Alfalfa	1,973,820	2,689,613	136
Oats	54,836,200	71,413,531	136
Corn	183,201,200	150,235,060	82
Hay	*5,544,749	*3,015,575	90

*Tons.

These figures only have meaning when the increase for 1914 is seen. For 1915 prospects are even brighter. The state has been well clothed in snow, the ideal condition for wheat; the crop acreage is larger than ever before and a banner year for 1915 is already fairly well assured. Prices are sure to be high, even if the war came to an unexpected end.

Grain Buys Cars

If the farmer were not the big buyer of cars it would be useless to quote crop figures such as these, but this is the granary of the world and if you would get your finger on the pulse of industry then get your mind firmly fixed on the crop situation. A. A. Murphy, president of the Murphy-O'Brien Automobile Co., distributor of Paige and Dodge cars, says his concern will sell two-thirds of its output to farmers. G. L. Dingman, sales manager of Stewart-Toozer Motor Co., selling Chalmers and Pierce cars, says the company sells 10 per cent. of its machines in Greater Omaha and the remaining 90 per cent. go to his majesty, the farmer. The farmer sales are well assisted by the fact that there are strong banks in the small towns in Nebraska as well as western Iowa, so that sales are largely cash, the banks arranging for any accommodations that the farmer may require.

J. R. Jamison, local Overland distributor, has a small territory, twenty-six counties in northern Nebraska and four counties in South Dakota, yet a week ago he had a trainload of Overlands arrive, thirty-two freight cars carrying 126 machines. This was the first time such a trainload of Overlands had reached this city. Mr. Jamison got the territory last autumn, yet seventy of these cars were sent direct into the territory and the other fifty-six into storage in this city. Mr. Jamison has already twenty-eight dealers, by May he hopes for forty, and he spends practically all of his time going through the territory.

For the last 10 years the automobile jobbing business has been growing very steadily, not only in Nebraska but in western Iowa and the lower part of South Dakota. Figures compiled by the Commercial Club of Omaha covering the last 3 years shed interesting light on this growth. Since 1912 the jobbing in cars and accessories has almost doubled, rising from an annual total of $9,598,750 in that year to $16,026,750 the present year. Statistics for the 3 years are:

OMAHA'S JOBBING BUSINESS

	1912	1913	1914
Cars	$7,289,976	$10,891,158	$12,358,558
Accessories .	2,308,744	2,281,500	3,668,192
Totals	$9,598,750	$13,175,658	$16,026,750

The increase from year to year is regular rather than spasmodic, and the 1914 figures are encouraging in spite of the war, which had its effect for 30 days in August until the citizens found that farming, dairy, and meat packing were to continue, war or no war.

A Big Accessory Center

Omaha is a big accessory distributing center, there being approximately eight supply houses that have considerable wholesale and retail business. Manager Powell, of the Powell Supply Co., was not only a pioneer in the car selling field in Omaha but also a pioneer in the exclusive accessory business. Today his supply house trade is 98 per cent. wholesale and 2 per cent. retail. But the accessory business growth has not been so consistent as the car business, in fact, 1913 fell a little behind 1912 but the gain in 1914 was most substantial over 1913. The drop in 1913 was largely due to cars, particularly the cheaper makes, being sold with complete equipment, a fact which reduced the accessory field, and makes the showing for 1914 more important.

Few Closed Cars and Electrics

Omaha is a poor city for electric passenger cars, and as such stands in strong contrast to Kansas City where the electric is strong. The Omaha citizen cites the hills as being a great reason for few electrics, particularly as the best residential section is all along the hills. Kansas City has its hills but it also has the electrics. Other reasons have been advanced why the electric has not made greater strides here, one being that this city is not a great manufacturing one in the sense that Toledo, Indianapolis and other eastern cities are, and that there is not the money. Another is that the zone of travel here is greater than in an eastern city of the same population, and the limitations of the electric are apparent. The fact remains that Omaha is not as yet a strong closed-car center, the gasoline coupé not being a big seller, and naturally the closed electrics are wanting.

As a dealers' show Omaha does not rank as high as Minneapolis and Kansas City, but this week has long been looked for by the local distributor and also the out-of-town dealer. The dealer comes to the show. There are over twenty Chalmers dealers in the territory and all were here. The "Hup" is represented by over sixty, nearly all of whom were present, and during the week many new ones signed up. The same is true of Overland, Dodge and a host of other makes.

Jitneys Promote Interest in Automobiles

NEW YORK CITY, Feb. 24—Reports of growing jitney activity and the rapid spread of the movement for 5-cent automobile fares throughout the country continue. Ohio and Illinois towns have taken up the idea, which means greatly increased popularity for the automobile, and Milwaukee has a $100,000 jitney company. Recent developments are:

COLUMBUS, O., Feb. 19—The jitney bus idea is rapidly spreading in the Buckeye State. Steps have been taken in at least four cities of Ohio to operate jitney buses on a more or less organized plan and outside of Columbus the movement has apparently met with considerable success.

The first city to start the buses was Cincinnati, where the "Jitney Mobile Bus Line Company" was organized. Several lines were first established and passengers were numerous. Later on the promoters extended their operations to other lines, and at present about a dozen routes are being covered.

In Cleveland the idea became so strong that President John J. Stanley, of the Cleveland Railway Company, the traction system of that city, started a counter movement to operate 3-cent buses in competition with the jitneyists. Mr. Stanley claimed that his company was preparing to transfer from the buses to the traction cars, and vice versa. Three competing lines declared their work a great success, claiming that each bus should clear $12 a day.

In Columbus the idea spread like wild fire when Promoter William O'Hara announced the formation of a partnership. Before O'Hara could get his buses in operation a number of individuals started lines, mostly from the center of the downtown section to the east and the west corporation lines.

In Toledo the idea was very successful. There is a fight against the traction system in that city, because of the expiration of the franchise, and many of the people took to the jitney buses in order to register a kick against the traction system. In all more than 50 cars are being operated in that city.

MILWAUKEE, WIS., Feb. 23—Although the jitney bus made its appearance in Milwaukee several weeks ago, it was not until Monday, February 22, that the latest public transit idea was firmly and definitely established here. The Milwaukee Jitney Bus Co., capitalized at $100,000, was incorporated on Monday and on Tuesday morning started business with thirty five- and seven-passenger cars, running on a strict schedule and over certain routes.

The new corporation was organized by C. A. Van Ess, who formerly was secretary of the Chicago, Peoria and Quincy traction line. E. A. Perkins is president and treasurer; Louis Rother, secretary, and Mr. Van Ess general manager of the new line. The offices are at 209 Second street, between Grand avenue and Wells street. Busses will be operated on five crosstown streets.

BLOOMINGTON, ILL., Feb. 20—The jitney bus idea has reached Bloomington, Peoria, Decatur and other central Illinois cities, but it is doubtful if it will be permanent, the business not being large enough to warrant the purchase of special cars. Automobiles holding five to seven passengers are temporarily in use. The street railway company managers are watching the performance of the new competition but say that it is not serious enough to warrant any action.

Making the Spiral Bevel Gear

How Its Action Differs from Ordinary Bevel Gearing and How the Cutting Operation Is Performed

EXPRESSED in a few words, the object of the spiral bevelgear is to spread over several teeth in partial contact the load that, in a plain bevel, would be all upon one tooth, and to provide teeth that do not engage over the whole length of tooth at once, thereby lessening the shock as tooth meets tooth. The fundamental basis of the bevel gear is the cone, which means that if the axes of two shafts when produced intersect at a point it is always possible to find a pair of cones that will roll together perfectly when mounted upon the respective shafts, and the points of the cones will always coincide with the intersection point of the shafts. Now, in forming an ordinary bevel gear the teeth are partly cut out of the surfaces of the theoretical basic cones, and partly built up on the cones, so the center line of each tooth may be regarded as being a line drawn on the surface of a cone. Imagine the two cones rolling together in frictional contact, and suppose we draw a line on one of them. If this line were made with some glutinous matter, we should find on turning the cones that the line was reproduced on the surface of the other cone quite sharply; there would be no smudging, because the cone surfaces roll over each other and have no sliding.

Layout of Curved Teeth

Now, in the ordinary bevel gear approximately half the depth of the tooth is *above* the surface of the base cone, so if we were to plane away the top half of a tooth we should be able to regard the two sharp edges of the remaining portion as two lines drawn upon the surface of the theoretical base cone. Since the same applies to the other member of the bevel gear combination it is easy to see that lines drawn lengthwise along the middle of the face of each tooth in the pinion will meet squarely against corresponding lines drawn on the teeth of the large gear. Returning now to the idea of the base cones, it is easy to see that the shape of the line drawn on one does not matter, any sort of a pattern drawn on the pinion cone will be reproduced upon the large cone. If we draw straight lines from apex to base they will reproduce lines of like character on the other member and the reproduction will be instantaneous for the whole length of the line, but if we draw the line slantwise across the surface, or if we make it curved, only one *point* on the line can be in contact with the surface of the other cone at any instant. The extreme case is, of course, a circle drawn round the small cone parallel to the base circle.

It is not necessary to go into the theory of gear tooth formation, to describe the complicated processes whereby the surfaces of the teeth are calculated so that every point on one tooth makes square contact with the opposite tooth without allowing any sliding or slipping. Assuming that the teeth are so formed it remains obvious that a straight tooth makes contact over its whole length at once just as the straight line drawn from apex to base of the base cone reproduces its whole length at one instant. If, however, we cut a curved or slanting tooth on the cones their point of contact will pass along their length from one end to the other just as the curved line on the base cone reproduces itself little by little on the other cone.

It is obvious that there ought to be less shock if we can arrange a number of curved teeth to replace an equivalent number of straight teeth, because while the load is traveling along the length of one tooth the next will be coming into action and the previous one will be nearing the end of its contact path. It is usual to proportion the size of gears and the dimensions of their teeth so that the tops of one pair are in contact at the same instant as the bottoms of another and the center portions of a third pair, but this distributes the load over several teeth by virtue of the shape of the teeth themselves, while the use of curved teeth distributes the load on account of the shape of the base line around which the tooth is built up, *as well as* by virtue of the tooth form.

It is practically impossible to design any gear so that all the tooth surfaces roll over each other without sliding, at all events such a gear could not be made by any manufacturing process, but the ordinary gear approximates fairly to the theoretical ideal. For cutting bevel gearing in particular the process known as generation gives the best results because it uses a tool that has merely to be ground to a plain straight edge and not in any sort of curve or tooth formation. To use such a straight cutting edge for the production of gear teeth, the blank from which the gear is to be formed has to be rotated slightly on its axis as cutting proceeds, or the carriage bearing the tool can be swung while the work remains stationary. In cutting curved teeth for spiral bevel making it is necessary to move both cutter and work because we have two curves to cut, that of the center line of the tooth and that of the tooth surface; the latter is, of course, at right angles to the former.

Advantages of Spiral Bevels

Before turning to details of the machine evolved for cutting the spiral bevel gear some remarks may be made as to its efficiency and its points of advantage and disadvantage. It is not to be expected that the efficiency is quite so high as in a plain bevel, because the thrusts are heavier, but it is not likely that this extra friction is in the least serious, and the advantage of quietness in operation is ample to compensate for it. Also it is a fact that there is not the same need to adjust the pinion and gear ring so accurately as is required to get reasonably quiet running from a plain bevel, though the efficiency of the spiral bevel must be at its best when the meshing of the teeth is in accordance with the theoretical pitch cone diameters, since with gears of any kind, deviation from proper meshing introduces irregularities in the rolling action of the teeth.

Caring for Thrust

The thrust that has to be resisted by the bearings supporting a spiral bevel is far greater than that of a plain bevel because the teeth of the former make an angle with the center line of the shaft on which the gear is mounted, instead of being parallel thereto. There is always thrust on bevel gears because of the natural tendency for one to roll away from, or out of mesh with, the other; just as there is a separating thrust between two shafts connected by ordinary spur gearing. The extra thrust due to the spiral teeth corresponds exactly to the endways thrust which appears on spur gear shafts when helical teeth are substituted for plain ones. The Gleason company have made a series of tests of plain bevel gearing and spiral bevels of different angles which show that

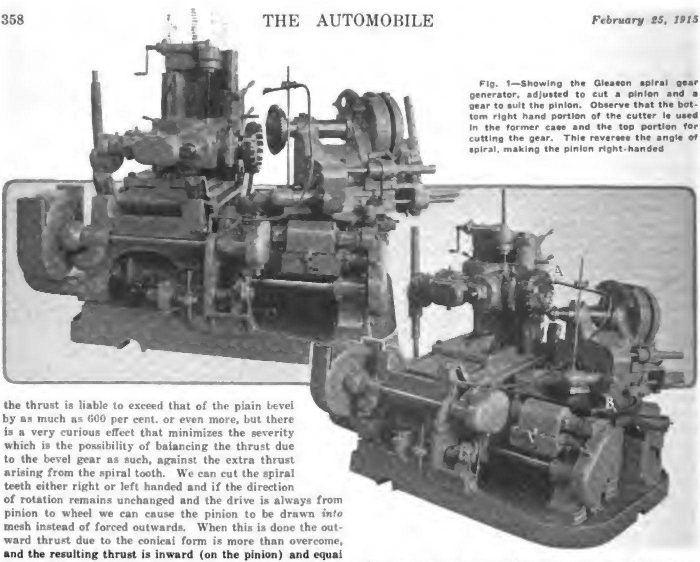


Fig. 1—Showing the Gleason spiral gear generator, adjusted to cut a pinion and a gear to suit the pinion. Observe that the bottom right hand portion of the cutter is used in the former case and the top portion for cutting the gear. This reverses the angle of spiral, making the pinion right-handed

the thrust is liable to exceed that of the plain bevel by as much as 600 per cent. or even more, but there is a very curious effect that minimizes the severity which is the possibility of balancing the thrust due to the bevel gear as such, against the extra thrust arising from the spiral tooth. We can cut the spiral teeth either right or left handed and if the direction of rotation remains unchanged and the drive is always from pinion to wheel we can cause the pinion to be drawn *into* mesh instead of forced outwards. When this is done the outward thrust due to the conical form is more than overcome, and the resulting thrust is inward (on the pinion) and equal to the difference of the two thrusts. Should the direction of rotation be reversed the two thrusts are added together and will act outward, so for automobile work it is customary, though not essential, if large thrust bearings are used, to cut the spiral in a direction which will cause it to draw the pinion inward during forward running under engine power, and only force it outward on reversing or on occasions when the car drives the gear by inertia, as in coasting and then, of course, the load is quite light. To quote a few figures from the thrust determinations made in the Gleason works the plain bevel showed an average thrust of 7.3 per cent. of the tooth load, a spiral bevel of 19 degree angle an inward thrust of 28.7 per cent and another spiral bevel of 31 degree angle had an inward thrust of no less than 49.5 per cent. the tooth load. These thrusts are quite capable of efficient handling by ball thrust bearings or roller thrusts of sufficient size, but their magnitude shows that bearing troubles may be expected if spiral gears are merely substituted for plain ones in an otherwise unchanged axle. A point which can be made in favor of the spiral bevel and which has not received quite the attention it deserves, is that it is suitable to greater gear reductions than the plain type, because of the way in which the tooth curvature spreads the load over a number of teeth and removes the shock of contact. Also the pinion is not weakened by undercutting to the same extent as it would be if made plain and of equally small diameter.

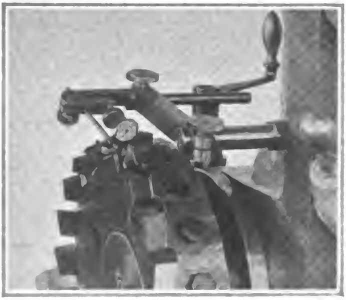


Fig. 3—Testing the circularity of the inserted tooth cutters by micrometer gauge reading to less than a ten-thousandth of an inch

Cutting the Spiral Bevel

The machine that has made the spiral bevel a commercial possibility has been developed by the Gleason Works of Rochester, N. Y., during the past couple of years. All the best machines for cutting plain bevels work on the generating principle, in which the blank being cut and the tool that does the cutting are made to roll during the operation, just as though they were two gears in mesh. This rolling being controlled by master gearing causes the tool to cut a perfect tooth form out of the blank. All generating gear cutting machines are somewhat complicated, but the Gleason spiral bevel cutter is only a little more so than ordinarily while it has the quality of operating almost as rapidly as the plain type bevel machines. In the latter the cutter used is almost always straight sided, all the curvature of the tooth face being produced by the rolling of the carriages holding the tool and the work, and the cutter is caused to reciprocate back and forth in a straight line. Obviously a straight line reciprocation cannot produce the curved tooth needed for the spiral bevel, so the Gleason machine has a revolving cutter head with multiple cutters, and this produces a tooth curved to the same radius as the radius of the cutter head.

Regulating the Cutter

It follows that if we regard the cutter as revolving on a fixed center, the tooth produced will make different angles with the axis of the pinion or wheel being cut according to whether the work is raised or lowered with respect to the cutter. This means that we can lay a series of curved teeth around a bevel blank either almost parallel to the axis (like slightly bent straight teeth) or at a sharp angle, the angle being measured from a tangent taken across the middle point of the tooth. Turning now to Fig. 1, A is the revolving cutter seen at work on a pinion. The pinion is mounted on a mandrel which is set in rigid bearings on a carriage which can be turned round in a horizontal plane by the rack shown. This adjustment is to suit pinions and wheels of different cone angles and has to be altered when the nature of the work is changed.

Determining the Angle of Tooth

Standing at the right end of the machine shown in Fig. 1 and looking squarely at the cutter it would be obvious that we should need to move the cutter either horizontally, vertically or both to get it to cut any desired angle across the face of the pinion. If we think of the cutter as a clock face and adjust it till the pinion blank touches the cutter ring at a position corresponding to 22½ minutes past the hour the tooth angle would be roughly 45 degrees. In the illustration as shown the pinion is being cut with a right hand spiral, but if we moved the cutter to bring the pinion to 7½ minutes past, that is the corresponding point on the upper half of the cutter circle, then the angle would be the same but the cutter would make a left hand spiral instead of a right hand. Since a wheel has to be cut of opposite hand to a pinion it is always necessary to adjust the cutter to the exact relative position when changing over from one to another. These vertical and horizontal settings of the cutter head must needs be extremely accurate, since the angle of the teeth and the proper relationship between pinion and gear depends entirely upon them. The vertical lifting screw for the cutter head can be seen in Fig. 1 and there is a scale at the back reading in even inches. Just in front of the handle at the left top of Fig. 1 the fine circular scale is seen, this reading in thousandths. There is a corresponding transverse slide which can be seen in Fig. 2 and this is equally delicate. So far we have the cutter head capable of sliding up and down vertically on a base that can itself be moved transversely on a second bed, and this second portion is semicircular and can rock to and fro on vees of which the ends are seen in Fig. 1, and a side view given in Fig. 2. Behind the blank being cut at the rear end of its mandrel are gears through which the mandrel can either be rocked or revolved and these gears are interconnected with those that give the rocking motion to the whole cutter carriage.

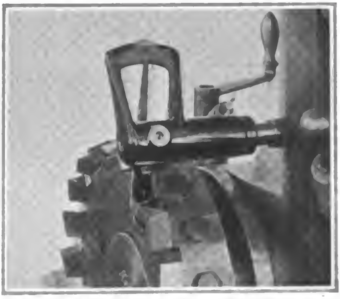


Fig. 4—Testing the distance of the cutter points from the head of the machine. This adjustment is to ensure the cutters being all in one vertical plane so as to give each an equal depth of cut

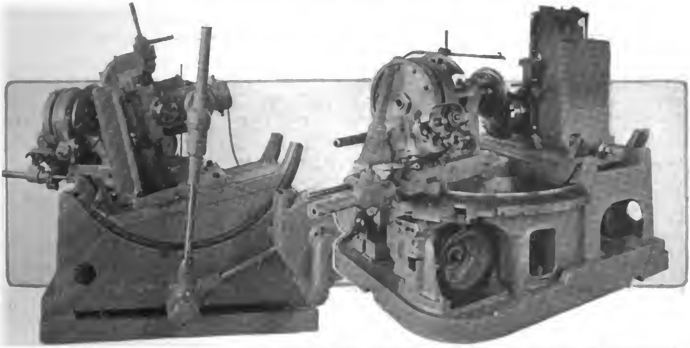


Fig. 2—Left—End view showing guides and V bed on which cuttter head rocks. Right—Showing driving gear for oscillating work mandrel and indexing

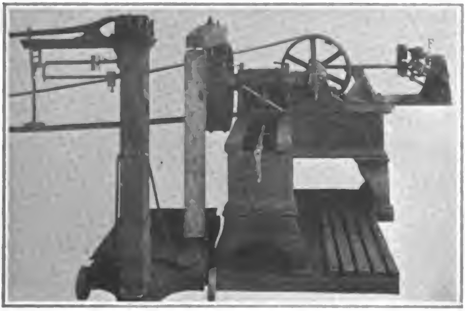


Fig. 5—Machine used to test thrust of spiral bevel and plain bevel gears. The pinion is held up to the gear by a sliding thrust collar, itself supported by the arm seen in the background. This arm terminates at the fork F, which is located between two calibrated springs, so that thrust can be read when pinion is adjusted into proper mesh

The cutter begins to operate on the blank at one end and, as it cuts, the blank is rolled slowly, causing the metal to be removed so as to leave a perfect tooth face on one side and a partially finished face on the other side of the groove. Meanwhile the cutter carriage rolls slowly also and this causes the cutting point to travel lengthwise along the blank, so continuing the groove right across the entire face of the blank.

Operation of Reversing Mechanism

As soon as one cut is completed a reversing mechanism comes into action turning the cutter carriage back to its original place. The work is swung away from the cutter in the horizontal plane, and the gears which roll the work mandrel index is ready for the next cut; whereupon the whole process is repeated. When the teeth are all finished on one side the opposite faces are dealt with and the cutters are staggered so that every other blade registers with the next but one; if there are twenty cutters ten operate on the outside and ten on the inside, doing opposite sides of the teeth. This introduces a slight inaccuracy, since the diameter outside the cutters is a little greater than inside them, and one tooth face is cut to a slightly sharper curvature than the other face. The effect is to cause the gears to mesh a little more tightly at the middles of the teeth than at the ends, but the deviation from theoretical form is possibly even an advantage in practice.

Making Adjustments for Roll

The adjustments for different degrees of roll to suit gears of differing sizes is made by a series of change wheels and the machine is sent out equipped with combinations to suit any ordinary styles or dimensions. There is only one fundamental setting that requires great care and this is the adjustment of the blades of the cutter. These blades are separate pieces and are ground upon a special machine in the Gleason works, but they require to be kept in an absolutely true circle. For testing this circularity the little gauge shown in Fig. 3 is employed, it being mounted on a peg screwed into the head and capable of reading to less than a ten thousandth of an inch. There are little wedges beneath each cutter blade and they enable the adjustment of any blade to be made rapidly and with high accuracy.

There is another important dimension of the cutter and this is the position of the tops of the blades, since the plane in which these lie must always contain the vertical axis about which the work carriage is swung. Another gauge, shown in Fig. 4, is used to check this adjustment, and to move the cutter back and forth there is a very fine setting for the bearing which supports it and this is equally as easy to handle as the other gauge.

Once the machine has been adjusted to suit the work in hand its operation is automatic, or nearly so, and there are so many facile adjustments that it is easy to correlate the roll of work and carriage. All change gears that need to be got at in the process of setting up are in accessible places and the lubrication is exceedingly thorough; the vee slides are supplied with oil under fair pressure from a pump. Thus there is nothing in the work that cannot easily be mastered by any mechanic accustomed to gear cutting, which means that the manufacture of bevel gears of spiral type can be undertaken by automobile plants far more readily than the cutting of worm gearing.

Detroit Tries Out Traffic Signal

Detroit, Mich., Feb. 20—To further improve traffic conditions here a new device invented by secretary of police Walters is being tried out on Woodward avenue, where traffic is most intense. It consists of a 7-foot metal post on top of which are mounted two metal cross pieces, one painted red, the other green, the former having painted on it in white letters the word Stop, and the latter the word Go, also in white. A handle placed at a convenient reach for the traffic officer in charge of the post permits him to turn the sign in whatever direction he desires, for either stopping traffic or having cars move on. At night the post is surmounted with a red light. The device will be tried out several weeks before it will be decided whether it is to become a permanent feature for the regulation of traffic.

Results of a Trip to the Firing Line

The effect of a shell which dropped on the fender of a car in the Argonne district, one of the battlefields of the Allies and Germans

Horizontal Shocks with Cantilever Springs and Flame-Welded Clips

(The Improvement of Spring Systems—VIII)

By M. C. K.

IN politics a letter to or from a friend—a private letter intended for publication—has often served conveniently to place on record an opinion or statement of facts which had been previously less aptly or correctly expressed. Such a letter has been received with regard to the means which might be adopted in order to take up horizontal shocks in connection with the use of cantilever springs. It explains itself, as such letters always do, and reads:

My dear M. C. K.—With the seventh of your series on Spring Systems just at hand, I feel that I should enter a mildly protesting disclaimer with regard to one of the sketches you have made to illustrate the provisional conclusions which we reached at our recent discussion of ways and means for introducing a horizontal cushioning effect in motor vehicles without interfering materially with standard design. I can do so with a sense of perfect freedom, as you know that I am in substantial agreement with your views on the ultimate necessity of this improvement for the commercial vehicles, if they are to run at more than 8 miles per hour over the humps and potholes of our crude thoroughfares, and of its desirability for all automobiles in view of tire economy and safety for the vehicle springs and passengers at high speeds. I refer to Fig. 18—which by some accident has been captioned Fig. 19 under the illustration—representing a cantilever spring hung from a pivoting clip which, as your text says, "is simply longer than usual and formed below the spring with a suitable abutment R for the thrust rod." This is scarcely in accordance with our conclusion; neither does it agree with your subhead to the effect that "combination springs are impossible." With all allowance for the omission of detail that is acceptable with mere diagrams, I am bound to look upon a spring made in conformity with this sketch and description as a "combination spring"; that is, one in which the vertical and the horizontal components of a shock are cushioned by the same spring elements without a distribution proportionate to their severity. You have explained why this ordinarily cannot be done satisfactorily, the fundamental reason being that vertical shocks are determined by the axle load and the horizontal ones by the weight of the whole vehicle and that, precisely when the shock is most severe and dangerous, the combined force of the two components must tax a combination spring beyond its capacity if it is adapted for the light work of cushioning the milder shocks in which the vertical component predominates. Let me attempt to express this in more concrete terms, using your own figures: "You cannot cushion 8,524 footpounds of horizontal stress in a 1 to 2 inch movement of the same spring combination from which you expect to use a 4 to 5 inch movement for cushioning 3,180 footpounds of vertical stress. That is, the two actions will be of very unequal efficacy."

Now, the spring arrangement outlined in Fig. 18, under Fig. 17, does permit vertical shocks to be cushioned by the cantilever spring alone, if they come entirely without complication with horizontal shock, but this is a rare instance. If there is a complication, on the other hand, the vertical action is plainly increased by the rearward axle movement, since this involves an additional pivotal movement of the cantilever spring. If the horizontal shock predominates, the situation is in my opinion worse. The receding of the axle is then necessarily accompanied by a sharp upward movement for which there is no use, and the front end of the cantilever spring is stressed correspondingly, while the movement of the thrust rod is unduly limited by these implicated resistances.

It is quite evident to me, after our discussion of the whole subject, that the construction shown must have slipped into print by inadvertence, as it is so contrary to the trend of your reasoning at all other points. I venture to offer you a corrected sketch, which represents, I believe, what we really had in mind, differing from the first Fig. 18 only by having an additional pivotal action which separates the vertical and the horizontal cushioning actions almost completely. Even so the construction suggested cannot be termed more than experimental. In wishing to substitute this sketch for the previous one, I have another object in mind, in which I know that you heartily concur. I refer to the effect which publication of this sketch may have to forestall another one of those numerous patents for obvious improvements—or obvious possibilities for improvement—which really should not belong to any individual or corporation, as they represent merely normal and unavoidable ideas in a development belonging to the industry at large and would crop out in one individual if they did not in another. We all know, however, that patents of this character, "copped" from the common fund of thought-material, are so much more obstructive of general progress as they are more obvious and therefore in lesser degree the moral property of the patentee.

Along this line of ideas, I sketch the clip in the corrected Fig. 18 on the supposition that a progressive and possibly patentable idea has also been incorporated in this detail. It is represented as produced by casting, forging or stamping, in the latter case with the aid of autogenous welding of the piece F, and this process is also used for the assembling with the spring. The accompanying notes will enable you to make the suggestion clear.

I dare say you are willing to induce your readers to linger a little longer on this whole subject of horizontal springing which so far has met with such scant and hesitating recognition of its importance, and I will therefore add one word about the front spring, Fig. 21. This is also a combination spring, frankly so, and must be a little hard for the shocks in

(*Continued on page* 389)

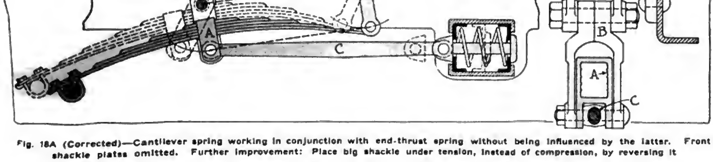


Fig. 18A (Corrected)—Cantilever spring working in conjunction with end-thrust spring without being influenced by the latter. Front shackle plates omitted. Further improvement: Place big shackle under tension, instead of compression, by reversing it

Light Pistons Make Smooth Motor

Reducing Piston Weight Increases Power, Lessens Vibration and Improves Durability of Motor

By Eric W. Walford

ALL reciprocating engines suffer from the disadvantage that the pistons have each to be stopped and restarted twice in every crankshaft revolution. Their direction of travel is changed at each dead center, so the inertia of the piston mass has to be overcome four times each revolution, since effort is required to start it moving either up or down and then to stop it moving at the other end of the stroke. It requires no mathematics to make clear that the lighter the piston the less the effort needed to move it or to arrest its motion, or to put it the other way round, if we have a definite power for starting or stopping the piston then the lighter it is the faster will it accelerate and the more quickly come to rest.

Thus reducing the weight of the pistons of a four-cylinder motor:

1. Reduces the jerk caused by reversing the motion at the dead point and so lessens vibration.
2. Decreases the stress on the crank bearings and connecting-rods.
3. By reason of 1 and 2 permits increased motor speed and so increased power.

Methods for Reducing Piston Weight

There are three ways of reducing piston weight; we can design with great care and machine more accurately so as to make the best possible use of good cast iron, we can substitute steel, or we can even use aluminum alloy. Each method has advantages and corresponding drawbacks which will be treated presently. Meanwhile it suffices to say that iron and steel are costly to machine with sufficient delicacy, steel is more liable to suffer from high temperature than iron, while aluminum is almost ideal providing that the metallurgists can give us an alloy which does not become brittle after long use. There is a kind of solidity about the light piston made from aluminum that is very attractive and this cannot be found in any construction of steel or cast iron.

Turning back to the three advantages tabulated above, a conclusive way of proving that they are correct would be to drive, through electric motors, two gasoline engines which are identical except that one possesses pistons which are half the weight of those in the other engine. At equal speeds of revolution the difference in vibration would be quite noticeable, and this would be particularly true at high speeds. In course of time, as the speed increased, trouble would be experienced with the connecting-rod bearings of the heavy-piston engine or, if the speed were increased rapidly to a high figure, it is very probable that one or more of the connecting-rods would break, while at the same speed the engine with the light pistons would not suffer. If the electric current consumed could be measured, it would be found that the light-piston engine would take less power to drive at high engine speeds than the engine with the heavy pistons; which means, conversely, that by reducing the piston weights the power is increased.

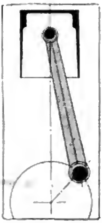


Fig. 1—Showing how bearing pressure is reversed on upstroke

Reduction of the weight of the pistons diminishes the vibration at all engine speeds, and one has but to make a substantial change in the weight of the pistons of a known car in order to appreciate the improvement. Recently the writer substituted built-up steel pistons for the original cast-iron set, saving almost half the piston weight. The effect was most pleasing and made it easy to understand why there is such a marked tendency amongst European manufacturers to reduce piston weights.

Effect on Speed

It is natural to associate light pistons with racing car engines and it is therefore assumed that their advantage is greatest at very high speeds, which is correct, but it must be borne in mind that the value of light pistons is only to be found at high speeds; there is no fixed engine speed above which it is essential to have light pistons, and below which no advantage accrues from their use. Those who urge that a reciprocating piston is a form of flywheel overlook the all-important inertia stresses which cause so much worry to designers of high-speed engines. English manufacturers who are building engines for very small cars, have experienced much trouble through failure of the connecting-rod bearings, because purchasers of these cars make use of the high speed capabilities of their motors; and many racing car designers consider that it is the connecting-rod bearing pressures that place a limit upon engine speeds. At one time the limiting factor was the inability to fill the engine cylinders; now the chief difficulty is to keep a film of oil between the connecting-rod bearing surfaces. This can, of course, be overcome by the employment of high pressure forced lubrication where the oil is taken direct to the connecting rod bearings through a drilled crankshaft, but there is a limit to the effectiveness of this way of tackling the difficulty.

Demonstrating Actual Stresses

The reduction of stress on the connecting-rod and its bearings by reducing the piston weight can best be demonstrated by an example. We will assume that a piston weighs 2 pounds and that it has a stroke of 6 inches. At 1,000 r.p.m. the maximum velocity reached will be about 33 feet per second, and the energy stored in a 2-pound piston at this speed is 34 foot-pounds, while the motive force necessary is 137 pounds and this represents the stress on the connecting-rod due to inertia. At 2,000 r.p.m. the figure is 548 pounds and at 3,000 r.p.m., it is 1,233 pounds. If the pistons weighed 3 pounds each the figures would be 210 pounds, 840 pounds and 1,890 pounds, respectively. It is clear, therefore, that, in order to reduce the stress on the connecting rod, the load on the connecting-rod bearings and the side thrust of the pistons on the cylinder walls, it is extremely important to cut down the piston weights. Side thrust is of great importance in slide-valve engines as it causes binding pressure on the sleeves. By reducing piston weight the connecting-rods can be made lighter, so that the reciprocating weights can be reduced still further, but it would obviously be fatal to lighten the rods and leave the pistons heavy.

From the foregoing it becomes clear why heavy pistons are detrimental to the life of a motor and how light pistons lessen the possibility of connecting-rod or bearing troubles.

Reversal of Load

We have seen that a rising piston moves faster and faster during the first half of the upstroke and then slows down again as the crank comes toward the top. If the motor is running fast there may be energy enough started up in the piston by the time it reaches the half way position actually to more than overcome the compression pressure of the gas above the piston. When this speed is reached the load on the connecting-rod bearings changes over suddenly, at half stroke, putting the load on the underside of the crankpin where it will remain for a quarter revolution before the firing stroke, or for half a revolution if the suction stroke is following at its upper side. After passing a half stroke, the piston slows down and the pressure on the wristpin and crankpin is transmitted to the other sides of these bearings. Obviously, the heavier the piston and the greater the speed of revolution, the greater would be the pressure on the connecting-rod bearing arising in this way from the inertia of the piston. Assuming that the bearings are designed to deal with a certain load due to the explosion, it is clearly possible to ruin these bearings by subjecting them to far greater pressures which may arise easily solely from the inertia of the pistons. As stated, the lighter the pistons the smaller will be the stresses due to inertia; or to put it the other way, the higher will be the engine speed before these stresses become serious. By reducing these stresses by lightening the pistons, bearing friction is reduced and there is therefore more power available. Consequently, by using light pistons, not only is the maximum power put up owing to the possibility of increased engine speeds, but at anything above moderate speeds, the power is increased because the friction is lessened.

It may be of interest to mention that many makers of very high speed engines find that the crankpins wear chiefly on the inner and not on the outer side. The explosion pressure comes on the outer side of the crankpin, but the chief inertia loads come on the inner side and that this is the part that wears out most quickly shows the importance of reducing the load due to inertia as much as possible.

Steel and Aluminum Pistons

The steel piston is easy to make strong and light if the expense of machining it is not considered, but this is so much greater than cast iron that one can say that steel pistons are almost out of the question for moderate priced cars. Also there is the disadvantage that steel pistons sometimes fail in the head because the extremely thin metal that is strong enough to bear the explosion is not able to carry away the heat to the cylinder walls fast enough. In racing car engines the failure of a steel piston through the head becoming red hot and blowing out is not uncommon. To overcome this the Sunbeam company devised a piston with a central leg, or strut, which was machined so as just to touch the middle of the wristpin. This gave support and also carried heat away, the pin being sufficiently massive to transfer the heat to the water-cooled cylinder walls with sufficient rapidity. This piston has been used in racing with complete success, but it is very expensive to make. Several light pistons are shown in Fig. 2.

Aluminum has the outstanding advantage that it is cheaper to machine than any other metal and a light piston has still to be thick enough to remove the delicacy from the machine operations. Its drawback is that it seems liable to become brittle under the action of continued heat, eventually reaching a crumbling stage when it blows out or gives way at the wristpin supports. Still aluminum alloy pistons have been used with great success on some high-powered motors, and it appears that the secret of success lies with the alloy makers. This is most encouraging because it suggests that a little more experiment may very probably indeed result in the discovery of an alloy that will be everything required.

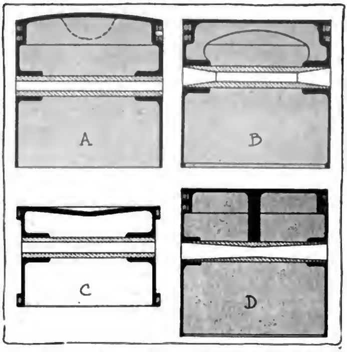


Fig. 2—A—Pressed steel piston with parts welded together by oxy-acetylene. B—Successful light cast iron piston used for aeroplane engine. C—Steel piston machined from solid bar with cylinder contact on piston rings only. D—Sunbeam design of piston machined from bar with central support for head

At present the easiest thing to do is to be prepared to spend a little money on making a motor smoother in running and to reduce the weight of cast iron pistons by using good iron, designing so that every portion of the piston does its share of the work—so that there is no dead metal—and machining with accuracy.

INERTIA STRESSES FOR PISTONS OF 2 AND 3 POUNDS WEIGHT

	2-pound piston	3-pound piston
1,000 r. p. m.	137 pounds	210 pounds
2,000 r. p. m.	548 pounds	840 pounds
3,000 r. p. m.	1,233 pounds	1,890 pounds

—

RACINE, WIS., Feb. 20—To meet the demand for instruction in Spanish occasioned by the inability of stenographers and correspondents in Racine manufacturing plants to cope with the South American mail now coming in, the Racine board of education has instituted a course in this language in connection with the evening high school courses conducted each winter. The initial enrollment in the Spanish course was eighty-two and has now reached more than 100. The Case, Mitchell-Lewis, and L. P. C. automobile companies and numerous other large factories in Racine are developing an extensive trade with South American nations and it has been found necessary to import correspondents and stenographers from large cities to handle the mail.

—

CLEVELAND, O., Feb. 20—The National Carbon Co., this city, has received a request from Borghoff, Santos & Co., Rio de Janeiro, Brazil, which states that they are very desirous of receiving propositions from manufacturers of all automobile accessories, tools and waterproof canvas, accompanied by prices, discounts, terms, and samples.

· The Engineers' Forum ·

Piston Ring Problems—Faults and Advantages of Various Sorts of Ring

TRENTON, N. J.—Editor THE AUTOMOBILE:—Seeing that there are now upon the market so many different kinds of piston rings, all having as their aim the removal of the small leakage always possible with ordinary rings, it occurs to me that readers of THE AUTOMOBILE may be interested in hearing how we were led to design our ring, since during our experiments we made some discoveries that were, to us, extremely interesting.

When first we started on piston ring production we took a most efficient type of ring which was a compound form of angular cross section. We knew that this type of ring gave great efficiency on installation, but that the efficiency fell off with use, and we therefore proceeded to make a careful study of the reasons for this loss. It proved ultimately to be a fact that while the joints of the two sections were held opposite to each other by means of a dowel, slight wear would allow the respective openings to separate. As soon as the gases under the high pressure generated by the explosion found their way behind the ring through the upper section joint, there was a corresponding point of egress developed at the joint in the lower section. That lubricating oil was working past the ring freely, was proved to us by the presence of quite heavy carbon formation behind the ring in the piston groove.

Weakness of Compound Ring

We made several types of compound ring and these were all tight so far as leakage past the face or behind was concerned; but we had difficulty in obtaining sufficient distention to prevent the ring riding over the lubricating oil film; that is to say, the ring did not give a clean scrape to the cylinder wall.

By chance one of our compound rings lay for some time beside a pot of zinc chloride used for soldering purposes, and thereby became covered with a uniform coating of rust. On picking up this ring in order to give a demonstration of the efficiency expected, we noticed that the friction created between the two ring sections by this slight coat of rust was sufficient to offset the expansive properties of the assembled ring; which we took as a proof that the inner member lost most of its expansive efficiency by friction against the outer member.

Further, we found that there was a tendency for the outer member to slip the ring groove as the piston was being put into the cylinder. These two facts turned our attention to the construction of a one-piece ring.

Before we reached this point however, we had noted, by a careful examination and calibration of numerous stock rings, that the average ring, in both the one- and two-piece construction, showed considerable "warpage" both circumferentially as well as in plane section. In fact some rings showed a "curl" of 3/16 of an inch.

Result of Using Unseasoned Materials

From this point developed our rule to turn and cut our castings into ring blanks, and then allow them to "set"; in preference to treating the entire casting as a whole in this manner. The lighter ring sections seasoned more readily and efficiently. We had by this time decided in favor of the concentric rather than the eccentric type of construction, from noting that the lesser area exposed on the cut side of an eccentric ring, through the presenting of less area to the side walls of the piston ring groove, shows a corresponding increase of side wear.

On the question of internal peening for expansion, after careful study thereof, the decision was reached that the stresses set up in the ring by such treating were offset in a short period of time by the pounding of the explosions above the piston, accompanied by the attendant vibrations developed by the motor when under power. In other words the natural stress of the iron was all that remained.

As to finishing the ring for dimensions, there was but one way to accomplish this with any degree of satisfaction, and that was to grind the ring circumferentially while held under compression. To accomplish this we inserted the cut blanks in tubular forms, that allowed the ring to exert its expansive properties in a perfectly natural manner, being held under circumferential control only. When clamped on the grinding form the sleeve is removed, and the face ground with micrometrical accuracy.

Yet the fact remains that there are practically no perfectly round cylinders in use today. This seems rather a broad assertion, but when the further seasoning of cylinders developed by the many changes in temperature of a motor when in actual use, is taken into consideration, as well as the side thrust of the piston against the walls, it is readily understandable.

From this we found that practically the only way in which perfectly fitting rings could be obtained was by the motor itself in driving a distance ranging from 500 to 1,000 miles in actual use, or by the driving of the assembled motor by outside power, using a light "soup" for a combined lubricant and cutting compound, for a period of time ranging from 5 to 20 hours.

On the point of relationship between width of ring face to diameter, our preference is to work on the ratio of 1-16 inch of face for each inch of cylinder bore. This means that for 3-inch pistons the ring would be 3-16 inch wide; for pistons 4 to 5 inches in diameter, 1-4 inch in width or possibly 5-16 inch.

As to the practical benefit of using an improved form of piston ring, I may say that it is usual for us to receive reports to the effect that oil consumption has been reduced very greatly indeed on motors which our rings have been fitted. In one particular case a car which used to use a gallon of oil for every hundred miles was afterwards enabled to cover 400 miles on the same quantity.

It is of course a fact that where high piston speed is made and maintained the compression and explosion of the gas takes place so very quickly that a close fitting piston without any rings will very nearly approach in efficiency another piston fitted with any number of rings. It is at slow speeds that the possibility for leakage of the ordinary style of ring becomes noticeable, and seeing that the ordinary automobile motor only occasionally operates at really high speed it seems to us rings which will enable the oil consumption to be cut down cannot be anything but advantageous. There should be less friction when using two or three rings which have no gap to allow the escape of gases than where the same degree of tightness obtained by the use of five or six ordinary rings, to say nothing of the increase in piston weight called for by increasing the number of rings. For these reasons we think that the ordinary old-fashioned piston ring is doomed to disappear from the automobile.—CARL H. ENDEBROCK, President End-Oxy Appliance Co.

Favors Adoption of Metric Standards of Measurements

ARCADIA, CAL.—Editor THE AUTOMOBILE:—Following my letter on this subject which you published in the Rostrum for January 28, the change of systems would entail prodigious difficulties, as you say, but it is feasible. These difficulties have accumulated by the tremendous industrial development of this country; and the longer the inevitable change is postponed, the more the obstacles will correspondingly increase. I make an attempt to enumerate below my personal views regarding the easiest steps for the adoption of the metric system by the United States.

First: Start an energetic educational campaign by the press and especially by the automobile and technical publications to convince the American public of the fact that our present system of weights and measures is antiquated and confusing and that the metric system is the only iogical and reliable one.

Second: Passing of a federal law that the metric system will be introduced in this country on a certain date—say January 1, 1917. In order to insure a gradual transition from one system to the other, the country should be first taught to use metric figures as well as the old figures, in order to more easily acclimate itself to the new regime.

Third: A federal appropriation for the making of an entire new set of metric measures and standards to be distributed free of charge to the trades and industries of the United States. The exclusive use of these measures would be of course compulsory on and after the above mentioned date, January 1, 1917. Exception would of course have to be made for the measuring and computing of repair parts pertaining to old goods.

Fourth: The rational but firm enforcement by the U. S. government of the metric system law.

These personal views will perhaps seem optimistic and imaginative; I do not doubt that they can be improved upon. The American public should be expected to contribute all the co-operation and the good will possible. Manufacturers and mechanics would most welcome the new system as they are all eager to enjoy its benefits. Concerning the automobile industry, the branch that actually manufactures the largest amount of measured parts, it can be asserted that the change would not prove very burdensome, considering the subsequent benefits. All the new motor cars would be metrically manufactured, and as the average life of a car is about six years, the drawback of making inch-measured parts would only seriously extend itself for a like period. Regarding products of longer life, most of such of their parts needing renewal, could gradually be replaced by metric ones. In 12 years, owing to the up-to-dateness of the American nation, the old system would be entirely forgotten.

It is a matter of fact that when accurate mathematical figures in any branch of science are required, the metric system naturally imposes itself. The Ampere, the fundamental electrical unit, deposes 0.00118 gram of silver per second. The international Ohm calls in its description for a column of mercury 106.3 centimeters long and one square millimeter sectional area, and so forth. You can find the metric system firmly implanted along the whole electrical line.

In conclusion, let it be recalled that the French (metric) horsepower is equal to 735.75 watts, or 736 watts. The British horsepower is equal to 746 watts. The French horsepower is then slightly smaller than its British brother, in the proportion of 1.0136. The French is equal to 75 kilogrameters seconds, and the British is equal to 33,000 footpounds-minutes. The value of a kilogram being about 2.204 pounds, and the meter, 3.28 feet, we have again the proportion:

$$\frac{75 \text{ x } 60 \text{ x } 3.28 \text{ x } 2.204}{33,000} = \frac{32,531}{33,000}$$

$$= 1.0136 \text{ (in favor of British H.P.)}$$

same proportion as above.

That proportion 1.0136 is very small, yet confusing. Why not eliminate it by making the British or American horsepower 736 watts, or making the French horsepower 746 watts? To settle this question, and for the sake of having one universal rating of power, why not then abolish the horsepower as a unit of force, and adopt the Kilowatt which is the same all over the world?—CHARLES VIVIER.

—Some months before the war the French government officially abolished the term horsepower and made the standard of power the kilowatt, which it is in France today.—Editor.

British to Standardize 11 Tire Sizes

NEW YORK CITY, Feb. 20—In 1913 the tire committee of the Society of Motor Manufacturers and Traders, England, established standards for twenty-three different sizes of pneumatic tire rims. It is announced in *The Autocar* for February 6, 1915, that there is shortly to be a reduction in this number to ten, while eleven different sizes will be standardized for tires themselves. Of this range of tires two of the smaliest fit the same rim, but of the rest each has a rim to suit it. The suggested standards are as follows:

Millimeters	Inches	Millimeters	Inches
700 x 80	27.5 x 3.14	820 x 120	32.3 x 4.72
*700 x 85	27.5 x 3.34	880 x 120	34.6 x 4.72
*710 x 90	27.9 x 3.54	895 x 135	35.2 x 5.31
760 x 90	29.9 x 3.54	935 x 135	36.8 x 5.31
810 x 90	31.9 x 3.54	915 x 175	36.0 x 6.88
815 x 105	32.1 x 4.13		

*These two tires fit same rim.

The Autocar points out that these standards neglect the demand for tires of larger diameter for use in the rougher of the British colonies and states that the idea is to leave the larger sizes unstandardized for the present.

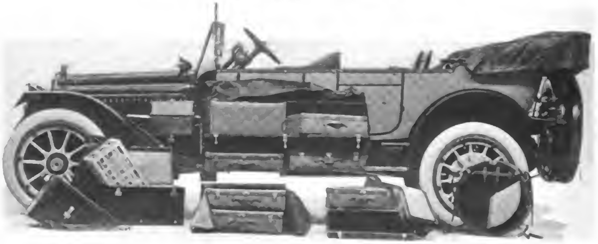
It is, of course, to be regretted that there is the fundamental difference between the British standards which will take effect throughout Europe and those in use here, which must necessarily lie between the inch and the millimeter, and it seems unlikely that American-made tires will fit the new standard rims unless made specially to conform to the S. M. M. and T. specifications. It might also be pointed out that it will at once become a drawback to an American car in Europe if it has not rims to take the standard tires, a matter which is worthy the serious attention of exporters.

Better Straining of Gasoline Possible

THE COMING of the vacuum will make the proper straining of gasoline even more important in some ways than it has been in the past. Not that dirt could very well choke up the vacuum tank, hut the latter contains certain valves that must work better clean than dirty. Every motorist has become accustomed to the idea that it is necessary to clean out the carbureter at frequent intervals, if trouble on the road is to be avoided, though there are a few who have fitted their cars with really efficient filters that trap all dirt and all water also. Such filters are not expensive, and are easy to attach in places where the filtering gauzes can be withdrawn for cleansing with great facility, and it is surprising that a much better filter than the average sort is not to be found on every automobile. A good filter is a petty detail doubtless, but it is one of those little things that go to make the "class" of a chassis, and with vacuum feed it could be mounted inside the hood in a most accessible place.

Solving the Baggage Problem

Clever Provision Being Made by Makers for Carrying Luggage, Tools and Spare Tires



Illustrating the amazing amount of space for carrying baggage which can be rendered available by the use of suitable trunks and suitcase carriers

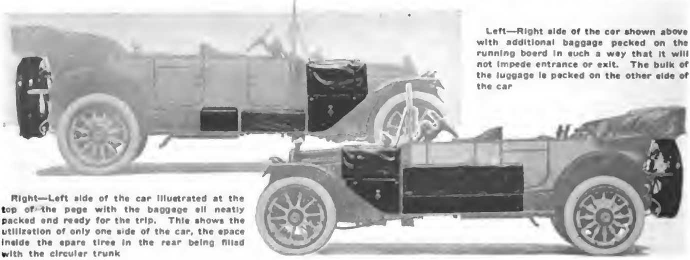
WITH an exceptional unanimity the automobile manufacturers of this country have turned their attention toward a logical solution of the baggage, tool, and tire carrying problems. There are two reasons for this sudden attention to a problem which is of the utmost interest to every owner who tours to any extent in his car. First, the development of the streamline form of body and the desire which went with this development to remove all interruptions from the contour of the body line has necessitated the inside storage of baggage and equipment. The second reason for this is the fact that automobile owners themselves have complained that they did not have sufficient room to store their luggage in a sightly and accessible manner.

Spare Tires at the Rear

This year we find that with few exceptions makers have endeavored to provide clean exterior lines in both the roadster and touring designs. Since both front doors are used with the left drive and center control, the spare tires which were in the way and of clumsy appearance when hung on the running board have been moved to the rear of the car. Here, upon a bracket rigidly fastened to the side members of the chassis frame, they are carried in a sightly manner without danger of putting uneven stresses on any part of the chassis construction.

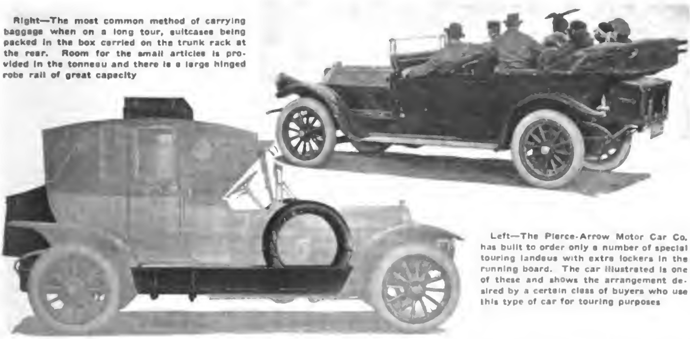
In the roadster there is a marked tendency toward a complete concealment of the spare tire. The streamline roadster provides a gradual terminating line as well as a smooth entrance. In carrying out this plan, the automobile designer has almost without exception adopted the rear deck construction. This offers the opportunity of making use of the compartment provided beneath the rear deck for baggage or tires. When the rear deck scheme was first adopted many put the tires on the top of the deck leaving the space beneath for parcels, etc. This arrangement, while good so far as space is concerned, interferes with the general streamline scheme that has become popular and more to coincide with this arrangement than to provide extra carrying space on the deck, the tires have come to be stored in the compartment provided.

In the S. A. E. ideal car, which has been discussed through-



Left—Right side of the car shown above with additional baggage packed on the running board in such a way that it will not impede entrance or exit. The bulk of the luggage is packed on the other side of the car

Right—Left side of the car illustrated at the top of the page with the baggage all neatly packed and ready for the trip. This shows the utilization of only one side of the car, the space inside the spare tires in the rear being filled with the circular trunk



Right—The most common method of carrying baggage when on a long tour, suitcases being packed in the box carried on the trunk rack at the rear. Room for the small articles is provided in the tonneau and there is a large hinged robe rail of great capacity

Left—The Pierce-Arrow Motor Car Co. has built to order only a number of special touring landaus with extra lockers in the running board. The car illustrated is one of these and shows the arrangement desired by a certain class of buyers who use this type of car for touring purposes

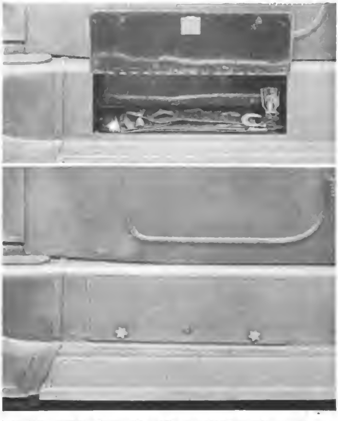
out the different sections of the society, and also at the general meeting, it seemed to be the balance of opinion that the ideal roadster should provide extra seats should they be in demand and at the same time should have these seats in such a position that they are invisible when not in use. This has been done on foreign cars by the use of a sliding panel which fits in the top of the deck, allowing seats of either one or two-passenger capacity to be folded out whenever desired. Of course, with this method of carrying extra seats the compartment beneath the deck is taken up and the extra tires must be carried in some other place. The most popular position is at the rear on a bracket similar to that used in the touring models.

Certain companies are carrying the battery box on one running board on their larger models and providing a large baggage-carrying box capable of holding three suit cases on the other board. This is only on large cars which have such a long wheelbase that when the box is placed on the running board against the front fender, there is no interference with entrance in either foredoor. One of the companies that employs this scheme makes a practice of carrying the box only on the larger model, while on the smaller models it adheres to the clean running board idea that is by far the more popular.

The increasing adoption of pressure gasoline feed, owing partly to the necessity of using a higher carbureter with the lower grade fuel used nowadays, has left the space beneath the front seat clear for other purposes than the tank. We find that in cars which formerly carried the tools under the rear seat, these have now been moved up to the position formerly occupied by the tank, while beneath the rear seat there is ample space for a number of small packages. This space has been further amplified by the fact that while the side curtains used to be carried under the rear seat they are now folded up and are carried within the top itself.

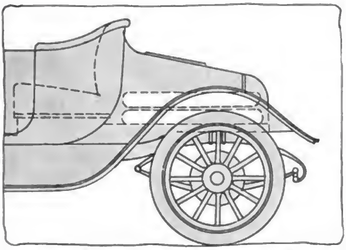
Special Extra Equipment

Many of the automobile manufacturers have made a study of the needs of owners who intend to use their cars for long distance touring. The conditions which such tourists meet are abnormal and it is of course not to be expected that the car driven about the city streets will ever be called upon to carry the amount of baggage necessary for a tour through wild and unsettled country. To be provided for the needs of the touring motorists two methods have been adopted by the American manufacturers. First, extra baggage-carrying equipment in the way of trunk racks, suitcase boxes, etc., especially adapted for the particular car under consideration are put on the market by the manufacturer of the car. The other scheme is to take advantage of certain parts of the car for the location of extra compartments. One of the favorite locations for these compartments is beneath the running board where a long, shallow space for small articles can be easily accommodated. Another method is to place behind the splash guard compartments for carrying the batteries or tools, leaving the room under the seat for other baggage.



Ingenious method of carrying tools in a compartment in the running board apron as used on the Stearns

Type of roadster in which the tools, baggage, etc., are carried in the compartment under the rear deck, while the spares are attached at the rear



Phantom view of roadster type using compartment under the rear deck for carrying spare tires, with room for other luggage

Many manufacturers specify among the extra equipment which they will furnish at extra cost, a trunk rack. These are of more or less similar design, generally of the type which has become familiar in the past few years. They fold up against the back of the body when not in use and are capable of supporting a great weight while passing over rough roads. There are a few concerns who take pride in the fact that they furnish these trunk racks as a part of the equipment of the car without extra cost.

Some Favor Using Running Board

It cannot be denied that the opinion of manufacturers differs to a large extent on whether or not the running board should be kept altogether clear and no doubt the voice of the sales manager has had an influential part in the adoption of the clean running-board in many automobile factories. With the roadster, the proposition is somewhat more simple than with the touring car. The chassis length of the two cars is generally the same and the needs of only two passengers have to be taken care of on a roadster body, whereas on the touring model from five to seven have to be accommodated. Naturally, this leaves more room for baggage on the roadster model. C. R. Green, chief engineer of the Speedwell Motor Car Co., states that he believes in carrying the extra luggage in a carrier on the running board. The Speedwell company provides such a carrier consisting of brackets for the attachment of straps at the option of the car owner. These straps and brackets are used to secure baggage such as suit cases and steamer trunks to the running-board. As the Speedwell car carries the tires in the rear they are prevented from carrying baggage in this position, but since the running boards are clear, except when baggage is carried, this scheme works very well.

The Nordyke & Marmon Co., maker of Marmon cars, is using on the larger car large boxes capable of carrying three or more suit cases. To balance this, the battery and tool box is placed on the opposite side in the same position. On the smaller model, where the streamline form is more closely adhered to, all the baggage is kept inside the car in compartments under the seats, and the running-boards are left clear.

Luggage Boot Is Good Practice

The H. H. Franklin Mfg. Co. is of the opinion that a luggage boot designed and constructed as a part of the body, placed in the rear of the passenger compartments is good practice and very frequently used abroad, but estimates that it would take 2 years of persistent argument to make this layout seem right to the average buyer or prospect because it would not look regular. "In fact," the Franklin officials say, "Nothing but the regular and commonplace in carrosserie design is safe practice in building American stock cars." In following this opinion the company has provided a strong trunk rack that will carry two trunks or several suit cases, attached to the rear of the car, as stock equipment.

L. E. Wilson, general sales manager of the Motor Car Mfg. Co., maker of the Pathfinder car, in speaking for the latter concern, holds a strong opinion on the baggage-carrying proposition. He says, "We feel that the clear running-board was a great mistake, and have changed back to larger boxes on the running-board. This allows us to provide three times the luggage space we have had previously while not interfering with passengers entering the doors." The Pathfinder car also has extra carrying space, located under the frame in the rear.

Baggage Rack Is Standard with Few

The Pierce-Arrow Motor Car Co., is another of the few concerns which include a baggage rack as standard equipment. Spare tires on the Pierce car are carried on the right running-board, leaving the rear end free for a touring trunk of large size when such is required. For the small articles, ample space is provided in the tonneau of the touring cars, and there is a large hinged robe rail of great capacity. This company has built a number of special touring landaus with extra lockers incorporated in the running-board. These are only to special order. One of these landaus, a 1911, 66-horsepower, is illustrated herewith. Such a car is, of course, only built to order but it shows the arrangement desired by a certain class of buyers who use cars of this type for touring.

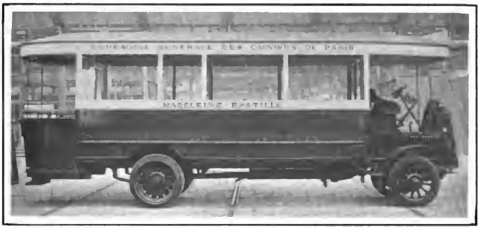
The Packard Motor Car Co. has approached the problem in a different way. Realizing that the user of a large car will very often want to make long trips and to carry considerable baggage with him, this concern has been offering for the past three years a special set of suit cases, trunks, etc., as baggage-carrying equipment which can be purchased in entire or single pieces as desired. This equipment is attached chiefly on the outside of the car on the trunk rack, running-boards or fenders, and in this way does not interfere with the roominess of the car, and does not cause the passengers in the tonneau any discomfort. Some of the units of these baggage-carrying outfits are illustrated on these pages.

These are special examples, however, and the average touring car of the 1915 season has very little carried on the running-board or in exterior positions. The use of the rear gasoline tank, with the tires swung in the rear, the tools under the front seat, the side curtains folding in the top, and the space beneath the rear seat clear for packages is the general layout of the five-passenger bodies. When the owner of such a car desires to take an extended tour he most often straps his extra luggage on the running-board in suit cases or similar devices. If the tank is under the cowl, leaving the rear a little more free, a baggage rack is often installed, or another scheme is to make use of the handy circular trunk which fits within the spare shoe. These are now made in many styles and are well waterproofed.

Sacrifice Stream Lines on Long Tours

Where the owner packs his baggage in suit cases, etc., on the running-board, he is often led to make a clumsy job and to find that the shaking of the car over a rough road will dislodge the articles. It is surprising the amount of strain that is put upon the fastening of baggage under the stresses of a pitching car. Nowhere could this be seen more plainly than in a recent Glidden Tour in which many private owners traveled the route with their baggage carried in various haphazard ways. All kinds of troubles were experienced from the start to the finish of the run by these owners, simply because a well-designed baggage-carrying space for this extra emergency had not been provided. For this reason many companies recommend that instead of depending on roughly tied bundles lying loosely in the tonneau that it is better on a long tour to sacrifice the streamline appearance of the car, and to make use of the running-board to carry suit cases in a suitable box.

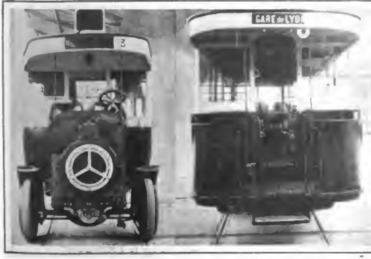
Better Bodies on Paris Motor Buses



Side view of one of the new type of Paris motor bus

PARIS, Jan. 22—Since the evening of the first day of August no motorbus has been seen on the streets of Paris. The government order to mobilize entailed the immediate withdrawal from public service of the 1,100 buses operated by the Paris General Omnibus Co. Passengers were bundled out with no more consideration than refuse and since then they have had to find other means of locomotion, which often meant the use of their legs. Immediately after the loss of its entire fleet of motorbuses—for when the war is over not many of them will be fit to enter public service—the bus company set to work to produce a new and improved model. After considerable difficulties it has been possible to build a certain number of these vehicles, but the public is unable to obtain the use of them, for no assurance can be obtained from the army that the vehicles will not be seized for military purposes if placed on the streets. Thus the peculiar situation has arisen of a public transport company having a set of vehicles almost ready for service, the public clamoring for their appearance, and the fear of the military preventing either party obtaining satisfaction:

Chassis features have undergone few changes in the new Paris motorbuses. They have four-cylinder overhead valve motors of 4.8-inch bore by 5.5-inch stroke, placed under the driver's feet, with shaft drive to bevel rear axle, without the use of torque or radius rods. A three-speed gearbox is fitted, but the gear ratios are of such a nature that practically all work can be done on second and third; the first is an emergency gear for starting on hills.



Front and rear of new Paris bus design

Body Features Refined

Body features have been refined. The single deck type is adhered to, with side windows much larger than formerly, those on the right hand side being fixed and those on the left movable. This is done in order to meet the objections of people against drafts. The roof is flatter, with no other projection than the service letter at the front. By means of an improved construction it has been possible to gain half a ton in weight and to increase the interior space without altering the external dimensions. Seating is transverse, the front half of the bus being for first-class passengers, with leather upholstered seats, and the rear portion being second class. These latter seats are not upholstered. There is a large rear platform for second-class passengers standing.

Electric Lighting Used

In place of the acetylene lighting set used on the old type buses, all the new models have electric lights from a dynamo driven off the motor. Direction boards do not project above the roof of the bus, as on the old type, but are inserted in the panel, just below the edge of the roof. They are illuminated by electricity at night. A circular type of splashguard is fitted to the wheels. This guard is a flat rubber ring practically the same diameter as the tire, attached to the outer face of this latter, with an interval of about 3-4 inch between tire and splasher. The guard is cheap and durable.

The Rostrum

Clutch Trouble Overcome by Adjustment

EDITOR THE AUTOMOBILE:—I have a 1914 Hudson 6-40, and would appreciate information regarding the following:

1—When you press the clutch pedal the disks do not disengage. That is, the gear grates in changing. I have washed out the clutch and renewed the same with half kerosene and half cylinder oil as per instructions, but it does not relieve it.

2—How can I take the tarnish off the lamps which are nickel plated?

Russellville, Ky. P. C. ANDREWS.

—To overcome the clutch trouble, remove the pin from the adjusting clevis connected to the clutch throw-out yoke. Unscrew this clevis two or three turns and put it back in its place. This will allow the clutch to be thrown out farther. It would be well to remember that in washing out the clutch with kerosene, it is necessary, after you have put the kerosene into the clutch, to start the motor and sit in the driver's seat working the clutch pedal in and out a couple of dozen times while the engine is running. Then stop the motor, drain the kerosene from the clutch and refill with the correct mixture of kerosene and cylinder oil, which should be thoroughly mixed before putting it into the clutch.

2—The most efficient way to remove tarnish is to take the nickel parts off and have them replated.

Energy Is Measured in Foot-Pounds

Editor THE AUTOMOBILE:—Will not a two-cycle four-cylinder motor give as great a torque and be as vibrationless, as smooth running, as noiseless and propel a car with as much smoothness as an eight-cylinder, four-cycle motor?

2—What is the difference between an ordinary motor and a high-speed motor?

3—What are the objections to steam cars?

4—How far will a gallon of gasoline run a steam car?

5—Does the White company make steam cars?

6—Do the cyclecars with 36 by 42-inch tread give satisfactory service?

7—How can I obtain instruments for charging storage bateries?

8—How strong a shock in pounds would the Gray & Davis and Westinghouse lighting and starting systems generate in high-tension wires? I mean by this, how hard a blow with a hammer would equal the shock of electricity in pounds? Would the shock from either system be hard enough to explode dynamite that required 40 pounds of pressure to explode it? I mean by high-tension wires, such wires as used in the transmission of current in a hydro-electric plant.

Cooper, N. C. SANFORD TEW.

—Insofar as a two-cycle, four-cylinder motor is concerned the number of explosions, and hence the theoretical torque, would be the same as for an eight-cylinder, four-cycle motor. Regarding the noiselessness, smooth running and absence of vibration, this would depend upon how the balancing elements were worked out.

2—Generally on a high-speed motor lighter parts, larger valves, and light-duty design are used to bring the horsepower curve to a higher r.p.m. before falling off. High-speed motors are designed to be used on a greater reduction than the lower speed, heavy-duty motors.

3—The biggest difficulty that the steam car has been confronted with is in the necessity for frequently renewing the water. This has been said to have been largely overcome in some of the late models. Another objection which has been urged against the steam car is in the necessity of carrying a pilot flame and having a somewhat more complicated control than the gasoline motor. Steam cars are still being made, however, and are operated by many who believe that the enormous torque which can be produced when necessary, the high speeds possible and the silence of operation meet their desires exactly.

4—The distance that a steam car may be operated on a gallon of gasoline is a variable factor, depending upon the weight of the car and many other varying features.

5—The White company no longer makes steam cars.

6—Cyclecars with narrow tread have been said to give satisfactory service, although the narrow tread has not seemed to appeal to public fancy.

7—The instruments necessary for charging storage batteries depend on the source of current, its voltage, etc., and these will have to be specified before details can be given as to what you need for a complete charging outfit.

8—It is impossible to measure electric shocks in pounds. The energy of a hammer or any other body which has been raised and let fall cannot be expressed in pounds simply, but only in foot-pounds, which is the product of the weight into the height through which the body falls, or the product of its weight divided by twice the acceleration due to gravity (32.16) into the square of the velocity in feet per second which it acquired after falling through the given height. If F is the weight of the body, M its mass, g the acceleration due to gravity, S the height of the fall and v the velocity at the end of the fall, the energy in the body just before striking is $1/2\ Mv^2$, or $\frac{Fv^2}{64.32}$. Either of the two expressions is commonly used to express the energy in a moving body. To transform electrical energy into foot-pounds, the equation that 1 kilowatt is equal to 44,236.5 foot-pounds per minute may be used as a basis. A kilowatt is 1,000 watts and therefore a watt is equal to 44.2365 foot-pounds per minute. A 6-volt current flowing at a rate of 1-6 ampere for a minute would thus exert an electrical energy that would be equal to 44.2365 foot-pounds per minute.

Gas and Air in Carbureters

Editor THE AUTOMOBILE:—When proportion of air to gas is referred to is it by weight or volume?

2—Does weight or volume of air flowing through circular apertures vary directly with the suction?

3—If not, what is the law governing the flow of each for varying suctions?

4—What is the suction below and above the throttle of the carbureter in touring cars at low speed (400 r.p.m.) at high speeds (1,500 r.p.m.)?

5—The ideal carbureter is, I understand, giving the same proportion of gas to air at all engine speeds and throttle openings. Will ideal carburetion work satisfactorily, or is a richer mixture required at low speeds, due to close throttling and lower compression and at high speeds due to lower volumetric efficiency than when at intermediate speeds?

6—What is the comparative volumetric efficiency of a four- and eight-cylinder engine of same displacement where the eight-cylinder engine has one carbureter?

Port Henry, N. Y. J. H. THOMAS.

—1—When air to gas is referred to in carbureter practice it is generally by volume and not by weight.

2—The weight varies directly as the volume in a gas, when the temperature and pressure are constant. Therefore, for a given velocity of gas through a circular aperture the weight and volume will vary directly as the area of the aperture or, when circular, as the square of its diameter always assuming that both the pressure and temperature are constant and neglecting for the moment the co-efficient of flow. The suction or difference in pressure between the cylinder and the carbureter will determine the velocity of the flow of gas and hence the weight or volume of air or gas flowing will bear a definite relation to this difference in pressure or suction. This ratio will not be a direct one, however, for the reason that the co-efficients of flow through circular orifices will vary for each pressure ratio. For example, for a circular aperture 1 centimeter or .394-inch in diameter, the co-efficient of flow for a ratio of pressure of 1.05 is given as .555; for a ratio of pressure of 2.15 the co-efficient is .788. To express it as a formula, the theoretical velocity in feet per second of flow of any fluid, liquid or gas through an orifice is $v = c\sqrt{2gh}$ where h is the head or height of the fluid in feet required to produce the pressure of the fluid or gas and g, gravity acceleration. For gases this formula only holds good for small differences of pressure on the two sides of the orifice. The reason for the varying co-efficient of flow c is that the friction of the orifice and the contraction of the vein, or flowing stream, have an effect on the velocity.

3—This is answered under question 2.

4—No definite figure can be given on this as it varies on every carbureter and every car.

5—Richer mixtures are generally required at low speeds for easy starting. This is taken care of in most carbureters by an air-choking, or strangling, device. At high speed it is possible to work with a great amount of air, due to the inherent ease of carburetion at higher speeds.

6—If the manifolds are properly designed there should be no difference.

Current Circuits in Bosch Coil

Editor THE AUTOMOBILE:—Will you kindly trace out the current circuits both in writing and diagram to this type of ignition which I have on my Winton six-cylinder car, namely, the Bosch Dual system, type Z R-6? Would like to know both the primary and secondary circuits, including internal coil windings, when running on either magneto or battery side.

In a simple diagram will you trace out the path of current when starting button on coil is pressed and the coil vibrator with its shower of sparks is brought into use?

How is the primary winding of the magneto affected by the so-called grounding wire? Please make clear by a simple diagram. Am inclosing a sample of a diagram of above mentioned system except that this is a four-cylinder, whereas mine is a six. This diagram is anything but understandable in my opinion.

Boston, Mass. A SUBSCRIBER.

—1—To understand the dual system it is first necessary to have a general idea of what this method of ignition accomplishes. In the first place there are two sources of current, the battery and the magneto. There is one distributer which is located on the magneto and one set of spark plugs. The high tension coils for the magneto and battery systems are independent of one another, that for the magneto being wound upon the armature and that for the battery being incorporated in the switch. Referring to Fig. 1 a general wiring diagram of the entire system is given. In Fig. 2 a detailed diagram is shown of the coil circuits.

The circuit with the coil in battery position is as follows:

When the push button pointer is at the designation run, the current starts from the battery, follows the arrow through the heavy winding, which is the primary, up to and across spring marked N, to contact marked B, out on wire that runs from the coil to the battery contact breaker on magneto. When the cam causes this contact breaker to close, the current, in following the path, causes the iron core to become magnetically saturated. When the cam causes the battery contact breaker to open, this magnetism dies away, and the reaction induces a current in the secondary winding. This secondary current is led out by wire No. 4 to the center point of the distributer, and from there to the plugs. At each opening of the battery contact breaker, a single spark is given to the plug.

When the button is turned to the designation "start", the following occurs:

Pin E will engage in slot F, and contacts C and C1, and

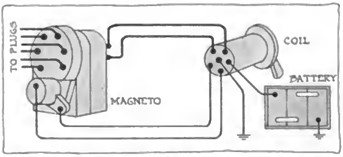


Fig. 1—Wiring diagram of the Bosch dual ZR-6 ignition system

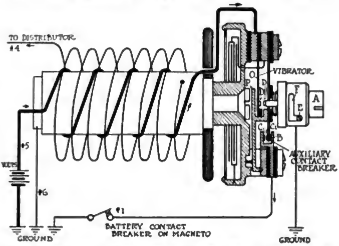


Fig. 2—Diagrammatic illustration of the coil used with the Bosch dual system

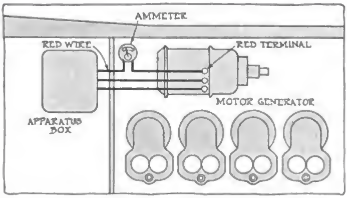


Fig. 3—Method of connecting an ammetar on a 1914 Cadillac

D and D1 are made. It is to be borne in mind that the upper part of the coil or the part that encloses this button is in metallic contact with the core, therefore, it is in electrical connection with the core, and the core is grounded by means of No. 6 wire. The circuit, under these conditions, is as follows:

Starting from the battery, current flows through the primary winding up and across spring N, across contacts C and C1, through wire to the battery contact breaker on magneto. Also, will go across the vibrator spring O, to and across contacts D and D1 to ground, by means of the metal part of button. This gives us a divided circuit, each of which are grounded. No action takes place until the cam causes the battery contact breaker to open, and when this occurs, one of the parallel circuits is removed, and the primary current then is from battery through the primary winding, across vibrator spring O, to platinum contacts D and D1, across metal part of button to ground. The core becomes magnetically saturated, and in doing so, attracts armature P which causes contacts D and D1 to separate, in this way open-circuiting the circuit, and this allows the vibrator P to return to its normal position, and again closes contacts D and D1, making the coil under these conditions, a vibrating one. The vibrating action induces a current in the secondary winding, which appears at the plugs in the nature of a vibrating spark. The vibrating and the single spark feature are both controlled by means of the battery contact breaker on the magneto.

The above takes in both the Run and the Start positions of the button.

Inasmuch as it is desirable to obtain a spark when the engine is shut down, regardless of whether the battery contact breaker on the magneto is open or closed, it can be obtained in the following manner:

If, for instance, the engine comes to rest in such a position that the battery contact breaker is closed, on pressing the button A, we cause contact points B and C1 to open and immediately close on C and C1. For each breaking of the circuit under these conditions, we obtain a single spark at the plug. Now if the engine comes to rest with the battery contact breaker on magneto open, on pressing button A, we first open contacts B and C, and a little further movement of the button causes contacts D and D1 to be made, which will complete the primary circuit and give us a vibrating spark.

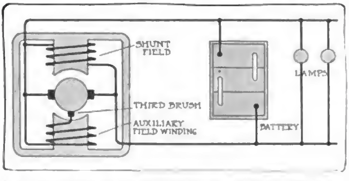


Fig. 4—Diagrammatic wiring schema to illustrate third brush regulation

Explanation of Third Brush Regulation

Editor The Automobile:—In The Automobile for January 21, page 145, an explanation of the third brush system of voltage regulation was given. On page 147 of the same issue is a wiring diagram of the same system. Will you kindly show the path the current takes in this system at both low and high speeds? In other words, account for the automatic voltage regulation.

2—Why the excessive voltage rise in the generator when the battery is removed and the car operated? I understand that this not only happens with the third brush system but with the ordinary shunt wound generators used, which when the battery is removed the shunt field remains undisturbed.

San Francisco, Cal. A. S.

—The two main brushes divide the coils of the armature into two halves, and the full pressure furnished exist between the two main brushes which are diametrically opposite one another. At the same time, smaller differences in e.m.f. exist between other segments of the commutator. This is exactly similar to what happens with a battery consisting of a number of cells connected together in series. Before a maximum pressure or e.m.f. depends upon the difference in pressure between the extreme terminals, but smalelr differences in pressure are available from any of the other terminals along the line.

When arranging an auxilliary brush to bear upon the commutator and connecting it to coils of wire wound around the field magnets, currents of varying strength because of varying pressure will be caused to flow through these coils surrounding the field. This current may supply the entire magnetic circuit or on the other hand it may neutralize the current of another coil. A diagram showing the circuits involved in this method of regulation is given in Fig. 4. As the speed of the armature increases, the magnetic lag causes a greater amount of current to flow through the auxiliary brush. This may be moved around the commutator and the current taken from it can be made to either assist the main coils at low speed or to oppose them at high speed.

2—The only influence that the removal of the battery could have on the circuit would be that which would be due to the removal of the counter e.m.f. and hence it would depend upon the method of regulation of the system to what degree this overloads the generator.

Connecting Ammeter on 1914 Cadillac

Editor The Automobile:—How can I connect an ammeter on a 1914 Cadillac? I wish to arrange it so it will show charging rate and discharge also, except when the starter is being used as the meter is not of sufficient capacity to indicate the current used by the starter.

Tarrytown, New York. R. E. Hopkins.

—After placing the ammeter on the dash disconnect the red wire from the generator and connect it on one side of the ammeter, then connect another new wire from the other post of the ammeter to the generator binding post from which the red wire was disconnected. If the ammeter indicates in the wrong direction reverse the wires on the ammeter studs. See Fig. 3.

Loose Pin Causes Knock

Editor The Automobile:—In my Chalmers 36 there is a slightly loose wristpin in one cylinder, although there is no apparent knocking until the motor is throttled down below

10 miles per hour. Even then the knocking is only slight. If this is very harmful to the motor, please give directions as to its remedy.

Detroit, Mich. JAMES C. FERRY.

—If you are sure that the knock is in the wristpin, it would be a good thing for you to repair it as the time required would be slight and it will eventually have to be done any way when wear progresses further. The wristpin on this model is fastened in the piston by a set screw and in the upper connecting-rod bearing there is a bronze bushing. The knock is caused by the wear either on the bronze bushing, the wristpin or both. You can reach the wristpin by loosening the lower connecting-rod bolts and pulling the piston through the bottom of the crankcase after having first removed this by draining out the oil and then taking out the bolts which hold it.

A cursory examination will tell you whether it is the pin, bushing or both which are worn. If it is the bushing the cost of a new one is $1.25, the pin costs $1 and the work of putting them in would generally cost you $0.75 an hour if done by a repairman.

It is possible that you will find the knock in the lower connecting-rod bearing instead of at the wristpin. To cure this it will be necessary to remove some of the shims and thereby tighten the bearing cap upon the bearing. Be careful not to get the bearing too tight when this is done. The method of taking down the motor and removing the shims is shown in Fig. 5.

Graphite Paint Prevents Rim Rust

Editor THE AUTOMOBILE:—Why is a six- or eight-cylinder car said to be better than a four?

2—A one-cylinder stationary motor generally has a governor. What acts as governor in a four-cylinder?

3—After wheels get rusty under the tires, what is the best thing to use to prevent recurrence of same.

4—When going into another state how long can one stay in that state before being compelled to take out a license?

Strong, Me. L. T. C.

—1—The gain claimed for an increased number of cylinders is that the torque is more continuous with the greater number of cylinders, due to the fact that the power strokes overlap one another to a greater degree. This is the basic reason generally advanced although a pro and con discussion would more than fill these pages.

2—A governor is not often used on a four-cylinder passenger-car motor because the speed is being constantly varied by the driver. On commercial vehicle motors governors are placed on the engines so that the trucks will not be operated at a speed high enough to cut down the life of the truck to a material extent.

3—The rust should be removed with emery cloth and the rims then painted with graphite.

4—This varies with different states and if you will mention the particular states to which you have reference this will be answered through The Rostrum. As a general rule, one can stay from 10 days to 2 weeks in another state without being compelled to take a license.

Determining the Brake Horsepower

Editor THE AUTOMOBILE:—Please explain and give formula for finding the brake horsepower of an electric or gasoline motor.

2—Does the size of the pulley make any difference?

3—In an article on starting and lighting systems in the January 28 issue of THE AUTOMOBILE mention was made of a certain starting motor having a stalling torque of 21-foot pounds. What does this mean?

Worcester, Mass. W. C. W.

—In finding the brake horsepower of a motor from readings on a braking system such as the Prony brake, the method that is followed is simply one of calculating the leverage exerted in multiplying it by the distance moved through. The brake primarily consists of a lever connected to a revolving shaft or pulley in such a manner that the friction induced between the surfaces in contact with it tends to rotate the arm along with the shaft. The tendency to rotate is counterbalanced by weights which are hung on the end of the lever. In order to measure the power for a given number of revolutions of the pulley it is only necessary to add weight to the scale pan until the friction induced just balances the weights and the lever or arm remains in a horizontal position while the shaft revolves at a constant speed. The formula then used is as follows: If P is equal to the power absorbed per minute, W the weight acting on the end of the arm, A the length of the arm in feet from the center of the shaft, V equals the velocity in feet per minute at a distance A if the arm were allowed to rotate at the speed of the shaft and N equals the r.p.m.; the horsepower is indicated by H.P., then, P equals W times V, or $2\pi ANW$.

Since H.P. equals WV divided by 33,000 we have H.P. equals $2\pi ANW$ divided by 33,000. If we allow the length of the arm A to be 33 divided by 2π the formula becomes simply H.P. equals N.W. divided by 1,000. 33 divided by 2π is very closely 5 feet 3 inches. The value often used in practice for the length of the arm.

2—The size of the pulley does make a difference because if the amount of the surface exposed to rubbing be too small the resulting friction will be very irregular, due to the great unit pressure and hence the probability of insufficient lubrication. The jaws often seize the pulley under such conditions, producing shocks and vibration of the arm, thus rendering it difficult to make accurate readings.

3—This means that a torque of 21 pounds installed at the end of a 1-foot arm or its equivalent would stall the motor.

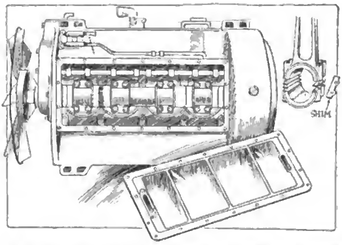


Fig. 5—Illustrating removal of Chalmers crankcase and showing location of connecting-rod shims

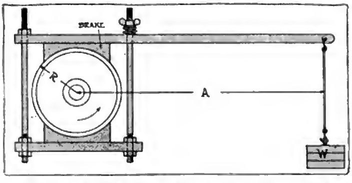


Fig. 6—Diagram of a Prony brake, showing the arrangement of the arm and weights

Measuring Automobile Efficiency

Car Performance Tested on the Block with Results That Can Be Reproduced on the Road

A Paper Presented to the Winter Meeting of the Society of Automobile Engineers

By A. B. Browne and E. H. Lockwood

MOTOR car testing should be conducted for two purposes: First—To determine the actual performance of the car as a whole.

Second—To determine the relative merits of the different components of the car.

The first is of practical interest to the sales department, the owner and the general public. Interest in the second is confined largely to the department of engineering. But from the engineer's standpoint much useless experimenting could be avoided by an accurate knowledge of the relative performance of different motor vehicles, as at present designed, before attempting any comparison of constructional details.

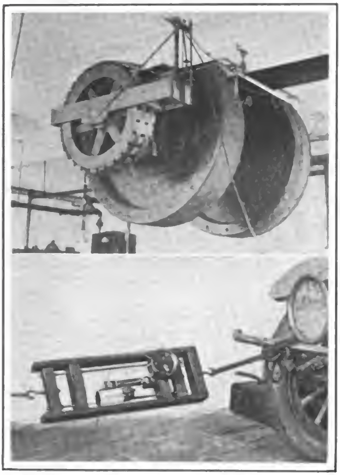
Road Testing

Any attempt at determining the actual performance of a car on the road is confronted with the problem of the uncontrollable variables introduced. Chief among these are the following:

(a) Condition of roadway.
(b) Force and direction of the wind.
(c) Frequent and uncertain change of gradients.

Among the instrumental difficulties encountered are:

(d) Lack of accurate apparatus for the determination of power, without a specially constructed car.
(e) Inability to measure fuel consumption accurately, owing to the vibration of the car body.



Upper—Brake and traction drums used for power measurements. The strap was originally made of steel band, lined with maple blocks. This has since been changed to a rope band giving smoother action

Lower—Recording dynamometer attached to the front of the car to determine the force required to pull it over the smooth, level floor of the laboratory

Proposed Tests of Performance

The purpose of this paper is to suggest a method of testing actual car performance on the block with results that can be reproduced on the road.

The method has been developed, and is at present employed, in the Mason Laboratory of Mechanical Engineering of the Sheffield Scientific School, Yale University.

An open stretch of level granolithic concrete floor about 75 feet long permits of towing tests to determine rolling resistance of the car at low speeds. For power tests the car is placed on traction drums, where appliances are at hand to measure power and pull at different speeds. The general appearance of the car entering the laboratory and undergoing various tests is shown in the illustrations.

Rolling Resistance

The first test is to determine the force required to pull the car slowly on the smooth level floor of the laboratory. This is accomplished by a recording dynamometer attached to the front of the car, as shown at the foot of the opposite column on this page. The recording elements consist of a Taber gas engine indicator, held by a suitable frame so that the pull compresses the spring, marking a line on the drum while the latter rotates under control of a clock.

Traction Drums

For power measurements the rear wheels are placed on drums whose top faces are level with the floor, while the front wheels remain at rest holding that end of the car in place. Connections are made from the rear axle to a permanent anchorage by chains and turnbuckles, affording adjustment to center the wheels on the drums and to resist forward movement when power is applied. The drums have faces 15 inches wide, treads centered 53 inches apart and the actual circumference of the drums is 17.51 feet; 301 revolutions of the drums are equal to 1 mile.

Power measurements are made on a Prony brake pulley, 36 inches diameter by 8 inches face, with a water-cooled rim, encircled by a rope brake. The brake is conveniently adjusted from the operating table on the main floor by a hand wheel and shaft telescoping over a worm shaft on the brake-arm.

The force required to rotate the traction drums with the brake strap removed is a necessary quantity. This has been determined approximately by placing a car exactly central on the drums and measuring the drawbar pull at different speeds by a spring balance. Thus far the friction force has been taken as 35 pounds, this being the average for cars of different weight, the change due to windage at various speeds having been too uncertain to be allowed for.

Drawbar Pull

The brake-arm, being equal to the radius of the traction drums, permits the direct determination of the drawbar pull from the brake load when the axle friction of the drums is included.

A Hopkins electric tachometer measures the speed of the traction drums, with the indicating dial mounted on the gauge board in front of the brake operator. This reads revolutions per minute of the traction drums correctly within 3 per cent. at all speeds. Accurate measurements of speed are made by a mechanical revolution counter, driven by linkage from the traction drums. This counter is located at the operating table beside the electric tachometer, where stop-watch observations are made simultaneously with the counter readings at beginning and end of each run.

Gasoline Measurement

The fuel supply is contained in a five-gallon tank placed on scales weighing to sixteenths of an ounce; thence led by a rubber tube to the gasoline inlet of the carbureter. The rubber tube is sufficiently flexible to allow accurate weighing while it is attached to the can. An electric connection through a mercury well operates when the beam drops, giving a bell signal for the start and end of each run. This device has proved very convenient and accurate. One half pound of gasoline is regularly used for light loads and one pound for larger loads, giving runs of from 2 to 6 minutes' duration.

A hand air-pump is attached to the weighing tank, giving the necessary pressure to supply fuel to the carbureter.

Since the car is at rest and only the motor, transmission and rear wheels are in motion, the radiator is deprived of the active air circulation found on the road. To prevent overheating the cylinders a supply of cooling water is added to the radiator, with the overflow of hot water running to waste. The temperature of the escaping water is recorded and is usually kept at 160 degrees Fahrenheit.

Methods of Testing

Rolling Resistance.—In calculating the rolling resistance the following steps are taken:

(a) The tires are pumped to 70 pounds pressure.

(b) The car is towed on level floor, in high gear, declutched, to obtain the pull by dynamometer.

(c) The projected area of the car body is measured, the width across the mud-guards and the height from the running-board to the top of the windshield (half up), or to the top of closed cars. Allowance is made for streamline bodies by reducing the area slightly.

If the slow pull is denoted by r, the projected area by a, and the speed in miles per hour by S, the rolling resistance is calculated by the formula.

$$R = r + .003\,a\,S^2.$$

This formula is assumed to give the rolling resistance, in pounds, of the car at various speeds on smooth, level road, comparable to the laboratory floor.

After the car is placed on the drums and the motor warmed up by a preliminary trial, the following runs are made, during which careful measurements are taken of the load on the scales, speed, gasoline weight, temperature of cooling water and time of run:

Run 1—At 5 miles per hour, or slowest speed possible, load equal to rolling resistance, level.

Run 2—At 10 miles per hour, load equal to rolling resistance, level.

Run 3—At 10 miles per hour, load maximum at that speed.

Run 4—At 20 miles per hour, level road resistance.

Run 5—At 20 miles per hour, maximum load.

Run 6—At 30 miles per hour, level road resistance.

Run 7—At 30 miles per hour maximum load.

Run 8—At 40 miles per hour, level road resistance.

Run 9—At 40 miles per hour, maximum load.

Measurements are made during the nine runs and recorded on suitable log sheets.

Diagram of Results

From these records calculations are made in two groups, one for level road conditions and one for maximum load, both over the entire range of speed covered. These calculations are made for

Actual speed, miles per hour S.

Maximum drawbar pull D.

Level road drawbar pull R.

Gasoline, reduced to miles per gallon, level road f.

Gasoline, reduced to miles per gallon, full load F.

Effective drawbar pull $(D - R) = P'$

Horsepower at rear tires, level road (calculated from R) Y.

Horsepower at rear tires, full load (calculated from D) Z.

These results are plotted and curves drawn as shown in Fig. 1.

The curves drawn through the plotted points are in three groups and are subject to a check. The drawbar curves for level road and full load conditions will intersect at the maximum speed of the car. The horsepower curves Y, Z will intersect at the same speed as given by the first-mentioned curves.

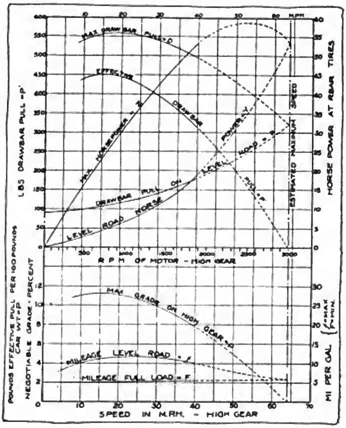


Fig. 1—Characteristic curves obtained from test in laboratory in accordance with the procedure described fully in the last paragraph in the opposite column

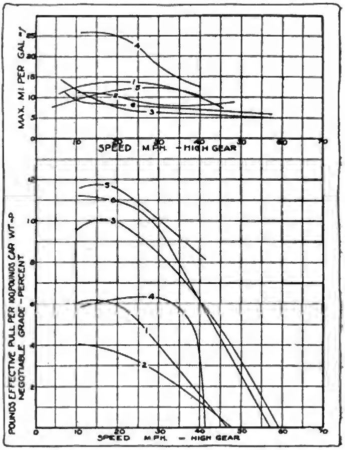


Fig. 2—Comparison of fuel consumption and power of six representative American cars. Cars Nos. 1 to 6 inc.

The acceleration factors are direct functions of the excess power of the car. By "excess power" is meant that total effort of the engine minus the total rolling resistance. In other words, it is the excess of pull of which the car is capable at any speed, exerted on the roadway, over and above the pull necessary to move the car against its own rolling resistance at the speed.

In brief, it is the net effective power of the car and may be conveniently expressed in pounds pull and designated P'. Concretely, P' is determined, as already noted, by subtracting the total rolling resistance from the maximum drawbar pull, as determined by the methods herein outlined.

Applicability to Road Conditions

The true value of this method of testing depends largely upon the fidelity with which its results can be duplicated on the road. To establish this, several road checks have been conducted by the authors under strictly test conditions and by others under ordinary conditions of driving. For example, a four-cylinder car was driven over a practically level course of 2,801 feet on Orange street, New Haven, a road surface corresponding closely to that of the laboratory floor. The throttle was set in various marked positions and the speed accurately noted by a stop-watch. Tests were duplicated with the car driven in both directions to eliminate the effect of any possible slight grade. The car was then placed on the test stand and the throttle opened to the same positions. The error per cent. ranged from .7 per cent. at 15 miles per hour to 5.33 per cent. at 20 miles per hour.

Disclosure of Characteristics

This method also shows to a surprising degree the relative action of certain parts of different cars. If the car is equipped with manual spark control and dash control of the carbureter, it also shows the relative skill of different drivers and the effect of these adjustments in the hands of the average user may be learned therefrom.

The test shows the performance of the car *as it is* at the moment of testing. What difference another make of tires, a different adjustment of the carbureter, or the change of any other feature would make, can be determined only by repetition of the test under the new conditions. For instance, in one case, the driver evidently desired his car to establish a reputation for fuel mileage. He was successful, but at the expense of speed, acceleration and hill-climbing ability.

Again, the rolling resistance of cars of approximately the same weight is found to vary markedly. Whether this is due to different tires or to internal friction can only be determined by substituting in one case or by more detailed investigation in the other.

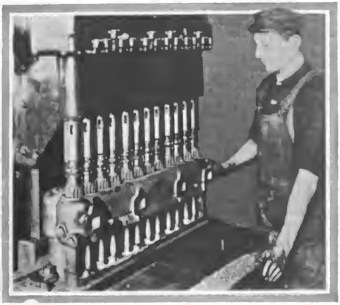
The authors cannot close without recording a protest against the use of horsepower as a unit for motor car rating. Whatever may be its value in the classification of motor car engines, it seems utterly inconsistent to apply it to the performance of a vehicle. *It is the pull or push* of the tire on the road that is effective in the propulsion of a car. Witness the utter absurdity of a steam car equipped with a 20-horsepower engine, outpacing and outclimbing gas cars, the engines of which will develop upwards of 80 horsepower on the block. The steam car accomplishes this by greater and more uniform torque (or turning moment) delivered to its rear wheels through the continued and overlapping admissions of high cylinder-pressures; therefore it is clearly this torque, or turning effort, that should be recognized, and its direct and easily measurable result, drawbar pull, seems to be the logical, final unit of such measurement.

Efficiency to Replace Horsepower

Professor W. C. Marshall said that he was glad to see that these tests were carried out with different degrees of throttle opening. "And heretofore," he said, "nearly all tests have been carried out with a wide open throttle for the purpose of securing all the power possible. He asked the authors why the tests were not carried out on the road and not only on a floor 75 feet in length. He also stated that the wind resistance is not considered and that to figure it out by calculating it out by projected area is very difficult as it is difficult to find the added projected area. Another point made by Professor Marshall was that the test should have been carried on beyond 40 miles per hour in order to get an accurate curve. He made a plea against the horsepower rating of a car and stated that the deficiency of the whole combination would be more practicable.

Henry Hess, of the Hess Steel Castings Co., said that the efficiency method was impossible because too many variables entered into the subject between the introduction of the fuel in the motor and the exertion of power at the rear wheels. A. B. Brown, replying to Professor Marshall's questions, said that the tests were not carried on on the road because it was found impossible to get accurate reading on drawbar pull on a road with its unequal surface. The reason that the tests were not carried out above the speed of 40 miles an hour because after that the risks of heating because of the lack of air blasts to cool the radiator. As it was, the speed of 40 miles per hour was accompanied by considerable risk in the overheating of the motor and it was sustained only long enough to enable readings to be taken which were practically accurate.

Studebaker Multiple-Spindle Reamers Cut Costs



Specially-designed Foot-Burt twelve-spindle reamers used in Studebaker plant; rough boring twelve valve cap holes and seats in a six-cylinder casting in one operation. The rough boring is done by the sides of the cutters, while the seats are machined by the bottoms of the cutters

IN the accompanying illustration, made from a photograph taken in the machine shops of the Studebaker Corp., Detroit, some good arguments for block casting of cylinders are brought out. Not only is this advantageous construction shown to be commendable from the standpoint of rapid production, but from that of accuracy as well.

On specially-designed Foot-Burt twelve-spindle reamers such as here seen, Studebaker rough bores the twelve valve cap holes and twelve valve seats required in a six-cylinder casting at a single operation. The sides of the cutters do the rough boring, while the bottoms machine the seats. It takes approximately 3 minutes for a block to be so treated. That is, twenty can be done in an hour, or 180 in a 9-hour day on one machine.

Not only is such machinery highly important in lowering production cost, but it obviously is a most accurate way of making the holes and seats exactly the same throughout the block.

Road Improvement Costs $204,000,000

WASHINGTON, D. C., Feb. 19—According to the report of the Joint Congressional Committee on Federal Aid to Good Roads, the annual expenditures for road improvement in the United States amount to about $204,000,000. Automobile license fees amount to about $8,000,000 annually. County, township and district road bonds were voted in 1913 to the amount of $50,635,000.

Efficiency in Milling and Boring

Dodge Miller Turns Out 18 Cylinder Blocks and Heads in 1 Hour—Buda Boring Machine Does Double Work

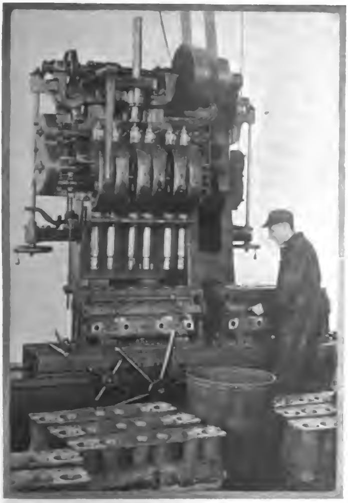
DODGE BROS. have just installed in their Detroit plant a milling machine which is unique for the amount of work it can turn out in an hour. With this special machine eighteen complete cylinder blocks and heads can be milled within the hour. Hitherto it has been universal practice to mill separately the cylinder head and the cylinder block but a considerable step in advance has been made by this machine which in one operation mills both the heads and blocks.

In carrying out the work, the method of mounting the parts to be milled may be seen from the illustration below. The cylinder heads are mounted in fixtures especially adapted to their shape located on each side of the loading table. Between the two sets of cylinder heads are two cylinder blocks held by the same fixture as that which holds the heads. Thus, nine fixtures hold eighteen sets of cylinder blocks and eighteen heads at one setting of the machine.

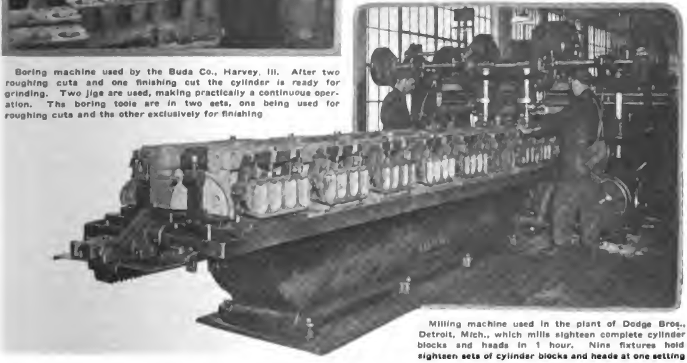
These eighteen sets of cylinders and heads are operated upon by four milling cutters, two of which are horizontal for the tops of the cylinder blocks and two vertical for work on the cylinder heads. The milling is a continuous operation. As soon as one pair of cylinder blocks and heads are completed, they are removed and replaced by the rough castings. In this way the table is never without a complete load at any time. When the table has run under the milling head the speed is reversed and with a full load the operation is repeated.

The milling table is 20 feet long, 42 inches wide and, exclusive of the fixtures, one loading of cylinders and cylinder heads weighs 4,000 pounds. The entire machine weighs 40,000 pounds and is driven by an individual motor.

The upper illustration shows a six-cylinder boring machine used in the plant of the Buda Co., Harvey, Ill. With this machine it is the practice to use two roughing cuts and one finishing cut. After these operations the cylinder is ready for grinding. The boring tools used are two sets of special Davis boring tools, one set being used for the roughing cuts and the second set for finishing exclusively. Two jigs are used, making practically a continuous operation, as the only time lost is that taken to index table, one jig being unloaded and loaded while the other jig is in operation. The accuracy obtained by this method is one of its chief recommendations.



Boring machine used by the Buda Co., Harvey, Ill. After two roughing cuts and one finishing cut the cylinder is ready for grinding. Two jigs are used, making practically a continuous operation. The boring tools are in two sets, one being used for roughing cuts and the other exclusively for finishing



Milling machine used in the plant of Dodge Bros., Detroit, Mich., which mills eighteen complete cylinder blocks and heads in 1 hour. Nine fixtures hold eighteen sets of cylinder blocks and heads at one setting

Universal Joint Losses Small

Tests Show That Under Ordinary Loads Efficiency Is Above 90 Per Cent—Installation Methods Are Important

From a Paper Presented Before the December Meeting of the American Society of Mechanical Engineers by P. F. Walker and W. J. Malcolmson

UNIVERSAL joints for use in automobiles are well above 90 per cent. efficient under all ordinary circumstances according to a paper presented by P. F. Walker and W. J. Malcolmson before the December meeting of the American Society of Mechanical Engineers.

The action of a set of two universal joints on an intermediate shaft between two parallel shafts was investigated by the authors of the paper under various angles and degrees of loads. Two sets of data were obtained, one in which the forks of the universal joints were in the same plane and the other in which the forks were at right angles to one another. It was found in all conditions that the installation with the forks at right angles to one another consumed the most power and set up vibrations due to a varying transmission of the motion between the shafts.

New Joints Used

In calculating the efficiency of the joints the conclusions were made applicable to a complete system including the two joints necessary to secure parallel operation of the main shafts. In case a knowledge of the efficiency of a single joint is desired it may be assumed without sensible error that the loss is one-half of the amount recorded for the double set and hence, the efficiency is that of the double set plus one-half the difference between that and 100 per cent. The efficiency is calculated directly from the derived values of friction loss. The curves of efficiency which are a result of the investigation are given in Fig. 1.

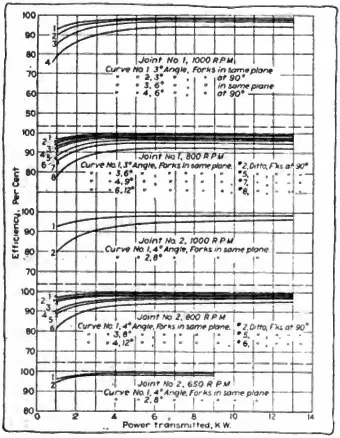


Fig. 1—Efficiency curves of universal joint set

An investigation of these curves shows that for universal joint sets that have the forks in the same plane the efficiency in transmitting loads of 8 kilowatts, the efficiency does not fall below 91 degrees at 800 r.p.m. for angles up as high as 12 degrees. Since the angle in a well-designed automobile, when under its designed load does not reach more than one-half this amount, the unimportance of universal joint losses is clearly brought out.

Load-Back Testing Method

The methods used by the investigators in arriving at their conclusion were such that the maximum accuracy was secured. The entire measurement in power and losses was electrical. Two electrical machines of the same size and design, one a motor and the other a generator, were connected mechanically and electrically to carry out the Puffer modification of the Kapp load-back method of testing. The motor drives the generator mechanically and the current generated by the generator is loaded back on the motor supply line. Thus, it is only necessary to replace the power lost represented by the difference in current between the original supply and that generated. Since the two machines are similar in construction, size and rating, and providing that there is no transmission loss, then the losses of one machine would be equal to half the total losses except for a small error due to the opposite effects on armature reaction in the two machines. Then, approximately, the power transmitted from the motor to the generator would be the load on the generator plus one-half of the total power supplied by the line. Thus, the transmission losses can be readily determined by a method of substitution. A wiring diagram of the electrical arrangement of the machinery of the test is given in Fig. 2.

Straight Line Losses Zero

The actual procedure in carrying out the test consisted in first running the machines with all shafts in the same straight line. The total losses of the system as a whole was then determined. Readings were then taken at different angular displacements of the shafts and similar runs were made for various speeds and loads. Experiments were made for both sets of joints, both with the forks on the intermediate shafts at 90 degrees to each other and with the forks in the same plane. Assuming, correctly, that the losses in the joint are zero for conditions of straight-line drive, with all other conditions remaining the same, the friction losses for a certain displacement of the intermediate shaft would be found by subtracting from the total losses of the system at that displacement the total losses under conditions of straight-line drive.

Owing to the vibration when the forks on the intermediate shafts were at 90 degrees to one another, it was found unsafe to operate the shafts at the larger angle. On plotting the curves with the forks so located, the data was found to be somewhat more unreliable than under the parallel condition and the exact nature of the curves could not be as accurately determined. It may be said in passing that many installations of universal joints are condemned for the sole reason that the engineers in charge have neglected to place the forks in parallel planes. A sample of the readings which were taken follows:

	Angle of Deflection	Line Current, Amperes	Generator Load, Amperes	Voltage, Volts	Load Transmitted, Watts	Loss, Watts
Forks in same plane..	0	58.1	100	65.8	7444	3820
	3	58.1	100	65.9	7450	3835
	6	58.6	100	66.3	7490	3880
Forks at 90 degrees..	0	58.0	100	66.2	7480	3835
	3	58.3	100	66.7	7530	3895
	6	60.9	100	65.7	7430	4000

The constancy in the efficiency fraction indicates a constant value of the coefficient of friction on the joint journals, since the bearing pressures are proportional to power transmitted when speed remains constant. Under conditions of service, questions of lubrication and protection from dust are important. A downward tendency in efficiency under large loads doubtless marks the point where bearing pressures on the journals make lubrication imperfect. The rocking motions of the journals tend to squeeze out the oil.

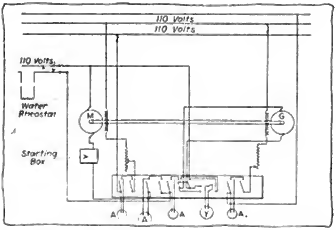


Fig. 2—Wiring diagram showing layout of testing apparatus

The Correct Propeller Shaft Layout

IN a paper presented to the S. A. E. for its winter meeting C. W. Spicer, Spicer Mfg. Co., Plainfield, N. J., gave the results from Messrs. Walker & Malcolmson's researches. He went on to state that the ideal layout is as shown in Fig. 4 because the total angularity is then divided between the two couplings. This is well enough so far as the mere joint efficiency is concerned but it introduces another factor which is worthy of consideration.

When a shaft is running at a steady speed, if it drives another shaft at an angle with it, the connection being by universal joint, then the second shaft runs at the same number of revolutions per minute, of course, but it does not run steadily. Owing to the relative motion of the inner and outer parts of the joint the driven shaft either lags behind the driver or hastens to catch it up,—so to speak; the actual effect being that the speed of revolution of the driven shaft varies from a maximum to a minimum each half revolution. To take an actual case, imagine a motor running steadily at 1,000 r.p.m. then if the propeller shaft is making an angle of ten degrees with the crankshaft, the speed of the propeller shaft will vary from a minimum of 984 r.p.m. up to a maximum of 1,016 r.p.m. If there is only one joint on the transmission then the bevel pinion will perforce vary likewise.

Now, if the gear ratio be four to one then the force applied to the road wheel will have four maxima and four minima per road wheel revolution, and its speed obviously cannot vary so rapidly it having the whole mass of the car to accelerate or decelerate for every change in its rotational velocity. Therefore the effect will be reversed; that is to say the mass of the car acting through the road wheel will force the bevel pinion to run steadily. As one shaft or the other *must* vary this means that the crankshaft and flywheel will have to do so, and this in turn means that the pressure on the teeth of the bevels will be continually fluctuating with a fairly rapid vibration.

Of course the flywheel is already fluctuating and, in an ordinary four-cylinder motor, it is usually assumed that the variation is in the nature of four per cent. This means that, if the average crankshaft movement is equivalent to 1,000 r.p.m., each explosion will accelerate the flywheel to a rate corresponding to 1,040 r.p.m. there being a slow falling off in velocity and then a rapid rise with the next explosion.

This variation with a four cylinder motor will be of twice the frequency of that variation due to the universal joint, but the two variations will "beat" like sound waves in certain chords, the effect being to produce a variation of slower pitch with a maximum of 1,056 and minimum of 944 r.p.m. for each crankshaft revolution.

Since pressures throughout the transmission are always subject to flywheel variation and to much larger variations due to inequalities in road surface it is obvious that the question is not of really prime importance, but the statement of the facts goes to prove that the use of a single universal joint may nullify the greater smoothness in running which always is obtainable by a slight increase in flywheel weight.

To remove all fluctuation due to universal joints it is only necessary to use two instead of one, keeping the axis of the bevel pinion shaft and the axis of the crankshaft always parallel, as shown in Fig. 3. Then one joint is being bent up while the other is being bent down, so to speak. When this is the case the propeller shaft runs irregularly, but the second joint being bent the opposite way to the first cancels out the variation.

This may seem a very small matter indeed, but the wonderful smoothness of the modern car has only been obtained by attention to multitudes of such insignificant details. In the setting shown in illustration, Fig. 4, the second joint simply doubles any variation due to the first joint. It would therefore, from the point of view of steadiness, be better to use the longest possible torque rod, if not even a parallel motion link as has been done on some cars.

Since it is only fair to look at the other side of the question Mr. Spicer is incontestable in that his design will cause less loss of power in the joints themselves but since, as he most ably shows, this loss is in no case worth considering it being so very small, it seems unlikely that the gain in efficiency obtained by his arrangement is worth its complementary drawback.

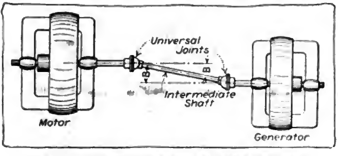


Fig. 3—Mechanical arrangement of testing apparatus

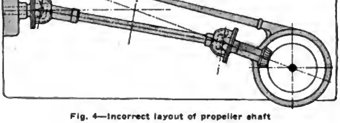
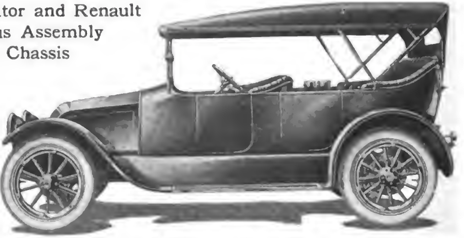


Fig. 4—Incorrect layout of propeller shaft

Stewart Six—A New Chassis

New Car Has Dash Radiator and Renault Type Hood—Ingenious Assembly System Feature of Chassis



The new six-cylinder Stewart touring car. Radiator is mounted at dash

As an example of to how great an extent it is possible to introduce individuality when designing a chassis to be made up chiefly from well known units, the new Stewart six made by the Stewart Motor Corp., Buffalo, N. Y., must take a prominent place. The company has been making trucks for several years and has a number upon the road but it is only during the last 2 weeks that it has entered the passenger car field. It is not the idea to scheme for a large output, but rather to employ a motor, gearset and axle of high quality and keep the price of the complete car down to a moderate figure by eliminating all unnecessary work in the process of assembly.

Figuring on the basis that the expensive part of an automobile is the labor, they have aimed to make one human operation cover as wide a range as possible while the parts that have to be handled are in no case heavy or awkward, with the solitary exception of the motor itself. Since this cannot be made a lighter part the task of handling it is rendered as easy as possible by the method employed for placing it in the frame, and there are no other parts whatever that require alignment with the power plant.

The Power Plant

The motor is a six-cylinder Continental rated at 44 horsepower with bore and stroke 3 1-2 by 5 inches, giving a displacement volume of 288.6 cubic inches, there is nothing abnormal in the engine save that the water header is reversed in direction on account of the radiator position. For starting and lighting the Westinghouse two-unit system is used, the motor having the usual flywheel drive. The carbureter is a Zenith, the hot air supply being taken through a pipe passing across the top of the cylinder jacket, and gasoline feed is by Stewart vacuum apparatus. Of course, the Westinghouse outfit takes care of the ignition, and there is no spark lever, the only motor control consisting of a pedal accelerator and a hand lever on the steering wheel for setting the idling position.

A three-speed Brown-Lipe gearset is bolted to the motor by a bell housing, and this carries the Raybestos and steel multiple-disk clutch, but the pedal gear is not attached to the unit power plant, being a separate assembly unit. Both the axles are Timken, the rear drive being through spiral bevels, and the wheel hubs are furnished with Timken taper roller bearings throughout.

Assembly System for Motor

There are three points of attachment for the unit power plant in the frame, a swiveling bracket at the front and two solid aluminum arms just forward of the flywheel. The latter rest on small brackets riveted to the frame, but the swivel housing is secured to the front cross rail of the frame by a couple of bolts. This cross rail is itself detachable, since separate corner plates are riveted to the sills and the cross rail attached thereto by a couple of bolts at each end. To insert the power plant in the frame the front cross rail is bolted to the motor and the unit then slung into place. As soon as the cross rail is secured the rear supporting arms of the crankcase take up their natural position on the brackets, and it is then only necessary to drill the four bolt holes in the frame to suit those already in the motor bearers. Similarly, should it be at any time desired to remove the motor, it can be taken out very easily without disturbing any other part, by removing the front cross rail and then pulling the power plant forward. It is not even necessary to interfere with the radiator, since the gear shift lever comes away with the lid of the transmission, and the hand brake lever is not attached to the power plant.

There is a short shaft with a single, wide bracket support, carrying both clutch and brake pedals and the throttle pedal also. This is secured to the middle cross rail of the frame by a couple of bolts only and, when attached, it remains only to connect the brake rod and the right pedal and a short drag link between the clutch pedal and the clutch operating lever that projects from the transmission. It will be seen that there is no need for alignment of any kind. The hand brake lever is made up with its quadrant and ratchet on a separate bracket also bolted to the middle cross rail.

Cantilever Springs Have Special Brackets

The attachment of the 50-inch cantilever springs, made by the Detroit Steel Products Co., is such that there is no twisting stress imposed upon the side rails of the frame, and the springs are in the best possible condition for transmitting the drive. The first operation in this assembly is to rivet a couple of brackets to the side rails, and these are the only parts of the chassis that need to be in line. A stout tube passing right across the frame is secured in these brackets with the ends projecting on either side of the frame, and the spring center clips are slid on the ends of the tube, being retained by nuts on the extreme ends thereof. Thus the spring clips are free to rock on the tube ends, but the cross tube ties the springs together and equalizes stresses on either side.

Further, the cross tube is not only used as a spring mounting, but is also the base for the brake assembly and carries the swinging bracket of the pressed steel torque stay. For mounting the compensating mechanism of the brakes there are three brackets of a three-armed form: each has a detachable cap on one arm and this part is drilled out to suit the cross tube. The bracket which has the middle position on the tube has each of the other two arms drilled out to suit the cross rods to which the brake operating levers are attached, and the two end brackets are drilled similarly, only the drill is not run right through, so the end brackets keep the rods in place. There is no compensation for the hand brake, since the cross rod is solid and has three levers, one linked to the hand lever and the other two to the expanding brakes. For the pedal brake the cross rod is in two parts, the junction being located inside the midmost bracket and a compensating beam introduced in the pull link from the pedal. Self-lubricating bushings are used for the bearings throughout this assembly.

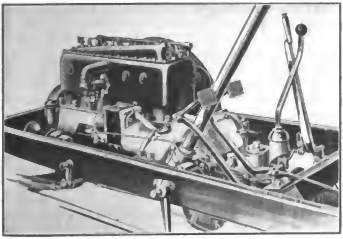
The steering gear is attached to the frame by a pair of bolts, and is independent of the power plant, while the bracket is such that the angle of rake is fixed by the toeboard bracket which means that it would be possible to alter the rake to suit special body styles or even individuals, though a regular adjustment is not provided.

Add to the steering gear the brackets for the front springs and for the front ends of the cantilevers, and we have itemized every frame attachment for chassis erection.

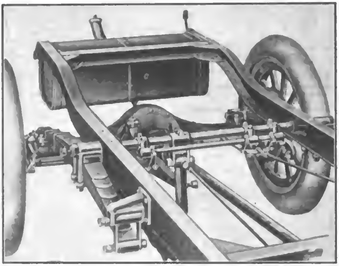
The radiator is made up in unit with the cowl and is a Fedder honeycomb with a fan behind it mounted on a bracket extending upward from the clutch case cover. This fan is belt driven from a pulley running in a swinging bracket located upon a pin projecting rearwards from the bell-housing portion of the transmission. On the same spindle as this pulley is a fiber-faced wheel that is kept bearing against the flywheel of the motor by a light spring, so providing the drive for the fan belt. The latter is adjustable for tension by a slide on the fan supporting attachment. All air is driven down beneath the footboards and there is sufficient gap behind the radiator to give insulation from the temperature of the latter, a point of some importance in summer with a dashboard radiator location.

Aluminum Body and High-Class Fittings

Money has not been spared on the body, which is designed to give ample room for its seven passengers, and the detail is cared for especially well. For example, the additional seats fold away into the back of the front seat, where they are concealed completely, there is an exhaust-heated radiator to increase the comfort of the tonneau passengers, and the upholstery is deeply padded. Owing to the great width of the seats there is plenty of free space between the driver and front passenger, which can accommodate a child if desired, or there is an optional body style with divided front seats. All the gauges and instruments are located in the dash in positions convenient for the driver, and the side lights are imbedded in the cowl. The wiring is arranged with all fuses hinged into the cowl board and junction boxes are placed in accessible positions.



Six-cylinder Continental block motor, with 3 1-2-inch bore and 5-inch stroke and rated at 44 horsepower, which is used in the Stewart six. Note clean design and accessibility



Rear construction of the Stewart six. Note special brackets for attachment of cantilever springs. The cross tube ties the springs together and equalizes stresses on either side

Turning to the specification details other than those mentioned; the wheelbase is 127 inches and the tread 56. Tires are 34 by 4½ inches with nonskid in the rear and plain tread in front. Firestone demountable rims are furnished with one extra rim. Gear ratios are 4.45, 7.55 and 10.58 to 1 respectively. The price fully equipped is $1,950.

During a short run in the car through the now somewhat rough streets of Buffalo the cantilever springs gave great ease in taking street car crossings some 6 or 8 inches below the road level, while there was very little roll on corners. The body, doubtless due to the aluminum construction, was free from any suggestion of drumming noise and all portions of the control operated smoothly.

United Trucks Appear at Grand Rapids

GRAND RAPIDS, MICH., Feb. 20—The annual automobile show which came to a close today was the best attended in the history of local shows. There were on display thirty-six different makes of passenger cars and eight of commercial vehicles. The exhibitors totaled sixty of which thirty-one showed motor cars.

There was shown for the first time the line of trucks of the United Motor Truck Co., a new local concern. The three models made are a 1 1-2-, a 3- and a 5-ton truck. All have Continental four-cylinder power plants with the cylinders cast in pairs. On the smaller truck the bore and stroke are 4 1-8 by 5 1-4 and on the two other models 4 1-2 by 5 1-2. All have Stromberg carbureters, Eisemann ignition, multiple disk clutches, Mayo honeycomb radiators, splash lubrication, Gemmer steering gears, left drive and center control, Timken front and Timken-David Brown floating rear axles.

The worm-driven model, the 1 1-2-ton type, sells at $2,150. The 3-ton truck with chain drive is sold at $2,750 and with worm-drive at $2,950. The 5-ton model is listed at $3,400 with chain-drive.

The wheelbase of the smaller truck is 148 inches. The other two models have a standard wheelbase of 144 inches, but at an additional cost of $50 a 120- or a 168-inch chassis is furnished, or a 192- or 216-inch chassis if $100 is added.

The tires on the 1 1-2-ton truck are 34 by 4 front and 36 by 4 dual rear; on the 3-ton model 36 by 5 front and 36 by 5 dual rear and on the 5-ton truck 36 by 5 front and 40 by 6 dual rear.

The AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, February 25, 1915 No. 8

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Reforming the Farmer

WITH grain crops worth approximately $2,000,000,000 grown in eight states in the Mississippi valley this year, and with even better crop prospects in these states for next season, the value of the farmer as a consuming factor in automobiles for the present season and also next season is apparent. In some of these states the farmer purchased over 60 per cent. of the cars marketed in 1914. In 1915 he will, according to conservative estimates, purchase upwards of 70 per cent. of those sold.

In several of these states the farmer is buying more expensive cars as year succeeds year. After all he is a human being, susceptible to the same likes and dislikes as his city brother. He started with the cheapest car, but today many are buying more expensive machines. The farmer is an experienced buyer of machinery. From the day he settled on his land he has been a purchaser of plows, harrows, disks, binders, wagons, gasoline engines and other necessities. He has learned how to care for machines and how they are abused. To him the automobile is another machine. He wants to buy it as he bought his binder, some cash down and the rest on notes. He wants to run it as he runs other machines, in fact, the car is merely an addition to his machinery equipment. He is a careful operator, one who frequently inspects to avoid breakdowns. There is one aspect of the car he has not realized, that is occasional washing; at present he uses the car as he does his binder, never washed from purchase until finally laid aside.

The more aggressive automobile dealers are reforming the farmer in some few respects. They are changing him from a credit buyer to a cash buyer in a few sections. Instead of carrying his repair and gasoline accounts for months they are getting him to pay in advance in a few sections and in other sections at time of delivery. Thus does the automobile give promise of working a good for the farmer that was deemed impossible.

A Chicago Section?

IN ratio of population Chicago has never been a strong center for the manufacture of automobiles or automobile accessories, with the possible exception of the carbureter field, in which the city has been well represented for years. The number of automobile engineers per unit of population is considerably lower than in Detroit, Indianapolis, Cleveland or perhaps New York. In spite of this handicap why not a Chicago section of the Society of Automobile Engineers?

The second metropolitan city of the land should be represented in the automobile industry by such a section. There are enough engineers within the confines of the Windy City to make a section possible; and then it can draw on Kenosha, Racine and Milwaukee, Moline, Rock Island and Davenport. Should monthly meetings prove too burdensome then quarterly ones could be handled to advantage.

Chicago has two enterprising technical schools, which draw from the enormous agricultural territory of the Mississippi valley. Many of the students could be interested in the work of such a section. There is a possibility for a large student attendance. The city by virtue of these institutions is well qualified to conduct technical tests, in fact, there is not any reason why Chicago should not launch its section before the end of the present year.

The Jitney

EASTWARD is coming the jitney movement. Conceived beyond the Rockies, it is invading city after city, and in the wake of each invasion grows up a stronger spirit in the masses in favor of the automobile. Already the jitney has written its story in the hearts of thousands of working people; a story which tells of quicker transportation to the office than was possible with established means of transportation. But the jitney has gone further. It has carried tens of thousands, who never expected to enjoy the latest means of locomotion, the automobile. These people have experienced what others have talked of, namely, that the automobile is not so much a luxury as a necessity. Never before did these masses believe it; today they are convinced of it. A great missionary movement for greater individual efficiency has already been stimulated; already have many experienced the difference between going to work in a poorly ventilated trolley car and riding in the open air on a quiet motor car. The jitney is a body stimulus, it is a mental stimulus.

H. Ward Leonard Dies Suddenly

Prominent Inventor Had Done Much for Automobile, Railway and Other Industries in the Electrical Field

The Late H. Ward Leonard

NEW YORK CITY, Feb. 19—H. Ward Leonard, electrical engineer and founder of the Ward Leonard Mfg. Co., Bronxville, N. Y., died suddenly of apoplexy last night at the Hotel Astor. Mr. Leonard, who was a director of the American Institute of Electrical Engineers, was at the hotel with his sister attending the banquet of the institute when he was suddenly stricken and died 15 minutes later in one of the reception parlors of the hotel.

Mr. Leonard was 54 years old and his death brings to an untimely close a career which was of the greatest value to the automobile and other industries covered by the wide field of his electrical inventions. For years he has been recognized as one of the country's foremost authorities on electrical apparatus, especially that covering different forms of control mechanism. In his work he has been closely associated with Thomas Edison and Sir Oliver Lodge. It is stated that he had over 100 patents actually in commercial use at the time of his death.

During the past few years Mr. Leonard has not taken an interest in the details of the Ward Leonard company but has concentrated his attention on the business created by his various patents. He was a strong figure in the patent world and the victor in many important litigations. His patent activities, however, did not prevent him from acting as consulting engineer for his company and he was always accessible for consultation regarding the important affairs of the business.

Mr. Leonard first became interested in the automobile industry in 1895 during a visit to France. On his return from this country he had shipped to him fifty foreign motors which he incorporated in a car of his own manufactured at the Bronxville plant. That these cars were successful is shown by their endurance runs won during the years of 1898 and 1899, but in 1901 the project was abandoned, owing to difficulties in securing material. Mr. Leonard never ceased to have a keen interest in the development of the automobile, however, and his opportunity to make his electrical genius of great use came with the introduction of electric starting and lighting. The Ward Leonard system of battery charging and regulation in which the basic idea has been to maintain a constant amperage output has been of special value.

Mr. Leonard came into prominence as an electrical engineer at the age of 23, a year after his graduation from the Massachusetts Institute of Technology, when he was made a member of Mr. Edison's staff of four engineers engaged in the Edison Central Station system. At 26 he was made general superintendent of the Western Electric Light Co., Chicago. In 1889 Mr. Leonard was made general manager of the combined Edison interests of the United States and Canada. Two years later he resigned this position to found a company of his own, the Ward Leonard Mfg. Co.

In this factory the manufacture of control systems for electric lighting and starting systems, for which the company is best known to American automobile manufacturing interests, is only a small part of the business. A broad field is covered based largely upon the inventions of the founder which embrace electric lighting systems for automobiles and railroad trains, electric distributing systems, electrically driven reversible rolling mills, electric mine hoists, locomotives, elevators, gasoline-electric transmission systems and various other automatic electrical control features.

The first inventive work of importance engaged in by Mr. Leonard was in connection with an electric lighting system for railway cars. In 1888 he put this system into actual use by installing it upon two trains running between Chicago and Minneapolis. This system with but few changes is still in use and has been installed on railroads throughout the world.

In 1891, he completed what was probably the most important invention of his life. This is the Ward Leonard system of speed control. By this system it is possible to secure a smooth speed control; to almost instantly reverse the motor speed from maximum in one direction to maximum in the opposite direction while at the same time minimizing the energy required to perform the work. The Otis Elevator Co. adopted this for use on its elevators and the battleship Brooklyn was fitted with it for turret control in the Spanish-American war. This worked out so well that it has been practically universally adopted by the U. S. Navy.

Mr. Leonard has been an important contributor to papers devoted to electrical and railway engineering. He has frequently delivered papers before the American Institute of Electrical Engineers, particularly on railroad work. For electrical research work the Franklin Institute of Philadelphia in 1903 conferred upon him the John Scott medal. He was also awarded the Gold Medal at the Paris Exposition in 1900 and at the St. Louis Exposition in 1904.

One of the connections he prized most highly was his membership in the Inventors' Guild. The society is fashioned somewhat after the French Academy and none but men who have become noted through important inventive achievement are eligible. Mr. Leonard has been president of the society.

He has been a vice-president and also a manager of the American Institute of Electrical Engineers which he joined in 1887. He was a life member of that organization. He was also a member of several social organizations including the Union League Club, of New York, the Inventors League, the Engineers Club, the Clove Valley Rod and Gun Club, New York Electrical Society, the Technology Club of New York and the Scarsdale Golf Club. He was a director of the Mount Morris Bank of New York, president of the Sagamore Development Co. and has been president of the village of Bronxville, a beautiful suburb of New York City where he resided in Lawrence Park.

Mr. Leonard was born in Cincinnati, O., February 8, 1861. He is the descendant of a long line of Americans, three of his forebears having lived in this country prior to 1639. These were John Alden, Solomon Leonard and William Ward. John Alden is the one of whom Longfellow speaks so frequently in his poems of the times of Miles Standish. Alden, as is well known, came to this country in the Mayflower. Solomon Leonard came to this country in 1629 and in 1642 along with John Alden and Miles Standish founded Duxbury, the first settlement out of Plymouth. William Ward came to America in 1639.

One of Mr. Leonard's ancestors founded the steel industry of America in Taunton, Mass., in 1651 and his great-great grandfather was General Artemus Ward, who was made commander in chief of the forces raised by Massachusetts for the defense of the colonies. When the troops for all the thirteen colonies were merged under General Washington, Artemus Ward was made second in command. He was the first major general in the American Army.

Mr. Leonard, in spite of his great business activity, found time to devote himself to his wife and his beautiful suburban home. He married Miss Carolyn Good of New York City in 1895. Both were fond of entertaining and both enjoyed outdoor sports and it was their custom to make an annual fishing and hunting visit to Camp Chippewa, their summer home at Pointe au Baril, Georgian Bay, Ont.

Hewitt Bill Would Double New York Fees—Other Bills Before State Legislature

NEW YORK CITY, Feb. 18—If provisions of a bill introduced in the New York legislature by Senator Hewitt of Cayuga are enacted into law, the registration fees for passenger vehicles will be doubled and in addition a heavy burden will be placed on the operators of commercial vehicles and passenger buses. Here are the fees advocated by the Hewitt measure as compared with those at present in force:

Passenger Cars

Horsepower Rating	Hewitt	Horsepower Rating	Present
25 or less	$10	25 or less	$5
25 to 40	20	25 to 35	10
40 to 50	30	35 to 50	15
50 and over	50	50 and over	25
Electric	10	Electric	5

Commercial Vehicles

25 to 40 and weighing over 4,000 lbs.	$30	For both gasoline and electric cars, irrespective of horsepower rating or capacity	$5
Electric weighing over 4,000 lbs.	$20		
$5 additional for each passenger-carrying capacity and $25 additional for each ton of capacity in baggage or freight for motor vehicle operated as bus.			

In addition to this measure, which is probably the most drastic of all those at present in the legislative mill, there are some nineteen others, the most important of which are as follows:

Assembly bill No. 19 introduced by Kramer, which provides that all provisions now applying to chauffeurs be made applicable to every operator of a motor vehicle; that is, license examination, badge, etc.

Senate bill No. 180 introduced by Simpson, which amends the Penal law in relation to injuring or removing road signs or danger signs on the highway and makes the displaying of advertising matter on the highway a misdemeanor, neither offense being punishable by a fine of not less than $5 nor more than $25 or by imprisonment for not more than ten days or by both.

Senate bill No. 332, introduced by Cristman, which would transfer to the state commissioner of highways the power and duties of the secretary of state in relation to motor vehicles.

Assembly bill No. 47, introduced by Flamman, which provides that every operator of a motor vehicle must pass an examination and carry out all the provisions now applicable to chauffeurs and obtain a license at a cost of $2; no person under 18 years shall be licensed.

Assembly bill No. 575, introduced by Pratt, which also provides for the transfer of the duties of the secretary of state in relation to motor vehicles to the state highway commission.

Wants to Change Arizona License Law

PHOENIX, ARIZ., Feb. 19—Secretary of State Sidney P. Osborn, in his annual report, takes issue with the Arizona tax commissioners, who made the assertion in their report that the registration fees for motor vehicles in this state are too low.

In arriving at their conclusion the commissioners took the California law as a basis. There the registration fee for machines under 25 horsepower is $10, and in Arizona it is $5. Osborn draws attention to the fact that California has issued $18,000,000 worth of bonds for a state highway system, and states that the Golden State motorists receive far more for their money than do the automobilists of Arizona. "The depreciation of a car in this state, because of the wear and tear occasioned by the miserable roads, is conservatively estimated to be 50 per cent. greater than in California, but under the present circumstances to raise the license fee would practically amount to extortion and would be unwise in the extreme," he says.

Osborn urges that the S. A. E. rating be abandoned and some more equitable system adopted for determining the horsepower of a car. Another recommendation is that the upper half of the glass in all automobile headlights be frosted.

At present the secretary is required to issue a chauffeur's license to anyone who can pay $5. He recommends that this license be abolished or that applicants be compelled to pass a practical and technical examination. He asks the Legislature to grant him authority to revoke a chauffeur's license for cause.

INDIANAPOLIS, IND., Feb. 19—A bill taking the collection of the state motor tax out of the hands of the secretary of state and placing it in the hands of the county auditors has been passed by the House of the Indiana legislature and it is believed it will become a law. The purpose is to reduce the cost of collection. The state is to sell the license tags to the counties at cost. The county auditors are to be permitted to charge a notary fee of 25 cents for issuing licenses in each instance. All beyond the cost of the tags is to be retained by the counties for good roads work. It now costs the state $40,000 annually to collect the license fees and all above this cost goes to the counties for good roads.

AUGUSTA, ME., Feb. 20—If the bill introduced in the State Senate this week becomes a law the Maine Highway Commission will be legislated out of office and the whole law of 1913 that meant so much for Maine will be repealed. The petition provides for other methods of handling the funds of the state in the building of roads.

LANSING, MICH., Feb. 19—Intoxicated automobile drivers are to be sent to jail for 1 year, or fined $250, or given both penalties if a bill presented by Representative George W. Miller, is adopted by the House. Any person who just before starting to drive takes a drink of any intoxicant, or who takes a drink while driving will be considered intoxicated.

LANSING, MICH., Feb. 19—State Senator Paul, of Kent county, has introduced a bill to compel automobile manufacturers to provide all motor cars with a safety device to prevent internal combustion engines from back-firing and thus cause people to be hurt while cranking their automobiles.

Delaware Makes Changes in Automobile Law

WILMINGTON, DEL., Feb. 19—Acts which have just been passed by the Legislature make the following changes in the Delaware automobile law:

1. The secretary of state shall revoke the license of any person

convicted of operating a motor vehicle while under the influence of liquor.

2. The secretary of state is empowered to revoke the license of any one upon three convictions of the automobile law in any one period of 12 months.

3. All magistrates are required to notify the secretary of state of all convictions under the automobile law.

4. Motor vehicles operated by a foreign corporation, firm or copartnership must carry Delaware tags, except foreign dealers or manufacturers, where reciprocity is given according to the nonresident reciprocity clause.

5. The speed limit is increased from 12 to 15 miles an hour in cities and towns, slowing up at intersections of streets. On highways in open country the speed limit is increased from 20 to 25 miles an hour.

6. Motorcycles are required to carry a new style of tag and no one is permitted to operate a motorcycle except the one who obtains the registration.

7. Defining the family operator's license as including a husband, wife, son, daughter or other relative or person who lives within the house or domicile of the owner, but does not include a servant, hired help or professional operator.

8. Prohibiting dealers from operating more than one car at the same time under the same registration number.

9. Officials of fire departments are given the same exemption as the fire engines and apparatus when responding to an alarm of fire.

10. Only official tags issued by the state can be used on any motor vehicle or motorcycle.

Senate Passes Compensation Law Amendment

ALBANY, N. Y., Feb. 22—An amendment to the workmen's compensation law, allowing an employer in this state to settle an award with an injured workman was passed tonight by the Senate. The bill now goes to the Assembly.

By the terms of the direct settlement clause, employers and employes may settle their cases without interference on the part of the compensation commission if the workingman is satisfied. If he is dissatisfied, he may appeal an injury case to the commission after 24 days. Sixty days after death his family may appeal if they do not like the settlement offered.

All Ohio Vehicles Must Carry Lights

COLUMBUS, O., Feb. 23—A law has been passed by the Ohio General Assembly compelling all vehicles, both motor-driven and horse-drawn, to carry lights, visible from in front and behind when operated on all of the public highways and streets of the state after sundown.

COLUMBUS, O., Feb. 23—The Ohio Senate has passed a bill, dividing chauffeurs into two classes, making a stiffer examination for one class as compared to that given the other class. The minimum age limit for operating cars is 16 years.

Representative Deaton has introduced a bill in the Ohio Legislature providing for the suspension of the owners' license for 60 days upon being convicted of violating the speed limit; a suspension of a year for the second offense and permanent suspension for any subsequent offense. The new measure makes no distinction between a chauffeur and an owner. This bill will be opposed by the Ohio State Automobile Assn. and the various local clubs in the state.

Indiana S. A. E. Thinks Eight a Fixture

Animated Discussion Over Designing and Manufacturing Problems —Predict 12-Cylinder

INDIANAPOLIS, IND., Feb. 22—The eight-cylinder motor was the subject discussed at the February meeting of the Indiana section of the Society of Automobile Engineers. The meeting was held last Tuesday night at the Claypool hotel in this city and the principal speaker was J. H. Heinze, chief engineer for the Northway Motor and Mfg. Co.

There was the widest latitude in the discussion, much of it centering around whether or not the eight-cylinder car has come to stay. Lon R. Smith was chairman of the meeting and opened by stating that George Schebler of this city is again working on a twelve-cylinder motor.

It was the opinion of Mr. Heinze that the eight has come to stay, but he did not believe it has reached perfection. He urged against the building of cheap eights, saying it would do the industry much harm. Ultimately he thought it might be possible to produce eights as cheap or cheaper than fours. Whether they will prove as economical to the public from an operating standpoint is a question time only can settle, he said.

Mr. Heinze said there are several problems confronting engineers in the manufacture of eights. One, he said, is that of lubrication. Advantages he saw in eights included general construction, cost of manufacture, less strain on parts, ease of riding and elimination of vibration.

Manufacturers, Mr. Heinze pointed out, are building successful sixes and there is no reason why they cannot make successful eights. He said engineers will not stop with eight cylinders, but will go on to twelve, and possibly more.

Charles Crawford, engineer for the Cole Motor Car Co., said there is a demand for eights, and pointed to an order for 100 Cole eights from Buffalo in answer to a statement by George Dickson of the National Motor Vehicle Co. that he could not see a demand for eights. Howard Marmon, of the Nordyke and Marmon Co., thought it might be a year before it is known definitely whether or not the eight has come to stay. The Marmon company, some years ago, built two or three eights for experimental purposes.

Gasoline-Electric Committee to Report

NEW YORK CITY, Feb. 24—The meeting of the Metropolitan section of the S. A. E. will be held Thursday evening, February 25. The report of the gasoline-electric committee, which will be submitted by David Beecroft, represents a great amount of research and a good representation of what can be done by section research committees. In addition to this report the constitution of the section as drawn up by the committee on constitutional amendment, comprised of Messrs. R. McA. Lloyd, J. E. Schipper and A. B. Cumner, will be heard. This is a model constitution proposed by the council of the Society for all sections.

The Indiana section of the Society of Automobile Engineers discussing eight-cylinder motors at the Claypool hotel, Indianapolis, February 16

300 Armored Trucks Ordered

Morton Four Wheel Drive Tractors for Use of Russia—Order Represents $1,500,000

YORK, PA., Feb. 20—An order for 300 armored motor trucks totaling $1,500,000 has been placed by the Russian Government with the Morton Truck and Tractor Co., Harrisburg. Samuel Morton, a member of the firm, arrived in London, England, this week and with R. L. Morton, who is also abroad, will represent the Harrisburg company in giving demonstrations and securing contracts for the allied armies.

W. S. Morton, general manager of the company, in speaking of the Russian contract this week, stated that the work will require at least 250 additional skilled mechanics and that with these extra facilities about fifty trucks a month will be shipped to Russia. The work will commence as soon as the amount covering the order is deposited in a New York bank by the Russian government. This is expected within a few days.

The contract calls for 300 tractors at $5,000 each of the heavy type recently perfected by the company after much experimenting. The cars are listed at $9,000, but the large number ordered will reduce the price to $5,000. The machines are gasoline driven, 120-horsepower, and four-wheel drive. They will be fitted with armor shields of ⅝-inch steel plate. The patented feature of the Morton tractor is the steering gear, which controls both axles, so that the rear wheels follow exactly in the tracks of the front wheels. This, with the four-wheel drive, is a strong factor of added power in traveling muddy roads and crossing rough country in military service. The tractors will be used to draw gun carriages, ammunition and provision trains. They can climb a 45-degree incline.

The Morton company has leased a portion of the Harrisburg Boiler works to facilitate the work of handling the big order.

Stewart-Warner Earns 10% on Common

CHICAGO, ILL., Feb. 23—The Stewart-Warner Corp.'s net profits available for dividends on its $10,000,000 common stock in 1914 were equal to 10 per cent. The common stock is at present listing at 48, while the preferred is listing at 101. In 1913 the company earned 10.88 per cent.

PHILADELPHIA, PA., Feb. 17—The directors of the Electric Storage Battery Co. have declared a dividend of 1 per cent. from the net earnings of the company on both common and preferred stocks, payable April 1, 1915, to stockholders of record at the close of business on March 22, 1915.

FREMONT, O., Feb. 19—The Lauth-Juergens Motor Truck Co., recently passed a resolution to issue $100,000 in 7 per cent. preferred stock.

Goodrich 1914 Net Sales $41,764,008

NEW YORK CITY, Feb. 24—The pamphlet report of the B. F. Goodrich Co., shows a net profit for the year ended December 31, 1914, of $5,440,427, an increase over the previous year of $2,840,680, the net profit being carried to the surplus account for the year. The surplus for the year compares with $2,599,747 surplus for dividends in the previous year. The year's net sales amounted to $41,764,008. A total of $2,968,500 was paid out in dividends, and 9,000 shares of the 7 per cent. preferred stock were retired at par. A balance of $3,177,909 was carried to surplus, against $705,982 at the close of the previous year. The preliminary report was published in THE AUTOMOBILE for February 4.

B. G. Work, president of the company, said in the report that the Société Francaise B. F. Goodrich, the French company, after ceasing operations for a few months, is again in operation and making a good showing.

Dorris Brings Out Seven-Passenger Six

ST. LOUIS, MO., Feb. 18—In adding a six-cylinder car to the Dorris line the Dorris Motor Car Co., St. Louis, has adhered to standard Dorris features of design, including unit power plant, multiple disk dry clutch, overhead valve mechanism with inclosed valves and speedometer drive from the inside of the gearcase. The car is built as a seven-passenger touring, has a wheelbase of 128 inches, 36 by 4 1-2-inch tires,

Automobile Securities Quotations

NEW YORK CITY, Feb. 24—Values were somewhat unsteady in the automobile securities market during the past week, but the general tendency might be described as continuing the upward trend which has marked the transactions of the past month. White stock was strong, registering a gain of 5 points. Kelly-Springfield common was 4 1-2 points higher than last week although the second preferred lost 1. Miller Rubber showed a gain of 8 points. Goodrich and Maxwell values also improved. Portage Rubber common declined 4 points and the preferred 5.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	200	..	250	..	..
Ajax-Grieb Rubber Co. pfd	98	101	100	..	..
Aluminum Castings pfd	97	100	95	100	..
Chalmers Motor Co. com	85	90	...	94	..
Chalmers Motor Co. pfd	92	94	91	94	..
Firestone Tire & Rubber Co. com	260	..	370	375	..
Firestone Tire & Rubber Co. pfd	105	107	109	111	+1
General Motors Co. com	59	61	94	95	— ½
General Motors Co. pfd	89	91	95	95½	..
B. F. Goodrich Co. com	24	25	33	33¼	+2
B. F. Goodrich Co. pfd	90	91	96¾	97½	+ ¾
Goodyear Tire & Rubber Co. com	215	225	190	194	—1
Goodyear Tire & Rubber Co. pfd	98	100	101	102	..
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	..	..	..
International Motor Co. pfd	..	15	..	..	..
Kelly Springfield Tire Co. com	48	50	112½	113	+4½
Kelly-Springfield Tire Co. 1st pfd	115	125	84	85	..
Kelly-Springfield Tire Co. 2d pfd	..	..	121	124	—1
Maxwell Motor Co. com	5	5½	22¾	23¼	+ ¾
Maxwell Motor Co. 1st pfd	27	27½	61½	62	+2½
Maxwell Motor Co. 2d pfd	8	8½	25	25¼	+1
Miller Rubber Co. com	..	..	158	165	+8
Miller Rubber Co. pfd	..	..	101	103	..
Packard Motor Car Co. com	..	..	..	100	..
Packard Motor Car Co. pfd	95	99	93	..	—2
Peerless Motor Car Co. com	15	25	15	21	+2
Peerless Motor Car Co. pfd	75	80	..	55	..
Portage Rubber Co. com	..	40	30	36	—4
Portage Rubber Co. pfd	..	90	80	85	—5
*Reo Motor Truck Co	7½	8½	11½	12	— ¼
*Reo Motor Car Co	17½	18½	24½	25¼	— ½
Stewart-Warner Speed. Corp. com	55	56	51	53	— ½
Stewart-Warner Speed. Corp. pfd	97	100	100½	102	+ ½
Studebaker Cor. com	28	30	46¾	47	+1¾
Studebaker Cor. pfd	85	87	95	96½	..
Swinehart Tire & Rubber Co	69	71	69	71	—2
U. S. Rubber Co. com	59	60	56½	57½	+ ½
U. S. Rubber Co. pfd	101½	102	102	103½	..
White Co. pfd	105	110	108	110	+5
Willys-Overland Co. com	66	68	95½	97½	+ ½
Willys-Overland Co. pfd	91	95	..	..	..

*Par value $10; all others $100.

Market Reports for the Week

NEW YORK CITY, Feb. 24—The dramatic rise of tin was the only important change in this week's market reports. On Friday this metal rose to $39.75 per 100 pounds from $37.00, due to speculative operations at London, alarm concerning shipping and frightened dealers and consumers. Tin was strong, excited and unsettled with prices irregular because of the psychological conditions surrounding the market arising largely from the alarm over the prospect of small shipments from London. The result of the violent fluctuations in tin in foreign markets during the last few days has been to almost entirely check trading in this city, both dealers and consumers being at sea. Cottonseed oil dropped $0.55 per barrel. Beams and channels rose to $1.26 per 100 pounds at a 5-cent gain. Business in the local market for crude rubber was more active on Tuesday. The market retained a firm tone and higher prices were demanded in some instances for plantation grades. Reports in regard to the condition of trade in rubber goods are generally favorable.

Material	Wed.	Thurs.	Fri.	Sat.	Tues.	Week's Changes
Antimony	.18½	.18½	.18½	.18½	.18½	......
Beams and Channels, 100 lbs.	1.21	1.26	1.26	1.26	1.26	+.05
Bessemer Steel, ton	18.50	18.50	18.50	18.50	18.50	......
Copper, Elec., lb.	.14½	.14½	.14½	.14½	.14⅝	+.00⅛
Copper, Lake, lb.	.14¾	.14¾	.14¾	.14¾	.14¾	......
Cottonseed Oil, bbl.	7.15	7.05	7.00	6.90	6.60	—.55
Cyanide, Potash, lb.	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown.	.14	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	......
Lead, 100 lbs	3.85	3.85	3.85	3.85	3.85	......
Linseed Oil	.60	.60	.60	.60	.60	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude.	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.75	.75	.75	.75	.75	......
Rubber, Fine Up River, Para	.58	.58	.58	.58	.58	......
Silk, raw, Ital	..	3.90	..	3.90	3.90	......
Silk, raw, Japan	..	3.32½	..	3.30	3.35	......
Sulphuric Acid, 60 Baume.	.90	.90	.90	.90	.90	......
Tin, 100 lb.	36.00	37.00	39.75	39.50	38.75	+2.75
Tire Scrap	.05	.05	.05	.05	.05	......

complete equipment including Westinghouse starting and lighting and sells for $2,475.

The cylinders are cast in threes and are 4 by 5, with valves in the heads operated through long push-rods and overhead gear; all the overhead parts are inclosed by a top housing of extremely neat design. A single camshaft with integral cams is employed. The crankshaft not only is unusually large, being 2 1-4 inches in diameter at the bearings, but it runs in seven bearings, so that each crank is supported on each side.

Lubrication is by constant level splash, the oil being circulated by a gear pump; a sight feed is mounted on the dash and an oil gauge on the crankcase. Cooling of the radiator is furthered by the fan-type flywheel, which exhausts the hot air from under the hood and draws in cool air through the radiator. The Westinghouse electrical system takes care of ignition as well as starting and lighting. The carbureter is a Stromberg with hot-water jacketed intake pipe.

The three-speed gearset is mounted as a unit with the motor, though there is no housing around the flywheel; the gear shafts run in Timken roller bearings, adjustable for wear. The dry disk clutch is housed in the flywheel, and is sufficiently small to leave ample room for the fan spokes.

Drive from the gearset to the rear axle is through a propeller shaft with two universals completely inclosed and running in grease. The rear axle is a full-floating Timken with helical bevels and a differential that is removable through an opening at the rear of the housing; Timken roller bearings are used in both axles

The rear spring suspension consists of a three-point platform system with 50-inch side springs and a 40-inch cross spring; front springs are semi-elliptics 42 inches long. Front springs are 2 1-4 inches wide and rear springs 2 1-2 inches. The steering gear is a Gemmer worm and gear, adjustable.

Both brakes are on the rear hubs and are 14 inches in diameter by 2 1-2-inch face; the service brake is contracting and the emergency brake expanding.

The equipment includes an engine-driven tire pump, Golde one-man top, rain vision ventilating windshield, 60-mile Stewart speedometer, tire carriers at the rear, an extra demountable rim, 10-inch electric headlights of the double bulb type, electric tail light with license carrier, electric inspection light, Klaxet horn, robe rail and foot rest, and the usual jack and tool outfit.

Herff-Brooks Small Four at $765

INDIANAPOLIS, IND., Feb. 23—The Herff-Brooks Corp., this city, has announced a new small four, called the Herff-Brooks 25, which sells for $765. The car will be made at the Richmond plant. It has a four-cylinder motor, developing 25 horsepower, the cylinders being block cast. A few other features are inclosed valves, unit power plant with three-point support and aluminum crankcase and gearbox. Cooling is by thermo-syphon, through a tubular radiator. The Atwater Kent Unisparker ignition system is used. There are three speeds forward with one reverse. Left hand drive and center control are used. The car has a 106-inch wheelbase.

Now Detroit Ward Leonard System

DETROIT, MICH., Feb. 23—The Detroit Starter Co. has recognized the validity of the late H. Ward Leonard's recently marketed patents and has entered into an arrangement by which it is now licensed to manufacture under these patents.

Hereafter the product of the Detroit Starter Co. will be known as the Detroit Ward Leonard system for starting and lighting and will continue to be manufactured in the plant of the Ross & Young Machine Co., Detroit. The officers of the Detroit Starter Co. are: J. W. Fitzgerald, president; F. J. Lamb, vice-president; A. D. Porter, secretary and treasurer, and H. M. Jerome, general manager.

Service Gear & Machine Co. Buys Parts

READING, PA., Feb. 19—The Service Gear & Machine Co. has purchased the entire stock of gears, shafts, patterns, etc., of the service department of the American Die & Tool Co. of this city. The former company will maintain a stock of transmission gears, spline shafts, countershafts, bevel differential gears and axle shafts for a great many obsolete cars. This stock will be carried in Reading and by the company's dealers throughout the country. J. D. Kaufman, formerly with the American company, will have charge with headquarters in Reading. The American Die & Tool Co. hereafter will devote its energies to the production of transmissions, small car rear axles, gears, etc., for manufacturers only.

President Smith Appointed U. S. L. Co-Receiver

BUFFALO, N. Y., Feb. 23—Judge Hazel here Monday in federal court, appointed J. Allan Smith, president of United States Light & Heating Co., Niagara Falls and Buffalo, as co-receiver for that concern, the affairs of which for the past several months have been in the hands of receivers, James O. Moore and James A. Roberts. Mr. Smith is required to file bond for $50,000.

Mr. Smith's appointment as receiver followed motion made 3 weeks ago by counsel for the heating company. At the time there was considerable debate as to whether Mr. Smith would be suitable to act as receiver because of his connection with the Niagara Falls company as president. The Central Trust Co. of New York City, which started an action in equity against the Niagara Falls concern, as well as other creditors, were strongly opposed to the appointment of Mr. Smith and through their lawyers they entered numerous objections. The two original receivers were present and they heartily urged that Mr. Smith be named as third receiver.

In his opinion filed Monday, Judge Hazel holds that although the Central Trust Co. of New York and other large creditors object to the appointment, he believed it would promote the best interests of the defendant company. When the original receivers for the concern were appointed President Smith was in Europe on business. Mr. Smith, in accepting the appointment, waives the usual fees and commissions. Judge Hazel, however, decrees that an order may be entered providing that Mr. Smith's annual salary shall cover additional services he performs as receiver

Five More Tire Makers Lower Prices

NEW YORK CITY, Feb. 23—Practically all makers of tires have now readjusted their prices in accordance with the downward movement instituted about a month ago. Comparisons of the new and old list prices have been given in THE AUTOMOBILE as they have been made and this week there are presented in the accompanying table the new and old lists of four principal sizes of those tires whose new figures had not previously been listed, Batavia, Federal, Michelin, Miller and Republic. In some cases February 1 is the date when readjustment went into effect.

New and Former Prices of Five Tire Makers for Four Principal Sizes

	30 x 3		32 x 3½		34 x 4		36 x 4½	
	Old	New	Old	New	Old	New	Old	New
Batavia								
Plain tread	$11.20	$12.15*	$20.00	$18.00	$29.65	$26.70	$39.50	$34.55
Security tread	17.10	12.35†	24.00	21.00	35.15	30.75	45.75	3.00
Red tube	3.50	3.00	4.50	3.85	6.25	5.30	8.25	7.00
Federal								
Plain tread	11.70	9.35	16.75	13.95	24.35	20.35	35.00	28.70
Rugged tread	13.80	10.75	19.70	16.05	28.50	23.10	40.98	33.80
Gray tube	2.80	2.35	3.70	2.80	4.90	4.00	6.45	5.30
Redskin tube	3.10	2.60	4.30	3.10	5.45	4.15	7.20	5.90
Michelin								
Soft bead	13.00	11.50	19.75	16.50	28.00	21.50	35.50	31.75
Q. D. clincher	....	....	20.75	18.00	28.00	24.50	35.50	31.75
Q. D. straight side	....	....	20.75	18.00	28.00	24.50	35.50	31.75
Steel studded	22.00	22.00	30.00	30.00	38.50	38.50	46.00	46.00
Tube	3.50	2.90	4.50	3.50	6.25	4.95	8.25	6.60
Miller								
Smooth tread	12.25	10.95	18.60	16.30	27.05	23.95	38.90	32.15
Non-skid	14.10	12.60	21.40	19.00	31.10	27.55	44.75	36.95
Gray tube	2.80	2.35	3.70	2.80	4.90	4.00	6.45	5.20
Republic								
Plain tread	13.25	11.35	18.35	15.70	28.25	23.80	40.00	31.20
Staggard tread	19.10	16.35	26.75	22.85	36.40	31.15	48.95	41.85
W M tread	13.95	11.95	19.35	16.55	29.75	25.45	42.10	36.00
Gray tube	2.90	2.30	3.90	3.05	5.35	4.20	7.00	5.50
Red tube	4.30	3.30	5.30	4.30	6.40	5.05	9.55	7.50

*Molded. Wrapped, $12.80. †Molded. Wrapped, $14.95.

To Hold Vanderbilt March 6

Bad Weather Stops Practice—Protest Against Holding Vanderbilt Cup Race After Grand Prix

SAN FRANCISCO, CAL., Feb. 22—*Special Telegram*—The Vanderbilt Cup Race was called off at noon today on account of inclement weather. March 6 is set for the start. The first practice, which was held from daylight to 9 o'clock Sunday morning, was featured by two wrecks. Eddie O'Donnell, driving the Duesenberg No. 19, was one of the first on the course. Driving through a gate at the far end of the Great Park, he saw that the guards had been stationed and started around. The car made fast time on the asphalt and went on to the boarded part of the track, which covered the dirt section of the course, at about 40 miles an hour.

During the night a heavy frost had whitewashed the planked track and the boards were as slippery as ice. O'Donnell battled with the wheel until he reached the center of the turn, then skidded through the outside fence. His car landed 15 feet off the course, turned end for end in a ditch. No serious injuries occurred. The second accident occurred when T. Tomasini skidded in front of the grandstand. The mud and slush under the boards came up through the wide cracks in the planking as the cars went over the timber and soon the boarded course was a muddy skid bed.

The decision on the part of the race officials to run the Vanderbilt after the Grand Prix, which is scheduled for February 27, started a wrangle. The Venice Grand Prix, scheduled for March 17, is being run under the auspices of the W. A. A. Officials of the Western Automobile Association who are here at the exposition protested that to postpone the Vanderbilt until March 6 would interfere with their event, which had already been sanctioned.

Cornelian Is Indianapolis Smallest Entry

INDIANAPOLIS, IND., Feb. 24—The speedway officials announce the entry in the 500-mile race May 30, of the Cornelian, to be driven by Louis Chevrolet. This little car will be the smallest that ever competed in the speedway classic. The whole car weighs but 1,000 pounds and has a displacement of only 95 cubic inches, less than one-third of the limit. The motor weighs less than 190 pounds and rates according to the S. A. E. formula at 12.1 horsepower at 1,000 feet per minute piston speed.

This car is made by the Blood Bros. Machine Co., Allegan, Mich. and made its début as a racer in the 100-mile race at Kalamazoo last fall, finishing seventh in a field of thirteen. The Indianapolis entry is almost a duplicate of the Kalamazoo entry.

The motor is a four-cylinder Sterling valve-in-head type, 2 7-8 by 4 inches in size. Valves are 1 1-4 inches in diameter and the pistons are of a special aluminum alloy. The motor is capable of a speed of 3,500 r.p.m. and the gear ratio is 3 to 1. Tires are 30 by 3 1-2 inches instead of the 28 by 3 inch tires used as stock.

There are three unique features of Cornelian construction which also have been incorporated in the racer. One of these is the rear axle. This is a flexible axle, much like that of the De Dion. This involves the use of four universals in the axle. The differential and bevel gears are mounted on the chassis and are carried on the springs so that unsprung weight is a minimum. Each wheel is independent of the other and does not carry the dead axle weight.

The front axle is provided with two transverse half-elliptic springs. The rear suspension comprises a three-spring transverse half-elliptic platform. A single sheet-steel shell comprises both body and frame. The racing body is narrow and has a long streamline tail.

Maxwell Builds Seven Racing Cars

DETROIT, MICH., Feb. 19—With Ray Harroun as the moving spirit in the enterprise, the Maxwell company will manufacture seven racing cars for the coming season. Harroun will superintend the construction of the cars, and will be permanently connected with the Maxwell company, in the capacity of chief engineer.

These racing cars, at present under construction at the factory of the Maxwell Motor Co., will be entered in most of the speedway events of the 1915 season. The different cars will be constructed for different classes so that their itinerary will include almost every race scheduled between the coasts. One or two drivers have already been selected to pilot the new racers.

Meetings, Elections and Conventions

NEW YORK CITY, Feb. 19—The directors of the Automobile Dealers' Assn. of this city held a meeting today in the association rooms for the purpose of electing officers. R. H. Johnston of the White Co., who has been president of the association for the past year was unanimously elected of the office of president for 1915. C. H. Larson of the Oldsmobile company was unanimously re-elected to the office of vice-president. Charles M. Brown of the Winton Motor Car Co. was unanimously elected secretary and treasurer of the organization in place of Frank Eveland of A. G. Spalding & Bros., who resigned on account of his company going out of the automobile business.

This is the first meeting of the new board of directors which was elected at the annual meeting of the association held February 4. The names of the directors are as follows: M. J. Budlong, Packard Motor Car Co.; C. M. Brown, Winton Motor Car Co.; Geo. Stowe, Chalmers Motor Car Co.; C. H. Larson, Oldsmobile Company; H. L. Stratton, Colt-Stratton Co.; Wm. C. Poertner, Poertner Motor Car Co.; R. H. Johnston, White Motor Car Co.; J. F. Plummer, Locomobile Co of America; Sidney B. Bowman, Bowman Auto Co.; and Wm. Parkinson, Stutz Motor Car Co.

JEANNETTE, PA., Feb. 19—At the annual meeting of the directors and stockholders of the Pennsylvania Rubber Co., the following officers were elected: Herbert DuPuy, chairman of the board; H. W. DuPuy, president-treasurer; C. M. DuPuy, vice-president; S. G. Lewis, general manager; G. W. Shiveley, secretary, and C. G. Morrill, assistant treasurer.

FLINT, MICH., Feb. 19—Presided over by general sales manager J. D. Mansfield, of the Dort Motor Car Co., about twenty-five district sales managers and big dealers of that new company held their first convention this week. Among the various subjects which were discussed was the condition of the automobile business in the United States, the outlook in the various states, dealers' selling campaigns and the establishment of service stations.

DETROIT, MICH., Feb. 18—A convention of all the salesmen, traveling men, department managers of the automobile department of the H. W. Johns-Manville Co., located in the lower peninsula of the state of Michigan was held at the headquarters of the company in Detroit. The general conditions of the trade and more especially those lines handled by the company were discussed. The meetings, at which about forty-five men of the sales organization took part, were presided over by Edward A. Cassidy, general manager.

Truck Club Discusses Recording Instruments

NEW YORK CITY, Feb. 17—"Effects of Self-recording Instruments in Increasing Deliveries and Decreasing Repairs" was the subject discussed at the regular monthly meeting of the New York section of the Motor Truck Club of America, held tonight in the auditorium of the Automobile Club of America. Three papers were submitted. One written by H. A. Long, general manager of the Service Recorder Co., Cleveland, O., was read by V. E. B. Fuller, local manager of the same company, in the absence of its author. Another, written by Gridley Adams, advertising manager of the Stewart Warner Speedometer Corp., Chicago, was read by the club secretary, F. Nelson Carle. The third was prepared and read by E. McGuirk, sales manager of the American Taximeter Co., New York City. Arthur Mayer of the Speedograph Corp., New York City, cited several instances where companies using the instruments manufactured by the Speedograph company on their trucks had been enabled to denote serious irregularities of operation and save considerable money as a result.

None of the papers presented described the instruments made by the respective companies, but discussed their application and cited cases where their use had enabled owners to know just what their trucks were doing when out on long trips; to detect overspeeding; excessive loading and unloading times, loafing on the routes and more than 1-hour lunch periods.

Mr. Long defined truck recording devices as some form of instrument which records time, mileage, speed, temperature, gasoline or oil consumption, or some combination of these, and which provides a permanent record in the form of a tape or chart. There are two types of such instruments, one, which is operated from the wheel through a flexible shaft, and the other, self-contained and having no connection with any moving part of the vehicle.

Mr. McGuirk touched briefly on the development of the taxicab and its recording device, and stated that the taxicab business had been made possible only by the use of a reliable recording device. The fares are calculated from the cost of operation per mile, as shown by the recording instrument. In a similar manner no truck operator can say positively just what his cost of operation is unless his vehicles are equipped with some sort of device which registers accurately the mileage covered each day. This point was forcibly brought out in the paper of Mr. Adams, who cited an example showing the great variance of cost-per-ton-mile figures when the mileage was guessed at instead of being determined from some type of reliable recording instrument.

Little discussion followed the reading of the three papers. G. H. Pride, of the Heavy Haulage Co., of this city, however, stated that he did not believe in instruments of this nature, because in his belief, there are none made which cannot be tampered with and put out of commission or circumvented in some manner. He believes in a truck owner knowing his business so thoroughly that no mechanical devices are necessary to determine irregularities of operation.

The next meeting will be held on Wednesday evening, March 17, at the Automobile Club of America. J. E. Cassidy, of the Postal Transfer Service Co., Inc., New York City, will present a paper on Traffic Problems as Found in the Operation of Motor Vehicles.

Horizontal Shocks with Cantilever Springs—Flame-Welded Clips

(*Continued from page* 361)

which the vertical component is the principal one, if it is made suitable for the worst horizontal components that may occur. But I suppose you let this pass, in default of something better, because it is common practice to have the front springing harder than it ought to be and helping it out, if pneumatic tires are used, by having these softer than they ought to be. You admit, of course, that the proposed makeshift still leaves the problem of doing better for commercial vehicles with solid front tires, and meanwhile it argues pretty strongly for using solid rear and pneumatic front tires as done by express companies and many private users of 1 to 2 ton wagons.

Trusting that our discussion will stimulate others to turn a few persistent thoughts in the same direction, I remain, as ever, truly yours,

New York, February 20, 1915. ALTER EGO.

Mr. Ego's letter certainly clears the ideas with regard to the need of separating the vertical and horizontal functions of a compound spring. Only with regard to the suggested front spring construction, Fig. 21, an exception may be taken. It is a combination spring in another sense from that previously used. The spring here yields obliquely in the average direction of a compound shock, and it will, as contended and admitted, be a little hard for purely vertical shocks. It will also be too soft for the severest horizontal shocks, if the rear load of the vehicle is much greater than the front load. It is a compromise—with a parallel in the front wheels of bicycles and in some early automobiles. But there is a strong probability that horizontal shocks of front axles are considerably milder than they can be figured, on account of the degree of flexibility always existing in vehicle frames and in wheels which perhaps delays the transmission of the momentum from the rear mass of the vehicle, in some measure, till after the road obstacle has been passed. The free rotation of front wheels, without retardation due to the inertia of the power transmission mechanism, should also have this effect. It is therefore believed that a construction of the general character shown in Fig. 21 would help materially to cushion the shocks now usually brutally resisted in the spring clips and the front pivot pins and from the latter transmitted to motor and load, and that it would do this also in the case of commercial vehicles with hard tires.

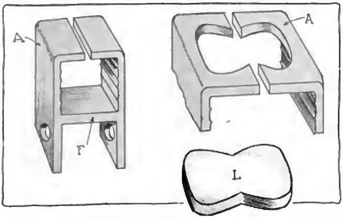


Fig. 18B—Details of flame-welded box-clip as used for construction, shown in Fig. 18A

Flame-Welded Clips

On the clip construction shown in the corrected Fig. 18, A and B, the following notes will make the suggested method perfectly clear. Stamping is the preferred process except for very heavy vehicles and springs, as it is probably the cheapest and for light and medium size vehicles will produce clips no thicker than necessary and of a suitable material. (Until the advent of chromium, clips made of Norway iron were the best.) Bushings are omitted in the sketch, also oilcups. To introduce a slightly yielding binder element within the grasp of the clip, to help in preventing longitudinal dislocation of the spring leaves while admitting the infinitesimal movements incidental to spring action in this place, the central portions of the spring leaves should be coated with a thin-flowing spelter when they are hot, before quenching and tempering. The coated areas should be mildly sandblasted to produce a suitable degree of roughness. The interior walls of the casting, forging or stamping should be corrugated in the manner shown to conform somewhat with the slightly rounded edges of the spring leaves. The top of the clip should be split, the split to overlap with chamfered edges if necessary.

To assemble, the clip is pried open sufficiently for the insertion of the leaves. One or two thin brass shims are wedged in at the top. The clip is then clamped firmly around the spring, and the split is closed by autogenous welding, the clamp staying on till the joint is cold. No pin is used. If it is found necessary at any subsequent occasion to take the spring apart, the joint is sawed open.

Additional security against slipshod workmanship in the welding, and in the case of heavy vehicles, may be obtained by forming the top of the clip with suitable cut-outs at both sides of the split and welding a locking piece L into the space thus formed, the clamp being used as before and weld metal as needed. Similar methods could be devised for clipping a spring to an axle with some gain in strength, neatness and cost over present methods, but other forms of construction may be better worth trying where it is desired to allow the spring a slight rocking motion on the axle, so as to obviate torsion of the leaves, as now done in many French cars and in some trucks.

Factory Miscellany

THIRTY Nationalities Represented—Between December 15 and February 10 18,200 men have applied to the Board of Commerce, Detroit, Mich., seeking employment. They have been classified, and according to the records they represent thirty different nationalities. Of the total 7,155 were skilled or semi-skilled workers and 11,045 could not be listed under any special trade, mostly being laborers. Among the 7,155 listed unemployed a large percentage came under the automobile and its allied trades classifications—21 per cent. being semi-mechanics, 4 per cent. full mechanics, 7 per cent. automobile body trade workers, 9 per cent. machine operators, 5 per cent. foundry workers, 3 per cent. sheet metal workers, 13 per cent. workers of building trades, 6 per cent. office workers, 5 per cent. domestics, 3 per cent. drivers, 20 per cent. laborers speaking English and 4 per cent. miscellaneous.

Paige on 24-Hour Schedule—The Paige-Detroit Motor Car Co., Detroit, Mich., is now working on a 24-hour schedule, with three 8-hour shifts.

Swinehart Planning Addition—The Swinehart Rubber & Tire Co., Akron, O., is having plans made for a 3-story reinforced concrete and brick addition, 60 by 130 feet, to be built at a cost of $75,000.

Pennsylvania Increases Force.—The Pennsylvania Rubber Co., Conshohocken, Pa., will increase its force from 800 to 1,400 as soon as the company's new plant is opened. This is expected to take place in 2 weeks.

F. & H. Wire Wheel in Springfield—The F. & H. Wire Wheel Co. is moving its plant and offices from Columbus, O., to Springfield, O., on account of increased manufacturing facilities and other inducements. It will have at its disposal a much larger plant with greater facilities for machine work and assembling.

Ford Building in Buffalo—The Ford Motor Co., Detroit, Mich., has had plans prepared for an assembling plant in Buffalo, N. Y., which will be 200 by 450 feet in size, four stories and basement, of reinforced concrete, and will be erected on a site at Main street and the New York Central Railroad Belt Line, at an estimated cost of about $400,000.

Kramer Leases Bailey Plant—The Kramer Auto & Carriage Co., Lancaster, Pa., has been incorporated with a capital stock of $5,000 by I. N. and G. R. Kramer, of Goodville, Pa., and Edward McLaughlin, of Lancaster, to manufacture vehicles and commercial automobile bodies. It has leased the former factory of S. E. Bailey & Co., on North Queen street, Lancaster. Edward McLaughlin is president, and I. N. Kramer, purchasing agent.

Wagner Resilient Purchases Plant—The Wagner Resilient Wheel & Tire Co., Chelsea, Mich., which was organized in Chicago last year under the laws of the State of Michigan, with a capital stock of $500,000, has purchased the plant formerly occupied by the National Peat Fuel Co., and will start manufacturing within a short time. The officers of the company are: W. F. Wagner, president; T. E. Russell, vice-president; A. C. Baird, secretary-treasurer. These officers and Wm. T. Ferguson and G. H. Karicofe makeup the board of directors.

To Mfr. Safety Fenders in Columbus—The Interstate Automatic Safety Fender Co., Columbus, O., has been organized with a capital of $10,000 for the purpose of manufacturing and selling fenders for motor trucks, under the patents held by the Automatic Safety Fender Co., of Chicago. It is planned to open a factory in Columbus and to cover the states of Ohio, West Virginia and Kentucky. Offices have been opened in room 74, Ruggery Bldg. J. V. Morgan is president; J. B. Moore, vice-president; E. J. Kinnison, secretary, and Peter Napier, treasurer.

Producing Light Car Motors—The plant of the Milwaukee Machine Tool Co., Sixtieth avenue and Mitchell street, West Allis, Wis., which passed into the possession of the Kearney & Trecker Co., milling machines, several years ago, is now devoting practically its entire attention to the production of gasoline motors for small cars. More than 2½ years of experimentation was undergone before the motors were placed on the market. The trade name of "Le Roi" has been adopted for the engine, which is built in two sizes, 2⅞ by 4 inches and 3⅛ by 4½ inches bore and stroke.

Rayfield Arranges for Large Production—The Rayfield Motor Co., Chrisman, Ill., has completed arrangements to produce the Rayfield "20" in large quantities. The engines, transmissions and axles will be supplied by the Pittsburg Model Engine Co.; the bodies and tops will be built in Indianapolis; the hoods, fenders and radiators will be made in Detroit; wheels will be built in Columbus, O.; springs, in Chicago, and the frames in Milwaukee; the final assembly will be made at the Rayfield Motor Co.'s plant at Chrisman, and the Great Western Automobile plant at Peru, Ind. With the two plants in full operation, it will give the company a capacity of at least fifty cars per day. The company has seventy-five agencies.

The Automobile Calendar

Feb. 22-25	Allentown, Pa., Show.
Feb. 22-27	Duluth, Minn., Show, Auditorium.
Feb. 22-27	New Haven, Conn., Show, Second Regiment Armory; W. N. Lindsay.
Feb. 22-28	South Bethlehem, Pa., Show, Coliseum; J. L. Elliott.
Feb. 23-27	York, Pa., Show, Coliseum Hall.
Feb. 23-27	Syracuse, N. Y., Show, Armory, Syracuse Auto Dealers' Assn.; H. T. Gardner, Mgr.
Feb. 23-27	Ft. Dodge, Ia., Show, Armory, C. W. Tremain, Sec.
Feb. 24-27	Freeport, Ill., Show, Freeport Automobile Show Co.
Feb. 27	San Francisco, Cal., Panama-Pacific Exposition, Grand Prize Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 1-5	Wilkesbarre, Pa., Show, Vehicle Trades Assn.
Mar. 1-6	Fargo, N. D., Show, Armory.
Mar	Benton Harbor, Mich., Show, St. Joseph and Benton Harbor, St. Joseph Garage, St. Joseph.
Mar	Charlotte, Mich., Show.
Mar. 2-9	Brooklyn, N. Y., Show, Motor Dealers' Assn., 23rd Regiment Armory.
Mar 3	Albany, N. Y., Associated Garages of America, General Convention.
Mar. 3-4-5-6	St. Joseph, Mich., Show, St. Joseph Auto Co. Bldg.
Mar. 4-6	Springfield, Mass., Show; J. H. Graham.
Mar. 6	San Francisco, Cal., Vanderbilt Race, Panama-Pacific Exposition Grounds.
Mar. 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13	New York City, Made in the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13	Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 8-13	Utica, N. Y., Utica Automobile Trade Assn.
Mar. 13-20	Harrisburg, Pa., Show Arena, Harrisburg Dealers' Assn.
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
Mar. 17-20	Elgin, Ill., Show, W. H. Tidmarsh, Mgr.
Mar. 22-27	Bangor, Me., Show, Bangor Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
Apr. 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., Two-mile Track Meet.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
June 25	Sioux City, Ia., Track Meet.
July 4-5	Tacoma, Wash., Road Race.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

Meers Empire Commercial Mgr—I. B. Meers has been appointed commercial manager of the Empire Automobile Co., Indianapolis, Ind. Entering upon his new duties Mr. Meers is now on an extended trip through the West in the interests of the Empire company, with which he was formerly connected as export sales manager.

Bishop Joins King—R. P. Bishop has been appointed assistant sales manager of the King Motor Car Co., Detroit, Mich. He was formerly sales manager of the Cutting Motor Car Co.

Mevis Heads Springfield Buick—G. A. Mevis has been appointed manager of the Springfield Buick Co., Springfield, Mass. The company will move to 650 Main street on or about March 1.

Hanks Heads Indianapolis Westinghouse—The Westinghouse Electric & Mfg. Co. has opened a sales and service station in charge of M. W. Hanks at 427 North Meridian street, Indianapolis, Ind.

Green Resigns from Speedwell—C. R. Green has resigned as chief engineer of the Speedwell Motor Car Co., Dayton, O., and has accepted a position in a similar capacity with the Mead Engine Co., Dayton, O.

McCleary Heads Dodges' Metallurgy Dept.—Dodge Bros., Detroit, Mich., recently completed extensive additions and changes in the metallurgical department of the plant. F. E. McCleary is in charge of the department.

Hockaday Mgr.—Ray Hockaday, of Wichita, Kan., will be the manager of the Hutchinson (Kan.) branch of the Hockaday Automobile Supply Co., to be opened March 1. The firm will take the building at 27 Sherman east.

Simpson Apperson Mgr.—B. A. Simpson, during the last 6 years with the Omaha (Neb.) Buick agency, has been appointed manager of the retail business of the local Apperson Jack Rabbit Automobile Co., 2417 Farnam street.

McGiehan Resigns from Motz—T. H. McGiehan, vice-president and general manager of the Motz Tire & Rubber Co., Akron, O., has resigned his position, effective March 1, to go in the rubber supply business in New Orleans. He will represent several tire and sundries manufacturers.

Keir Troy Wagon Representative—J. L. Keir has been appointed manufacturers' agent for the Troy Wagon Works Co., Troy, O. His offices are in the Abbott Bldg., Broad and Race streets, Philadelphia, Pa. He will handle Troy motor truck trailers, reversible traction-drawn wagons and dump wagons.

Quinn Pittsburgh Goodyear Mgr.—J. M. Quinn is the new manager of the Pittsburgh (Pa.) branch of the Goodyear Tire & Rubber Co., 5952 Baum Boulevard. He succeeds W. A. Hazlett, who was recently promoted to the position of manager of the Goodyear branch in Detroit.

Campbell Club Treasurer—H. F. Campbell, treasurer of the Stutz Motor Car Co., Indianapolis, has been elected treasurer of the Columbia Club, Indianapolis. The Columbia is one of the oldest clubs of Indianapolis, and its membership includes a large proportion of the successful business and professional men.

Former Packard Men Make Change—G. S. Loomis and W. F. Winklemann, formerly connected with the Packard Motor Car Co., Detroit, have been appointed general manager and sales manager, respectively, of the Southern Motors Co., agent for Packard, Hudson, Dodge and Detroit electrics, Louisville, Ky.

Morris Joins Moon—J. C. Morris, formerly manager of the Johns-Manville Co., Seattle, Wash., for the entire Northwest, this week signed a contract with the Moon Motor Car Company, of St. Louis, to handle the company's automobiles in the Northwest. He assumes entire charge of that district, selecting agents in Washington, Oregon, Idaho, Montana and Colorado.

Kempff Heads Harrisburg Fisk—The Fisk Rubber Co., of New York, has leased the storeroom at 19 South Third street, Harrisburg, Pa., and will open a local factory branch and service station March 1. E. P. Kempff, formerly with the Front-Market Motor Supply Co., will be in charge. C. D. Whitney, district representative for Fisk tires in this territory, will be associated with the branch and make the Harrisburg store his headquarters.

Garage and Dealers' Field

New Location for Knight Tires—The New England branch of the Knight Tire & Rubber Co. has been moved from 153 to 179 Massachusetts avenue, Boston, Mass.

Cleveland Oakland's New Salesroom—The Adams-Oakland Co., distributer for Oakland cars, Cleveland, O., has leased the property at 3122 Euclid avenue and will have erected a two-story salesroom and garage, to be ready in May.

Singer's N. Y. Showroom Opened—The Singer Motor Co., Long Island City, N. Y., has taken a showroom at the northeast corner of Sixty-first street and Broadway. The store was opened February 22.

Titan Battery Changes Name—Due to the existence of a battery jar marketed under the name Titan, the Titan Storage Battery Co., Newark, N. J., has changed its name to the General Lead Batteries Co. No change whatever in ownership, officers or policy is involved.

Thirty-two Fords Destroyed—A fire entailing a loss of $40,000 destroyed the three-story building at 145 South Cameron street, Harrisburg, Pa., occupied by the Ford Garage and salesrooms. Thirty-two automobiles were destroyed in the fire. The building is a total loss.

Burd Piston Ring Agents—Christman & Poole, 420-422 Jefferson street, Milwaukee, Wis., specialty distributors, have been appointed district sales agents for the Burd high-compression piston rings, covering the states of Wisconsin, Iowa, Michigan, Illinois and Minnesota.

New Smalley Daniels Plan—Smalley Daniels, manufacturers' distributor, Detroit, has completed arrangements whereby garagemen and repairmen can obtain the products of the New Era Spring & Specialty Co. at trade price without the necessity of purchasing them through the dealer of the car for which they are intended.

Westinghouse Opens Cleveland Store.—The Westinghouse Electric & Mfg. Co. has opened a department for automobile equipment at 2025 Euclid avenue, Cleveland, O., with a thoroughly equipped sales and service station. S. L. Blackburn is district manager in the southeastern territory for the company.

Deals in Waste—The Wisconsin Waste Co. has been organized at Milwaukee, Wis., to make a specialty of dealing in waste for garages, machine shops and factories. The office is at 228 Muskego avenue, and warehouse at 256 Reed street. The owners of the concern are H. E. Jacobs and L. D. Fisher. Waste will be sold at wholesale and retail.

Philadelphia Willard Service Station—The J. G. Duncan, Jr., Co., Philadelphia, Pa., official Willard L B A distributors, has opened a service station at 1311 Race street in addition to the one already maintained at 131-133 South Twenty-fourth street. The company makes a specialty of renting service batteries while car owners' batteries are being recharged or repaired.

Los Angeles Cos. Consolidate—Consolidation of the Western Motor Car Co. and the California Motor Co. was effected recently under the firm name of Earle C. Anthony, Inc., of Los Angeles, Cal. Both companies were owned by Earle C. Anthony and both are now housed in the five-story structure at Tenth and Hope streets. The new concern controls the distribution of the Packard, Chalmers and Grant lines in Southern California.

Tire Agencies Recently Established—During the past week reports from different localities have shown much activity in the way of the establishment of new tire agencies. From Seattle, Wash., comes the report that John Baisden, for some time past connected with the United States Rubber Co. in that city, has been given the local agency for the Goodyear line. A. M. Peterson has taken the agency for the Batavia tire in Washington, Oregon, Idaho, Montana and British Columbia. He has established the Pacific Tire & Rubber Co., 604 East Pike street, Seattle, Wash. A Diamond and Goodrich branch has been established in Tacoma, Wash., with the Automobile Supply Co. Ralph De Witt, 414 Columbus Savings and Trust Bldg., Columbus, O., has taken the Midgley distribution. The Polack Tire & Rubber Co., New York City, has established a branch office in the Union Central Bldg., Cincinnati, O.

Recent Incorporations in the Automobile Field

Canada

OTTAWA—Canadian Lippard-Stewart Motor Car Co., Ltd.; $50,000; to manufacture motor trucks. T. A. Burgess, J. S. Innis, Louis Cote.

Illinois

BLOOMINGTON—Ford Garage Co.; $5,000. F. D. Hackett, J. C. Harvey, E. E. Donnelly.

CHICOUTIMI, QUE.—Chicoutimi Auto Bus Co.; $20,000. Adelard Tremblay., Pitre Gaudreau, Louis Gagnon.

CARBY—Westcott Auto Sales Co.; $10,000; dealer. W. C. Turner, H. M. Grant, J. W. Yanaway.

CHICAGO—Berlin Motor Co.; $2,500; manufacturing and dealer in machinery, tools, automobile parts. T. W. Prindeville, J. D. Daly, A. J. Schmidt.

CHICAGO—King Motor Co.; $50,000; dealer. A. P. Mackie, C. F. Woods, J. W. MacCulehan.

CHICAGO—Shoger Mfg Co.; $2,500; manufacturer in accessories. G. D. Wellington, H. C. Peterson, E. W. Clark.

ROCKFORD—Cadillac Automobile Co.; $5,000; dealers. F. P. Keyt, C. H. Erb, O. P. Kent.

Indiana

FORT WAYNE—Brosius Automobile Co; $3,600; dealer. Jesse Brosius, Andrew Brosius, H. Brosius.

INDIANAPOLIS—Adjustable Auto Shoe Co.; $10,000; dealers. W. A. Parr, L. O. Gillaspy, G. E. Parr.

INDIANAPOLIS—Scarborough Motor Guide Co.; $30,000; sale of automobile guides. Marcel Rocamora, I. R. Holycross, Claude Palmer.

LOGANSPORT—Automobile Accessories Co.; $25,000; manufacturer. C. E. Young, C. B. Billman, J. Lairy.

Kentucky

PADUCAH—Home Garage; $2,000. F. W. Katterjohn, Herbert Melton, W. F. Paxton.

Maine

PORTLAND—Gillette Safety Tire Co.; $1,000,000; rubber goods, machinery and vehicles. A. F. Jones, T. L. Croteau.

Massachusetts

BOSTON—Co-Operative Motors Corp.; $500,000; garages. B. C. Boyd, H. I. Bailey, F. B. Taylor

Michigan

DETROIT—American Double Service Tire Co.; $3,000. Hanley Dawson, J. G. and B. C. Pennell.

DETROIT—Auto Spray Co.; $10,000. R. H. Evans, H. J. Skivington, D. H. Bentley.

DETROIT—Cadillac Car Co; $12,000; dealer. Duncan Walker, H. B. Graves, Frank and I. M. Krupferx.

DETROIT—Elmer W. Brown & Co.; $5,000; accessory dealer. E. W. Brown, Christian Rasmussen, O. H. Dawson.

DETROIT—Magee Sheet Metal Machinery Co.; $10,000; to manufacture sheet metal wiring machines specially used in wiring fenders. W. R. and B. R. Magee, F. W. Atkinson.

DETROIT—Somers Carbureter Co.; $10,000; manufacturer. D. G. Mears, J. H. Means, J. F. Somerville

Missouri

KANSAS CITY—Rotary Valve Mfg. Co.; $250,000; manufacturers. C. R. Jones, J. M. Burgner, L. A. Sherman.

LA GRANGE—West Suburban Garage Co.; dealer. H. D. Howe, C. C. Collister, H. L. McConnell.

ST. LOUIS—Burger Motor Co. of St. Louis; $5,000; dealer. Mary and Ferdinand Burger, J. H. Plameier.

ST. LOUIS—Cole-Arbogast Automobile Co.; $10,000; dealer. W. B. Hont, Wm. Schmidt, Ed. Ward.

ST. LOUIS—Gillham Motor Car Co.; $10,000; dealer. F. R. Tate, F. C. Gillham, H. W. Blodgett, Jr.

New Jersey

EAST ORANGE—Maccar Co. of New Jersey; $50,000; general automobile business. G. F. Kallberg, W. F. Hobbie, Jr.; W. A. Boone, East Orange.

NEWARK—Wills Garage, Inc; $10,000. J. H. Wills, J. J. Wills, G. F. Braudenbugh.

New York City

NEW YORK—Aero-Cushion Tire Co.; $750,000; manufacturer. J. A. Le Daux, F. Rause, G. A. Le Daux, W. S. Locke, W. L. Biddle, M. D. Callius, E. M. Oriva.

NEW YORK—Anti-Puncture Corp.; $20,000; liquid compositions. C. M. Stanton, 105 Berkeley Place, Brooklyn; Myra Emmons, Sidney Morris

NEW YORK—Brickner's Auto Supply Co.; $5,000; dealer. Norman Brickner, Mae Brickner, Herman Widowsky, 1741 East 12th street.

NEW YORK—W. H. Cahn Co.; $10,000; to act as agent for manufacturers of Smith motor wheel, etc. W. H. Cahn, 226 W. 70th street, New York City; J. H. Hobbs, T. J. Canty.

NEW YORK—Greene Motor Trucking Co; $6,000; motor trucking. J. M. Greene, A. A. Schwartz, D. Kaxtman.

NEW YORK—Haines Auto Accessories; $5,000; dealer. N. E. Ray, 600 West 183d street, New York City; S. E. Ginberg, H. S. Hochheimer.

NEW YORK—Hilltop Automobile Station; $10,000; general garage business. Lauritz Johansen, Margarete Johansen, R. B. Hand.

NEW YORK—Jeffersyon Auto Van Co.; $1,000; trucking. Isidor Smith, S. Peckin, H. Puret, 43 E. 112th street.

NEW YORK—The John Mano Co.; $1,000; dealer. John Mano, G. H. Miller, Louis Cesky, all of 255 West 57th street.

NEW YORK—Lansden Co.; $1,000; manufacturing electric and gasoline automobiles and appliances. Martin Lipman, Emma Ullman, E. Manoel, L. Meyer; attorneys, McLaughlin & Stern, 15 William street.

NEW YORK—Lexington Sales Co.; $10,000; dealer. M. J. Swetland, A. T. Smith, F. P. Foster, all of 239 W. 56th street.

NEW YORK—Mutual Motor Sales Co.; $25,000; dealers. Geo. Ozanne, 225 W. Englewood ave., Englewood, N. J.; W. P. Buchler, J. B. Kalmuk.

NEW YORK—New Denver Ford Starter Corp.; $20,000; manufacturer. J. R. Duff, 35 Broad street; M. L. Effinger, 1779 Broadway; J. T. McGovern.

NEW YORK—Overman Cushion Tire Co.; $150,000; to manufacture tires, rims and other automobile accessories. Max C. Overman, 250 West 54th street, New York City; C. A. Taussig, W. R. Lowther, 43 Cedar street.

NEW YORK—Radiator-Fix Co.; $10,000; manufacturer chemical solution for repairing automobile radiators. C. S. Galbraith, W. A. Harrison, L. H. Peck, Whitestone, N. Y.

NEW YORK—Reliable N. Y. & Brooklyn Auto Delivery Co.; $1,000; trucking. C. Cohen, 2011 Amsterdam avenue; L. B. Carhart, D. Katzman.

NEW YORK—Ridgewood Automobile Co.; $500; dealer. A. J. L. Knight, F. C. Kreuscher, R. S. Kreuscher, both of 2395 Silver street, Ridgewood, N. Y.

NEW YORK—Royal Electric Motor Co.; $9,000; dealer. Abr. Zwonitsky, 174 Kosciusko street, Brooklyn; Isaake Joffe, B. Schwartz.

NEW YORK—Spengler Automobile Co.; $10,000; dealer. Henry Spengler, 334 St. Nicholas avenue; Gustave Supper, E. E. Braendle.

NEW YORK—Terrace City Motor Car Co.; $25,000; dealer. R. S. Conant, 159 Warburton avenue, Yonkers; Woodruff Smith, H. B. Mook.

NEW YORK—Vitaspark Corp.; $10,000; ignition devices for automobiles. F. C. Schofield, Roderic Wellman, F. A. McGurk, all of 15 Wall street, New York City.

NEW YORK—130th Street Garage; $5,000. Mendick Johnson, Jr., Agnes Johnson, John Mortensen, all of 3242 Broadway.

New York

ITHACA—Cole Garage Co.; $12,000. W. W. Cole, John Hovanna, J. A. Sherwood.

BROOKLYN—Auto Storage Co.; $500. Henry Bender, Geo. Jung, D. J. Ennis, 394 East 2d street, Brooklyn.

BROOKLYN—Baker Electric Motor Service; $20,000; dealer. F. A. Jannicky, 906 Eastern Parkway, Brooklyn; Frederick Bowers, B. R. Shears.

BROOKLYN—Bergen Taxi Cab Co.; $1,500; taxicab business. H. Weingold, 811 Eastern Parkway, Brooklyn; Jas. Shapiro, M. Miller.

BROOKLYN—Brooklyn & Long Island Auto Associates; $20,000; dealer. A. J. Farrell, 1178 Bedford avenue; C. F. Batt, R. P. Lumley.

BROOKLYN—Dujardin Rubber Co; $100,000; tires, tubes, accessories. F. B. and F. B. Hutcheco, Henry Dujardin, 3303 Glenwood Road, Brooklyn.

BROOKLYN—Lewis-Dietz-Caldwell; $2,000; dealer. K. S. Caldwell, Rue De St. Delia, Far Rockaway, N. Y.; G. C. Dietz, G. W. Lewis.

BROOKLYN—Reid Ave. Garage & Machine Co.; $5,000. Abr. Goldfarb, 5 Beekman street, New York City; R. K. Allison,, O. E. Weidlieb.

BUFFALO—Frick Auto Sales Corp.; $10,000; dealer. J. L. Frick, F. H. Pickett, C. R. Jackson.

HUDSON—Hudson City Taxicab Co.; $3,000; taxicab business. A. B. Miller, G. C. Miller, B. M. Mossman, all of Hudson

MINEOLA—Gibson and Domhan Co.; $1,000; dealer. R. M. Gibson, J. J. Domhan, Chas. Liebeck.

NEW ROCHELLE—Saxon-Tracy Co; $3,000; to manufacture motors, etc. Wm. Abramson, 825 Tinton avenue, New York City; D. Straus, L. Rothfeld.

POTSDAM—Island Garage; $5,000. L. B. Bartholemew, J. L. Dandy.

QUOQUE, L. I.—Dimond-Apperson Motor Co.; $15,000; dealer. J. R. Dimond, 171 W. 71st street; Thos. Dimond, A. C. Warren

ROCHESTER—Eastern Tire & Supply Co.; $5,000; manufacturer. J. G. Barclay, W. T. Kincaig, Arthur Smith, both of Rochester.

ROCHESTER—C. H. Washburne; $25,000; dealer. C. H. Washburne, E. P. Washburne, E. H. Lamb.

SYRACUSE—Resilient Steel Wheel Co.; $25,000; manufacturer. J. M. Grenan, 372 S. Salina street, Syracuse; C. Leonard, H. F. Leonard.

Ohio

AKRON—Portage Motor Sales Co.; $8,000; dealer. H. W. Petley, Henry Petley, H. M. Hagelbarger, G. K. Doolittle, E. M. English.

AKRON—Xylos Rubber Co.; $50,000, manufacturer. H. W. Pohlemus, M. S. McGregor, G. Slater, J. H. Focht, W. E. Davies.

CLEVELAND—Enix Starter Co.; $10,000; to manufacture starters and other accessories. J. T. Scott, D. L. Johnson, M. C. Byrnes, B. E. Robertson, M. G. McAleenam.

CLEVELAND—Lohse Automobile Improvement Co.; $25,000; manufacturer. Richard Ryder, W. G. Rauder, Matthew Reitz, Richard Lohse, K. C. Wehrmeyer.

COLUMBUS—Remington Auto Sales Co.; $10,000; dealer. C. H. Shira, Orrin Thacker, W. A. Jackson, W. E. Pearse, O. H. Mosler.

IRONTON—Ironton Garage Co.; $10,000; accessory dealer, etc. R. W. Rowland, I. L. Riley, T. N. Erskine, W. R. Edwards, A. C. Robinson.

Oklahoma

OKLAHOMA CITY—Paige Motor Car Co.; $8,000; dealer. J. T. Wheatly, W. H. Crane, J. L. Daniel, all of Oklahoma City.

TULSA—Jeffery Motor Sales Co.; $3,000; dealer C. R. Adams, F. B. Adams, L. L. Giacomi.

Pennsylvania

PORTAGE—Portage Automobile and Machine Co.; $10,000; dealer. J. M. Stedart, J. F. Schofield, R. L. Houck, F. W. Eleber, O. W. Mitchell, all of Portage

Texas

DALLAS—McGraw Tire and Rubber Co.; $10,000; dealer. C. E. Pumphrey, R. E. L. Saner, S. L. Warner.

Utah

LOGAN—Kimball Auto Co.; $25,000; dealer. N. W. Kimball, W. R. Sloan, Roy Kimball, H. G. Hayball.

Virginia

NORFOLK—Dixie Motor Co.; $20,000; dealer. B. R. Wrenn, G. D. Taylor.

RICHMOND—Baker Electric Car Co.; $3,000; N. R. Elrich, P. B. Smithson.

RICHMOND—Harrisonburg Auto Transportation Co.; $50,000; motor bus business. A. M. Graves, H. M. Effinger.

RICMOND—Motor Air Pumping Sales Corp.; $25,000; manufacturing and dealing in air pumps. H. K. McHarg, Jr., president; O. R. Newton, secretary, both of Roanoke.

Washington

SEATTLE—Combs Automobile Tire Co.; $100,000; manufacturer. P. S. Combs, A. E. Combs, P. S. Combs, Jr.

SEATTLE—Manitou Motor Car Mfg. Co.; $2,000,000; manufacturer. R. O. Ring, H. B. Schenck, J. K. Schenck, F. E. James, 404 Joshua Green Bd., attorney.

Wisconsin

OSHKOSH—Paragon Oil & Supply Co.; $15,000. E. L. Thompson, T. F. Coffey, Eric Thompson

Change in Capitalization

Ohio

CLEVELAND—Cleveland Motor Car Sales Co.; $25,000 to $50,000.

Wisconsin

RACINE—Standard Electric Works; $25,000 to $100,000.

Automobile Agencies Recently Established

PASSENGER CARS

Arizona

Mesa	Maxwell	E. D. Bayless
Phoenix	Dodge Bros	McArthur Bros
Tucson	Maxwell	Hankins & Martin
Tucson	Ford	Mansfield & Condon

California

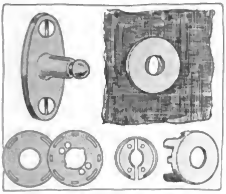
Brentwood	Oldsmobile	Brentwood Garage
Carmel	Oldsmobile	G. Schweninger
Los Angeles	Howard	L. C. Buxton
Los Angeles	Lexington	L. C. Buxton
Los Angeles	Moon	L. C. Buxton
Los Angeles	Mitchell	Wm. R. Ruess Co
Oxnard	Oldsmobile	C. M. Penland
Pasadena	Stearns-Knight	A. L. Ryder
Pasadena	Mitchell	A. L. Ryder
Pasadena	Oldsmobile	W. J. McCulley
San Francisco	Jeffery	W. Milburn
San Francisco	Trumbull	C. S. Clancy
Sao Francisco	Chalmers	M. Bunnel
San Jose	Chandler	W. J. Benson
South California City	Jeffery	Carlton-Faulkner & Bowles

Colorado

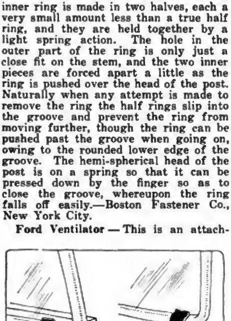
Denver	Krit	Wm. Thorney Auto Co.
Denver	Walker Electric	E. M. Jackson
Denver	Dodge Bros.	T. Botterill
Denver	Briscoe	G. A. Estabrook
Denver	Monroe	H. E. Maines
Denver	Monarch	S. H. Klein
Denver	King	Mid-West Auto Sales Co
Denver	Grant	Mulnix & Steese

ACCESSORIES

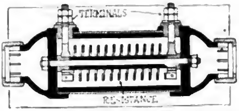
TOP FASTENERS—A clever invention is the Boston Push and Pull fastener for tops, automatic curtains or leather goods of any sort or kind. It consists of a vertical stem attached to one part and a ring clinched to the other. Just beneath the head of the post there is a groove and the extreme top is rounded off. The under side of the head (which is made almost hemispherical by the rounding) has a sharp edge, but the lower edge of the groove is rounded off a little. The ring clinched to the curtain or other similar part is hollow and there is within it a second smaller ring that lies loosely and can shake about from side to side. This inner ring is made in two halves, each a very small amount less than a true half ring, and they are held together by a light spring action. The hole in the outer part of the ring is only just a close fit on the stem, and the two inner pieces are forced apart a little as the ring is pushed over the head of the post. Naturally when any attempt is made to remove the ring the half rings slip into the groove and prevent the ring from moving further, though the ring can be pushed past the groove when going on, owing to the rounded lower edge of the groove. The hemi-spherical head of the post is on a spring so that it can be pressed down by the finger so as to close the groove, whereupon the ring falls off easily.—Boston Fastener Co., New York City.


New top fastener

Ford Ventilator—This is an attachment for a Ford windshield which allows the whole shield to be drawn back a little, so opening a slot the whole width of the dashboard. It is of extremely simple construction and has a latch to secure it in the normal or closed position. To open it is only necessary to turn the latch and pull back the windshield. The fitting should be easy to attach to the car and sells for a remarkably low price.—L. P. Halladay Co., Streator, Ill.

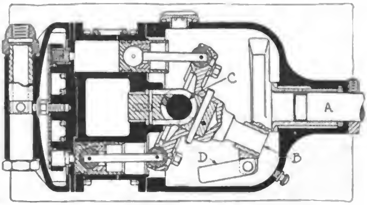

Ventilating windshield for Fords

Carbureter Air Heater—Nearly every starting difficulty with automobile motors is due to poor carburetion arising from the low temperature of the air and the fuel. It must not be forgotten that the vaporization of a liquid extracts heat from the gas or air in which the vaporization takes place, so that if we start with cold air it becomes still colder by the time it has taken up the gasoline spray. If the original air temperature is low enough the result of the chilling action of the gasoilne may easily result in the latter being thrown down in the manifold and cylinder in liquid form, and in such a case it is only the lighter fractions in the gasoline that mix with the air and give an ignitable gas. Often in actual fact it is the heat generated by the compression of air in the engine that causes the deposited gasoline to vaporize and this sometimes explains why a motor will start after repeated spinning following injection of raw fuel. Since the modern car has always plenty of electricity available it is a natural enough idea to utilize some of it for heating up the air to be used for starting purposes, and one of the neatest devices having this end in view is the Paul preheater, illustrated. This is a section through the apparatus which is intended to be inserted in the middle of the hot-air pipe of the carbureter; the split ends of the preheater in conjunction with the cap nuts enable it to be gripped on flexible pipe if desired, so attachment is easy. Inside the chamber there is a coil of flat metal strip having a fairly high resistance, and the ends of this strip are fixed to the two terminals shown. A wire is run from the cranking battery to one of these terminals, and the return wire passes through a switch which can conveniently be located in the cowl. To use the heater it should be switched on about half a minute before cranking and the carbureter primed in the usual way. As soon as the motor starts, the exhaust pipe heats up and there is no more need for the preheater, so it can then be switched off.—Fort Wayne Engineering & Mfg. Co., Fort Wayne, Ind.



Carbureter air heater for easy starting. To be inserted in hot air pipe by means of the split ends and cap nuts

Garage Air Compressor—A very compact form of air compressor for tire inflation in garages is shown in this illustration. There are eight cylinders arranged in a block with their axes all parallel, and the corresponding eight pistons are driven by what is perhaps best described as a wabble gear. The shaft A is revolved and this causes the pin B to be carried round, also causing the plate attached to B to wabble or rock on the pin C. The little connecting rods have ball-and-socket ends so as to allow for the motion in two directions, and there is a dipper or blade D which splashes oil and spreads it over all the working parts. The cylinder bore is 1 inch and the stroke 1 5/16 in., giving a capacity of over 2 cubic feet of air per minute at the rated speed of 450 revolutons per minute. The air intake takes place through a stationary port and the outlet valves are brass, peened and not ground to their seats, and restrained as to lift so as to prevent hammering.



Section through Utility garage air compressor

Portable compressor with electric motor drive

The pump is said to be able to deliver air at 600 pounds per square in. pressure, if required, and is made of robust materials. It is supplied in form suitable for mounting, as a fixture supplying pipe lines laid in the garage, or it can be made up in portable form with an electric motor on a wheeled stand.—Utility Compressor Co., Detroit, Mich.

Jacks—Many types of lifting jacks for carrying on the car or for use in the garage are dealt with fully in the Eureka catalogue. Most of the portable type have a rapid action and either fixed or detachable handles. Special attention is drawn to the tire saving set of four jacks on which a car can be set up when putting it away for a long period.

Cored Bearing Bronze—A range of six graduated size bars of cored "Non-Gran" bronze are said to be sufficient to enable a repairer to turn up any of the fifty-four sizes of standard bushings and so cover the full range of automobile work, except for such bushings as exceed 1 1-4 in diameter. The range of bars is sold by the makers as one parcel at an inclusive price and the assortment is said to weigh about 21 pounds.—American Bronze Co., Berwyn, Pa.

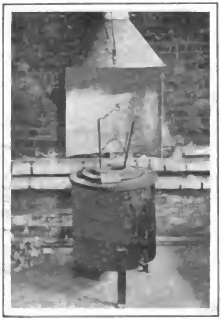
New Method of Gauging and Checking Furnace Temperatures, Inexpensive and Reliable

THERE is scarcely any process dealing with steel in the heated condition which does not call for an accurate degree of heat. Many alloy steels derive their special qualities solely from the heat treatment, which needs to be of very great accuracy indeed, and in drop forging it is possible to ruin an alloy steel part altogether by stamping it when a little too hot or not quite hot enough. The electric pyrometer has hitherto been the only practical instrument for determining temperatures and it has the two drawbacks that it is expensive to install and requires frequent attention if its accuracy is to be maintained. The essential part of a pyrometer is the thermocouple which has to be located within the furnace, and this slowly deteriorates with long-continued high temperature and becomes less and less accurate till it has to be discarded eventually and replaced by a new part.

A much simpler method of gauging high temperature has recently been invented by Harry Brearley, who is one of the best known practical metallurgists in the world. Developed in Sheffield and found utterly satisfactory the idea is now being exploited in this country by the Carl Nehls Alloy Co., Detroit, Mich., who anticipate a very large demand.

The idea which is the basis of the system is simply that it is possible to find a salt that will melt at almost any desired temperature within a quite wide range. Thus if we have a salt which melts at 800 degrees Centigrade, and if we place some in a furnace and keep it under observation, we know that as soon as it commences to melt the temperature must be at least 800. Of course this only gives a check on one side, and if we do not want the temperature to rise above, say, 820 degrees we must have a second salt melting at that degree of heat. If we now arrange the firing so that the first salt remains molten and the second stays solid we know for certain that the temperature of the furnace is between 800 and 820 degrees Centigrade.

This extremely simple notion is not new, but has been used in the laboratory for a long time, so Mr. Brearley's work has been to choose a suitable series of salts to cover all the needs of the steel trade and to make them up in convenient forms.


Carbonizing furnace with cylinders of Sentinel salt in blind tubes A. Rods B and C rest on these cylinders and since B has dropped while C is still raised we know that temperature in furnace is between the melting points of the two Sentinels

The name Sentinel Pyrometers has been chosen to describe these salt mixtures, and they are made up in two principal forms, either as solid cylinders 7/16 in. diameter and ⅝ in. long or as pastes. The cylinders are packed in wrappers showing their melting temperature, and for use in places where the degree of heat is below the melting point of glass they can be sealed in tubes and used over and over again. Still, even if only used once, the cost is very small, since 100 cylinders are supplied for $5 packed in tin cases holding fifty cylinders each.

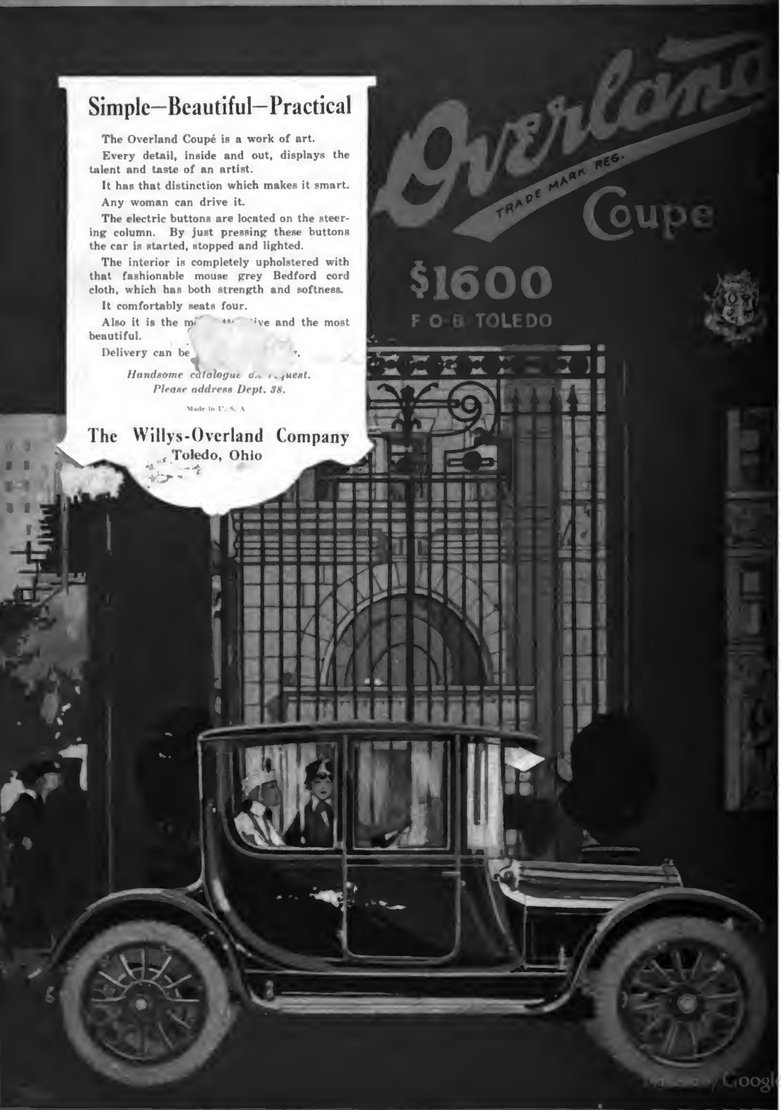
The second way in which the salts are put up is as pastes, and in this form they can be used to show the temperature of actual pieces of metal, such as steel bars being heated for drop forging. The salt is ground up finely and mixed with paraffin wax, in which condition it can be daubed on any part and the desired temperature has been reached as soon as the paste melts off. Sufficient paste to make several hundred tests is packed in cans and sold for $1.25, so its use is far from costly. The paste is a convenient form in which to use the salt to check the even heat of a furnace, since a bar of steel can have a series of daubs of paste put along it, and if one melts before another it shows that the heating of the bar is uneven, which knowledge could only be obtained with an electric pyrometer by the use of a series of thermo-couples, and these require careful and costly fitting to the furnace.

To check the temperature of a carbonizing furnace, which ought not to be opened or examined internally during the process, it might appear that the salt would be no use, since it would be out of sight. To overcome this trouble the ingenious idea has been hit upon of placing the salt cylinder at the bottom of a blind-ended tube which runs up to a visible spot outside the furnace, and then sliding a rod down the tube till its lower end rests on the Sentinel. When the latter melts, the rod of course falls, and by using two tubes, one with a cylinder that is to be kept melted and the other with a salt that ought not to melt, it is only necessary to watch the ends of the two rods. This arrangement is shown in the illustration.

While the Sentinel pyrometer cylinders and pastes will doubtless be of the greatest value to steel makers and to manufacturers using alloy steels, the pastes ought also to be very useful in repair shops where proper electric pyrometer installations would be impossibly costly for the small use to which they would be put.

Sentinel Pyrometer pastes and solid cylinders showing method of packing and marking. At back a paste sealed in a glass tube for repeated use and in front pastes daubed on an old file for testing regularity of temperature in a furnace

The new story on Carburetion and the Zenith—Send for it.



Simple—Beautiful—Practical

The Overland Coupé is a work of art.

Every detail, inside and out, displays the talent and taste of an artist.

It has that distinction which makes it smart.

Any woman can drive it.

The electric buttons are located on the steering column. By just pressing these buttons the car is started, stopped and lighted.

The interior is completely upholstered with that fashionable mouse grey Bedford cord cloth, which has both strength and softness.

It comfortably seats four.

Also it is the m[illegible]ive and the most beutiful.

Delivery can be [illegible].

Handsome catalogue on request.
Please address Dept. 38.

Made in U. S. A.

The Willys-Overland Company
Toledo, Ohio

MARCH 4, 1915

10¢ A COPY

The AUTOMOBILE

MAGAZINE

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

An Outward Expression *of* Inward Worth

Honesty and sincerity are woven into the very warp and woof of MULTIBESTOS Brake Lining. In making it complete in our own factory we are mindful of the important work it has to do when finished and in actual use.

To us it is serious business—this manufacturing of an article upon which the safety of thousands of our fellow men depends.

It is so easy to be mislead in the purchase of brake lining; so many have the same outward appearance, that we are now marking MULTIBESTOS with "White Foot Prints", or plain white lines which run across the fabric at intervals of exactly one foot.

Not only do these "White Foot Prints", protect MULTIBESTOS users; they also afford a great saving of time and inconvenience to the men in the trade who are handling it, for the marks are spaced exactly and can be used for measurement.

So, look for the "White Foot Prints"—the outward expression of true worth in brake lining.

Standard Woven Fabric Company

FRAMINGHAM, MASSACHUSETTS

SALES BRANCHES

BOSTON—903 Boylston Street, F. S. Boyd
PHILADELPHIA—1309 Race Street, N. A. Petry Co., Inc.
CHICAGO—1430 Michigan Boulevard, F. W. Sparks
SAN FRANCISCO—Cor. First and Howard Streets, Fred Ward & Son

MULTIBESTOS REG.U.S.PAT.OFF.
PAT.APPD.FOR
MULTIBESTOS REG.U.S.PAT.OFF.
MULTIBESTOS REG.U.S.PAT.OFF.
MULTIBESTOS REG.U.S.PAT.OFF.

Safe
in the Grip *of*
Multibestos

Vol. XXXII NEW YORK—THURSDAY, MARCH 4, 1915—CHICAGO No. 9

The AUTOMOBILE

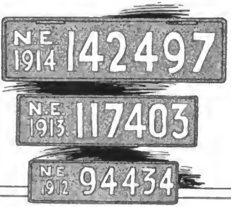
New England Gains 48,063 Cars in 2 Years

142,497 Cars and Trucks, as Compared with 94,483 in 1912—One Car to Every 52 People

By James T. Sullivan

BOSTON, MASS., March 1—Until a person has delved into statistics about the automobile industry, and these figures have been tabulated, he does not get any really comprehensive idea of what it represents. When, however, these figures are brought out it shows why the industry, as represented by the manufacturers, is such a marvelous one, and why it has enjoyed so large a growth. New England offers about the best example, comparatively speaking, of the reasons for the makers' success because, while it has a small area it has much wealth, and it was this per capita wealth that is an important factor in the buying of cars and their accessories.

Take New England to-day with its area for the entire six states of 66,424 square miles. In this country there are other states that are larger than all New England. Either New York or Pennsylvania have more people within their borders than one finds in the six New England states, and Illinois has nearly as many, which gives some idea of area and population. Yet in New England to-day there is one automobile for every fifty-three inhabitants, taking an average for all the six states.



The number plates illustrate diagrammatically the number of cars in New England in the past 3 years

New England Statistics

	1914	1912
Number of cars.........	142,497	94,483
Population	7,540,000	6,570,000
People per car..........	52	69
Total fees...............	$2,025,000	$1,070,000

Gains in 1914 Over 1912

	No.	Per Cent.
Number of cars.........	48,063	50.8
Population	970,000	14.8
People-car ratio.........	17	24.6
Total fees...............	$945,000	88.2

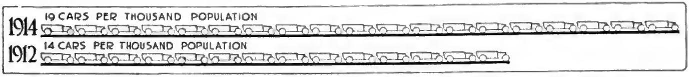
To give some idea of comparative figures, the 3 past years were gone over. In 1912 there were approximately 750,000 inhabitants in Maine, while in that year there were 7,743 cars; which equals approximately one to every ninety-seven people.

Last year the population, based on general averages, was about 800,000 and, with 14,240 machines, the per capita was approximately one to every fifty-six.

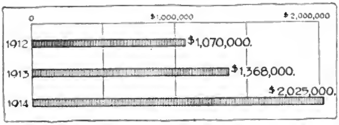
In 1912, New Hampshire had 440,000 people, and, with 5,764 cars, a ratio of one to every seventy-six; but in 1914, with about 463,000 people and 8,040 machines, it changed to one in every fifty-seven.

Vermont, too, showed a gain from 356,000 inhabitants in 1912, giving it one car to every eighty-two, while last year it was one to every forty-eight, based on 7,613 cars and about 370,000 population.

Massachusetts is the big fig-



There were nineteen cars per thousand population in the New England States in 1914, as compared with fourteen in 1912



A diagrammatic comparison of the total registration and other automobile fees received by New England States in the last 3 years

Approximate Fees Paid for Registration, Etc., in New England States

State	1912	1913	1914	Total	Gains 1914 as to 1912
Connecticut	$182,000	$233,000	$407,000	$822,000	$225,000
Maine	102,000	140,000	191,000	433,000	89,000
Massachusetts	492,000	616,000	926,000	2,034,000	424,000
New Hampshire	117,000	153,000	196,000	466,000	79,000
Rhode Island	96,000	115,000	151,000	362,000	55,000
Vermont	81,000	111,000	154,000	346,000	73,000
Totals	$1,070,000	$1,368,000	$2,025,000	$4,463,000	$945,000

Dealers, Garages and Repair Shops in New England

State	1912	1913	1914	Gain or Loss
Connecticut	409	416	507	+ 98
Maine	98	202	300	+ 202
Massachusetts	952	978	1,233	+ 281
New Hampshire	141	150	230	+ 89
Rhode Island	142	148	203	+ 61
Vermont	103	101	98	— 5
Total	1,845	1,995	2,571	726

Cars in Massachusetts Cities

Boston	7,950	Salem	620
Worcester	2,955	Waltham	620
Springfield	2,840	Pittsfield	600
Newton	1,730	Fitchburg	530
Lynn	1,425	Medford	525
New Bedford	1,260	Beverly	455
Lowell	1,180	Everett	455
Somerville	1,175	Chicopee	425
Fall River	1,130	Melrose	425
Brockton	1,105	Gloucester	395
Haverhill	1,010	Northampton	340
Cambridge	785	Chelsea	290
Malden	765	North Adams	235
Quincy	740	Woburn	225
Lawrence	670		
Holyoke	655	Total	33,515

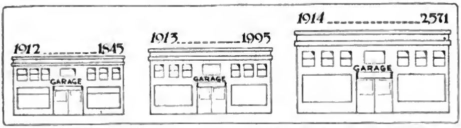


Chart illustrating the growth of dealers, garages, repair shops, etc., in New England during the past 3 years

ure in all New England statistics. In 1912 its population was 3,366,000 and with 51,229 cars it meant one to every sixty-six persons. Last year the figures grew so that an estimated population of 4,042,000 and 78,350 registrations gave it one car to every fifty-one people.

Rhode Island had 543,000 people and 7,565 cars in 1912, and this meant one car to every seventy-two people. Last year with about 600,000 people and 12,331 cars, there was a change to one in every forty-nine.

Connecticut in 1912 had 1,115,000 inhabitants and 17,950 cars, so there was one to every sixty-two. Last year there was one to every fifty-seven, based upon 21,923 cars to an estimated population of 1,265,000.

Totaling up the states, it shows that in 1912, with 6,570,000 people and 94,434 cars, there was one to every sixty-nine persons, whereas to-day, with an estimated increase to about 7,540,000 inhabitants and 142,497 cars, it is one to every fifty-three, a remarkable gain.

That this gain was productive of much wealth to the states is evidenced by the amount taken in by the states from their motor departments in the 3 years past, as it totals something more than $4,000,000.

Taking the states as individual units gives a more comprehensive series of figures:

In 1912 Maine had 7,743 cars registered. Last year, with 14,240, it showed a gain of 6,497.

New Hampshire had 5,764 cars in 1912 and 8,040 in 1914, an increase of 2,276.

Massachusetts, with 78,350 machines last year and only 51,229 3 years ago, had a gain of 27,121.

Vermont with 4,183 in 1912 and 7,612 last year added 3,430 cars in 3 years.

Rhode Island had 7,565 cars in 1912 and 12,331 last year, a gain of 4,766.

Connecticut, with 21,923 automobiles last year and 17,950 3 years ago, had 3,973 for its gain. These figures show 94,434 cars registered in New England in 1912 and 142,497 last year, or a jump of 48,063 cars in 3 years, an average of 16,021 cars a year. That gives a good idea of the consistently increasing way in which New England has been absorbing the product and in this way has helped to maintain the industry on its strong financial basis.

Fees Are Large

The fees by individual states are large. Maine received just over $100,000 in 1912; last year it received nearly double that sum and for the entire 3 years it has received well over $400,000.

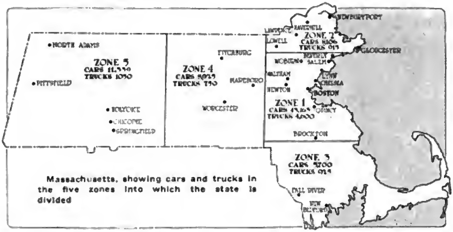
New Hampshire collected nearly $120,000 in 1912 and last year received nearly $200,000, or over $460,000 in 3 years.

In 1912 Vermont received $100,000, but last year it got over $150,000. For the whole 3 years the state received about $350,000.

Massachusetts got the big share, the fees in 1912 exceeding $490,000 and last year they were close to the million mark. In 3 years Massachusetts received about $2,000,000 in fees.

Rhode Island contributions in 1912 were roughly $95,000 and last year about $150,000. Its 3 years' total was $360,000 in round figures.

Connecticut, with its fund of under



Massachusetts, showing cars and trucks in the five zones into which the state is divided

Cars and Trucks in Massachusetts Cities and Towns in 1914 by Zones

Zone 1	
Beverley	455
Salem	620
Lynn	1425
Chelsea	290
Boston	7950
Quincy	740
Brockton	1105
Cambridge	785
Newton	1730
Everett	445
Malden	765
Melrose	425
Waltham	620
Medford	525
Woburn	225
	18,105
*Towns	25,058
Total	43,163

*Estimated.

Zone 2	
Lowell	1180
Lawrence	670
Haverhill	1010
Newburyport	145
Gloucester	395
	3400
*Towns	4706
Total	8106

Zone 4	
Fitchburg	530
Worcester	2955
Marlboro	255
	3740
*Towns	5185
Total	8925

Zone 3	
Fall River	1130
New Bedford	1260
	2390
*Towns	3310
Total	5700

Zone 5	
North Adams	233
Pittsfield	600
Holyoke	655
Chicopee	425
Springfield	2840
	4753
*Towns	6586
Total	11,339

†Based on averages of last year.

†Trucks 1	
Zone 1	4000
Zone 2	915
Zone 3	925
Zone 4	750
Zone 5	1030
Total	8220

$200,000 in 1912 and over $400,000 in 1914, was just about double and in 3 years it received $800,000, giving a total for the five states of nearly $4,500,000.

It is not possible to go back very far to get an idea of the increase in dealers, but there are figures available to show how they have gained for the past 3 years. Take Maine: In 1912 there were ninety-eight men representing cars or handling accessories and garages in the various cities and towns. In 1913 the figures grew to 202 and last year to 300. That showed an increase in 3 years of no less than 200 per cent.

New Hampshire had 141 automobile business places listed in 1912, 150 in 1913 and 230 last year, gaining eighty-nine in 3 years.

Vermont had 103,101 and ninety-eight respectively in the 3 years, showing a total loss of five traders.

Massachusetts trade showed steady growth, 952, 978, and 1,233 being the figures for the 3 years, 1912, 1913 and 1914.

Rhode Island figures were 142,148 and 203 for the 3 years, a gain of sixty-one altogether.

Connecticut had 409, 416 and 507 in the 3 years, a gain of ninety-eight.

At the same time there was a gain in the number of cities and towns where dealers, garages or repair shops could be found. This shows that the distributors are cutting down the territory and putting in more agents so that they will cover all available prospects more efficiently.

It was not possible to get the truck figures for all New England for some of the states do not keep a separate record. But the electric dealers keep track of the trucks they sell and so the figures on these for the past 2 years were secured. They are as follows:

State	1913	1914
Maine	4	4
Massachusetts	409	537
Rhode Island	20	45
New Hampshire	17	22
Connecticut	141	143
Vermont	3	1
Total	595	752

In Boston alone there are now 257 electric trucks. On the truck subject the Massachusetts registrations went above 8,000, showing an increase of over 2,000 in the course of 1914.

Last year THE AUTOMOBILE published a calculation of the trucks according to the distribution in the five zones into which the state was divided. So, comparing the figures of a year ago with those of the past year and striking an average it shows that approximately more than half the trucks are owned in the section that has Boston as its center. There is a pro ratio distribution elsewhere as shown by the map.

In the matter of passenger cars the lists of the different cities contain some interesting figures. Nearly half the cars out of the total registrations are owned by residents of thirty cities, leaving the rest distributed in the towns. Of course the greater number are owned in and about Boston, for within 5 miles of City Hall or the State House there are over 16,000 cars, this including about 8,000 in Boston.

A list of the cities shows that Boston with its 7,950 has twice as many cars as any other city. Worcester and Springfield are close rivals with only 115 dividing them. Newton ranks fourth, though it is not a big manufacturing or business city, being a large residential center.

20 to 30 Horsepower Cars

In the registration figures for Massachusetts it shows that the cars between 20 and 30 horsepower are still the favorite. In 1913 there were 12,731 of 20 horsepower and under, and the 1914 figures showed 16,911. The 20 to 30 horsepower class had 29,390 2 years ago and 35,806 last year. The 30 to 40 class had 9,145 and 10,848 and the 40-50 class 4,832 and 5,733 respectively. The 50 and over had 620 in 1913 and 635 in 1914. These figures do not include re-registration at half prices. It was possible to get the figures in Massachusetts for the past 6 years relative to dealers, chauffeurs, private operators, etc., from the highway commission. They show a steady increase year after year, as the accompanying tables indicate.

Number of Cars, Population and Ratio of Cars to People in New England

State	Approximate Population		Ratio of Automobiles to Population		No. of Cars Allowing for Duplicate Registration			Gain in No. Cars Since
	1912	1914	1912	1914	1912	1913	1914	1912
Connecticut	1,115,000	1,265,000	1 to 62	1 to 57	17,950	23,263	21,923	3,973
Maine	750,000	800,000	1 to 97	1 to 56	7,743	10,570	14,240	6,497
Massachusetts	3,366,000	4,042,000	1 to 66	1 to 51	51,229	60,826	78,350	27,121
New Hampshire	440,000	463,000	1 to 76	1 to 57	5,764	7,420	8,040	2,276
Rhode Island	543,000	600,000	1 to 72	1 to 49	7,565	9,894	12,331	4,766
Vermont	356,000	370,000	1 to 82	1 to 48	4,183	5,430	7,613	3,430
	6,570,000	7,540,000	1 to 69	1 to 52	94,434	117,403	142,497	48,063

Resta Wins Grand Prize

Peugeot, Skidding and Sliding, Covers 400.2856-Mile Track at 56.12 M.P.H. in Driving Rain—Wilcox, in Stutz, Second—Hughes' Ono Third

Winners of Grand Prize Race

Car	Driver	M.P.H.	Prize
Peugeot	Resta	56.12	$3,000
Stutz	Wilcox	55.26	2,000
Ono	Hughes	54.37	1,500
Stutz	Anderson	53.15	1,000
Simplex	Disbrow	52.79	500

Drivers Claim Course Is Not Fit for Vanderbilt—Many Wish to Withdraw

By A. G. Waddell

SAN FRANCISCO, CAL., Feb. 27—*Special* to THE AUTOMOBILE—Dario Resta, driving a Peugeot, today piloted his car to the front in the sixth grand prize race for the gold cup of the Automobile Club of America and $3,000 in prize money. He covered the 400.2856 miles or 104 laps in 7 hours, 7 minutes and 57 seconds, an average of 56.12 miles per hour and the slowest time ever made in the history of the grand prize, due to the fact that the major part of the contest was run in a driving rainstorm. The fact that the course was perhaps the slipperiest that drivers in a classic automobile race have had to contend with makes the story of the race one of the daring of the drivers as much as the stamina of the cars.

Although the victory is again the result of a foreign combination, American cars and drivers forced the victors to their utmost throughout the entire distance. Howdy Wilcox, driving a Stutz, was second to pilot his skidding mount across the finishing line. He was 7 minutes behind the Peugeot. Hughie Hughes, now an English citizen, driving an Ono car, a combination consisting of a Fiat chassis with a Pope-Hartford motor, was third. Gil Anderson and his Stutz took fourth money, and Louis Disbrow, with the Simplex of dirt-track fame, was fifth to complete the muddy journey and the last man to get the checkered flag of the starter, signifying the race was over.

Eight Still Running

At the time the Simplex finished eight other cars were still running. These were Louis Nikrent's Mercer, Harry Grant's Case, Tommy McKelvy's Overland, Kennedy's Edward special, Jack Gable's Tahis, Newhausen's Delage, Durant's Chevrolet and Taylor's Alco. Of the remaining cars ten had been withdrawn, not through mechanical trouble but because their drivers did not believe in taking chances on the slippery course. These included the following: Carlson, Maxwell; Alley, Duesenberg; LeCain, Chevrolet; Pullen, Mercer; DePalma, Mercedes; Herne, Case; Ruckstall, Mercer; Parsons, Parsons special; O'Donnell, Duesenberg; Gordon, Gordon special; and Bragg, Californian.

During the race seven cars were forced to abandon their attempt due to injuries which put them out of the race. Earl Cooper's Stutz, before the the opening of this great skidding contest, one of the favorites, sustained a broken crankcase after the fourth lap. The German Bugatti, driven by Marquis, had to drop out in the tenth lap with ignition trouble. Lou Gandy wrecked the Edward special, skidded into a straw bank on the northwest corner of the course, breaking his steering gear and putting himself out on the twenty-third lap. A broken piston on the Maxwell was the cause of Barney Oldfield's retirement on the twenty-ninth lap. Caleb Bragg, winner of the grand prize in 1912, was forced to abandon the contest after driving 126 miles because he had no non-skid tire in his pit. Rickenbacher's Maxwell dropped out on the forty-fourth lap, the reason being attributed to fouled spark plugs. Klein's King stopped in the forty-eighth circuit with a broken piston.

Although thirty cars were lined up at the start, the field was five less than that shown in the original entry list. The drivers who abandoned the contest, probably due to a premonition of the dangers of the course, were Erwin and Grover Bergdoll, in the Benz and Erwin special, respectively; Tomasini, pilot of the Tomasini special; Gates with the Renault; and Francis on the Francis-Blackman special. Nearly all held that the course was too dangerous to render the race worth while.

Speed Dropped 10 Miles

The race was started promptly at 10:30 a. m. by Starter Wagner who sent the cars away in groups of three. At that

time, although the weather was threatening, rain had not commenced to fall and did not until about 100 miles had been covered by the leaders. The pace up to this time showed that the time would have been close to the 70-mile mark had dry weather continued. Before the rain Resta was averaging 68 miles per hour and his pursuers were going more than 60. As soon as the deluge started the speeds were materially reduced and the two right angle curves on the course commenced to be taken at speeds as low as 25 miles per hour. After 80 miles, it is reported, Resta equipped his car with non-skid chains on all four wheels.

The course of macadam and planks soon became so treacherous that ten of the thirty drivers who started withdrew, refusing to take further chances in the driving downpour. The 68,000 people in attendance experienced a series of thrills which rarely if ever have been equalled on an automobile race course. Car after car slid from side to side and once Jim Parsons turned completely around in attempting to avoid a statue on the course. His car was headed straight for San Francisco Bay when finally he managed to bring it to a stop. That no one was injured during the entire day is only due to the good fortune of the drivers. Lou Gandy narrowly escaped disaster when his car went head-on into a bank of straw breaking his steering gear. Neither he nor his mechanic was injured, although their escape was miraculous. Pullen and DePalma skidded into the hay bulwarks so often that the crowds on the turns began to accept it as a regular occurrence. The drivers themselves are amazed that they are all safe and sound and none of their mates are occupying any of the local hospital wards.

A pit scene on the Vanderbilt and Grand Prize race track, with Anderson's Stutz in the foreground

Ralph DePalma withdrew after completing sixty-seven laps. Although his Mercedes was in condition to continue he believed it was foolhardy to take any more chances on the hazardous course, especially in view of the fact that he is entered in the Vanderbilt Cup race to be run next Saturday and he did not wish to injure his prospects for that race. Two other favorites to withdraw were Barney Oldfield and Ed Pullen. This left the race to the dark horses. Resta had never driven in America before but he had become famed through his driving of the Sunbeam at Brooklands and his victory in the 1912 French Coupe de L'Auto. His daredevil driving soon brought the spectators to the realization that this new invader from Europe was a master of his car in wet treacherous conditions. The manner in which he guided his torpedo-shaped car in spite of the rain and on the greasy, slippery roads was a revelation.

Gasoline Cost Hughes $500

Hughie Hughes, reinstated within the week by the American Automobile Assn., was Resta's most dangerous rival throughout the struggle. He was always close to the winner and for ten laps showed the way. This was between the eighty-fifth and ninety-fourth circuit. At that time he ran out of gasoline on the back stretch and his mechanic was forced to sprint the course to the pits for fuel. The time lost in spite of the fleetness of foot of the mechanician was never made up and at the finish Wilcox led Hughes by 7 minutes. The gasoline required to go half way around the course cost Hughes $500.

Anderson and Hughes came among the moneyed five only after the fortieth lap was finished. At that time Ed Pullen was running in fourth place. At first the officials gave Disbrow fourth, but a rechecking of the tables put him in fifth place and the Stutz fourth.

Foreign-built cars have won the grand prize five out of the six times it has been run. The only American triumph was scored last February when Eddie Pullen, pilot of the Mercer, captured the trophy at Santa Monica. Previous to 1914, the winners were Caleb Bragg, in an Italian Fiat in 1912, David Bruce-Brown, Fiat, 1911, and Benz, 1910, and Louis Wagner in a Fiat in 1909.

Drivers Protest Vanderbilt Course as Unfit

SAN FRANCISCO, CAL., March 1—*Special Telegram*—Unless there is a change of feeling among the drivers between now and Saturday, the Vanderbilt cup race, to be run over the Panama-Pacific exposition course March 6, will be a huge farce and the premier motor contest of America will be a comedy of laughs instead of a struggle of thrills.

At the completion of the water-soaked grand prize race, many of the drivers declared that they would not start in the Vanderbilt cup classic and threatened to leave San Francisco immediately. They will be compelled to remain, however, and start Saturday under penalty of being blacklisted by the American Automobile Assn. if they do not. Had they given formal notice of their withdrawal from the lists immediately after the announcement of the postponement of the Vanderbilt cup race from February 22 to March 6, they would have been safe and the governing body could not disqualify them. The drivers claim that the course is unfit for racing.

Despite the storm of protests and the existing dissatisfaction, the list of starters in the Vanderbilt cup race Saturday will be the same as that announced for February 22 with three exceptions. Erwin Bergdoll has been released by the management and has shipped the Erwin Special and the Bens, a reserve car, to Philadelphia. Bergdoll was injured in practice when his car went through the fence.

Tomaeini may not be allowed to start as the other drivers claim that he is not capable. The Renault, formerly owned by Barney Oldfield and now the property of Ivan R. Gates, of San Francisco, also has been withdrawn. It was not permitted to compete for the grand prize as it was regarded as dangerous.

Equipment on Winning Cars in Grand Prize Race in Order of Finish

Car	Driver	Carbureter	Magneto	Plugs	Tires	Oil	Wheels	Motometer
Peugeot	Resta	Master	Bosch	Rajah or Oleo	Nassau	Oilzum	Rudge	Boyce
Stutz	Wilcox	Schebler	Bosch	Bosch	Silvertown	Monogram	Houk	Boyce
Ono	Hughes	Master	Bosch	Bosch	Firestone	Oilzum	Wood	Boyce
Stutz	Anderson	Rayfield	Bosch	Bosch	Silvertown	Monogram	Houk	Boyce
Simplex	Disbrow	Rayfield	Bosch	Bosch	Silvertown	Oilzum	Rudge	Boyce

S. A. E. Standards Committee

Two New Divisions—Summer Trip to Georgian Bay

NEW YORK CITY, March 1—Announcement has been made by the Society of Automobile Engineers of the personnel of the new standards committee and of the plans for the itinerary of the summer meeting of the society which will take place June 14 to 17 on board the *S.S. Noronic* in the waters of Georgian Bay.

In accordance with the custom of the society to annually revise the membership of the standards committee, the council at its last meeting made appointments of members for the year of the administration of President William H. Vandervoort. It will be noted that a new division has been created under the name of the International Standards Division and another known as the Chain Division. For the time being the aluminum and copper alloys division, broaches division, commercial car wheels division, data sheet division, motor testing division and standards exchange division have been discontinued for the time being. The commercial car wheels division has been combined with that devoted to truck standards.

The activities which the data sheet division has maintained will be continued through the office of the society in co-operation with members particularly well informed on the various subjects covered by the data sheets. The various matters which the standards exchange division has been working on, particularly the standardization of bell housings, will be taken in hand by the miscellaneous division. The divisions which have been discontinued are those which have finished their work insofar as it is at present practicable to carry it out.

International Standards Division

The newly-created international standards division has been founded for the purpose of promulgating the standards of the society abroad and to formulate and assist in formulating recommendations as to the international standards relating to the design and construction of motor vehicles. The need of such a division has been particularly suggested by Past-President Leland who pointed out at the last meeting of the standards committee the difficulties involved in American car manufacture owing to the difference in the European and American standards of pneumatic tire rims. On this subject Mr. Leland's remarks were as follows:

S.S. "Noronic" on which S. A. E. will take summer trip in Georgian Bay, June 14 to 17

> "We are seriously handicapped by the fact that there is no standard, but chaos, in metric sizes. While our shipments abroad at the present time are comparatively limited, this is a considerable annoyance to us. While we are making but one size chassis, and so far as the American trade is concerned would like to use only one size wheel, yet we find today when considering the various types of the different makes of tires we have to use, we are carrying thirty-two types of tires. Insofar as the metric sizes are concerned, it means a different type and sized rim in many cases. That makes it necessary to have in stock wheels all painted to go with any given car. This is expensive and at times a serious handicap."

The council has established the same division in pursuance of the resolution passed at the last meeting of the standards committee to the effect that it is desirable to have a committee endeavor to formulate a standard tooth for silent chains.

As announced in THE AUTOMOBILE for February 18, K. W. Zimmerschied, past vice-president of the society, will serve as chairman of the standards committee during the year. Herewith is the new committee list.

The Summer Meeting

The summer meeting will be held on board the steamship *Noronic*. This is the flagship of the Northern Navigation Co. fleet. It is 385 feet overall. This is a solid steel double-bottom vessel having six decks.

STANDARDS COMMITTEE

K. W. Zimmerschied, Chairman, General Motors Co.

Ball and Roller Bearings Division

F. G. Hughes, Chairman, New Departure Mfg. Co.

C. H. Clement, Metal Products
David Ferguson, Pierce-Arrow
F. M. Germane, Standard Rol.-Bear'g
B. D. Gray, Hess-Bright Mfg.
F. J. Jarosch, J. S. Bretz
C. W. McKinley, Willys-Overland
W. R. Strickland, Peerless
M. W. H. Wilson, Cadillac

Carbureter Fittings Division

Jerome J. Aull, Chairman, the Lunkenheimer Co.

Arthur B. Browne, Consulting Eng.
C. W. Findeisen, Findeisen & Kropf
C. P. Grimes, Wheeler & Schebler
George M. Holley, Holley Bros.
Howard Marmon, Nordyke & Marmon
C. W. Stiger, Stromberg

Chain Division

Warren J. Belcher, Whitney Mfg.
John R. Cantley, Peter A. Frasse
Herbert F. Funke, H. F. Funke
F. L. Morse, Morse Chain
H. Schipper Pierce, Link Belt
W. A. Rockenfield, Am. High Sp. Chain

Electrical Equipment Division

A. L. Riker, Chairman, Locomobile Co. of Amer.

Joseph Bijur, Bijur Motor Lighting
W. L. Bliss, U. S. L.
C. M. Bunnell, Edison Lamp Works
Alex. Churchward, Gray & Davis
W. H. Conant, Gould Storage Battery
H. W. Harter, Howard Min. Lamp
Russell Huff, Packard Motor Car
Leonard Kebler, Ward Leonard
T. L. Lee, North East Electric
A. D. T. Libby, Splitdorf
Alden L. McMurtry, Consulting Eng.
R. J. Nightingale, Willard Battery
H. G. Osburn, Nat'l Metal Moulding
Wm. H. Palmer, Jr., El. Stg. Battery

Electric Vehicle Division

A. J. Slade, Chairman, Consulting Engineer

J. R. C. Armstrong, General Vehicle
H. S. Baldwin, General Electric
E. P. Chalfant, Martin Carriage Wks.
Alex. Churchward, Gray & Davis
W. H. Conant, Gould Storage Battery
R. S. Fend, Woods Mo. Veh. Co.
Bruce Ford, Electric Storage Battery
J. H. Hertner, Rauch & Lang
W. E. Holland, Anderson Electric
Wm. P. Kennedy, Consulting Eng.
R. McA. Lloyd, Consulting Eng.
E. J. Ross, Jr., Edison Stg. Battery
C. A. Ward, Ward Mo. Veh. Co.
G. W. Wesley, General Vehicle
F. A. Whitten, Gen. Motors Truck
E. R. Whitney, Comm. Truck Co.

Frame Sections Division

J. G. Perrin, Chairman, Lozier Motor Co.

C. E. Clemens, Perfection Spring
J. E. Maloney, Hydraulic Pr. Steel
A. L. Riker, Locomobile
L. R. Smith, A. O. Smith Co.
W. R. Strickland, Peerless Motor Car Co.

International Standards Division

W. H. Allen, B. F. Goodrich
C. C. Carlton, Firestone Co.
A. Ludlow Clayden, Class Journal
J. E. Hale, Goodyear
H. M. Leland, Cadillac
B. Maraini, Fiat Co.
John V. Pugh, Rudge Whitworth
A. A. Remington, Wolseley T. & M.
C. B. Whittelsey, Hartford Rubber Works Co.

Iron and Steel Division

K. W. Zimmerschied, Chairman, General Motors Co.

G. F. Fuller, Wyman & Gordon
Radclyffe Furness, Midvale Steel
J. A. Mathews, Halcomb Steel
Geo. L. Norris, American Vanadium
J. H. Parker, Carpenter Steel
C. F. W. Rys, Carnegie Steel
G. W. Sargent, Crucible Steel
Henry Souther, Ferro Mch. & Found.
F. W. Trabold, J. H. Williams & Co.

Lock Washer Division

C. H. Loutrel, Chairman

C. E. Davis, Mechanical Eng.
C. W. McKinley, Willys-Overland

Miscellaneous Division

John G. Utz, Chairman, Perfection Spring Co.

E. H. Ehrman, Chicago Screw
Berne Nadall, Stewart-Warner
N. B. Pope, Motor Trades Pub. Co.
C. W. Spicer, Spicer Mfg. Co.
E. E. Sweet, Cadillac
E. R. Whitney, Com. Truck Co.

Pleasure Car Wheels Division

E. R. Hall, Chairman, Goodyear Tire & Rubber Co.

H. L. Barton, Mercury Cyclecar Co.
C. E. Bonnett, Tire Mfrs. Assn.
R. S. Bryant, Standard Welding
C. C. Carlton, Firestone
J. G. Vincent, Packard
J. H. Wagenhorst, United Rim
C. B. Whittelsey, Hartford Rubber
C. B. Williams, Mott Wheel Co.

Research Division

David L. Gallup, Chairman, Polytechnic Institute

R. M. Anderson, Stromberg
R. C. Carpenter, Sibley College
H. L. Connell
Walter T. Fishleigh, Univ. Mich.
F. R. Hutton, Consulting Eng.
Charles E. Lucke, Columbia Univ.
J. A. Moyer, Penn. State College
Daniel Roesch, Armour Inst.
C. B. Veal, Purdue Univ.

Springs Division

C. W. McKinley, Chairman, Willys-Overland Co.

A. C. Bergmann, Mercer
C. E. Clemens, Perfection Spring
Ralph L. Morgan, Consulting Eng.
W. M. Newkirk, Wm. & H. Rowland
C. F. W. Rys, Carnegie Steel Co.

Truck Standards Division

Wm. P. Kennedy, Chairman, Consulting Engineer

W. H. Allen, B. F. Goodrich
B. B. Bachman, the Autocar Co.
George D. Carpenter, White Co.
H. D. Church, Packard
C. E. Clemens, Perfection Spring
J. E. Hale, Goodyear
Russell Hoopes, Hoopes Bros.
Robert McA. Lloyd, Consulting Eng.
C. T. Myers, Mechanical Eng.
F. F. Phillips
A. C. Schulz, Locomobile
E. R. Whitney, Com. Truck Co.
C. B. Whittelsey, Hartford Rubber
John Younger, Pierce-Arrow

S.A.E. Gas-Electric Committee Reports

Metropolitan Section Hears Preliminary Results of Work of Research Committee—Two Classes of Drive—Officers Elected

NEW YORK CITY, Feb. 22—Last night's meeting of the Metropolitan section of the Society of Automobile Engineers, marked the close of the fiscal year. Besides the business coincident with the closing of the year, the subject of discussion was the report of the gasoline-electric research committee which was appointed early in the summer of 1914 to investigate and report on the status of this art.

Robert McA. Lloyd, consulting engineer, was elected chairman for the ensuing year, succeeding Joseph A. Anglada, who held that office for the last 3 years. J. Edward Schipper was elected secretary and Prof. W. C. Marshall, treasurer. Under a new form of Constitution adopted prior to the election, the Governing Committee is increased from three to five members, Ex-President Anglada and Niran Bates Pope, the retiring secretary, being elected as governors to serve for 1 year.

Membership Is 140

The financial reports of the section showed a balance on hand of $192.99 and a membership of 140. The secretary's report giving a review of the year dwelt particularly on the work of the research committees of which six were appointed but only in one instance, that of the gasoline-electric, had any real valuable results been obtained. It was pointed out, however, that this should not discourage the work as with new methods of attack, this can be made one of the most valuable branches of the society's work as the results will not only be available for the section members, but also for the Society at large through the transactions.

The report of the gasoline-electric division which consists of David Beecroft, THE AUTOMOBILE, chairman, W. P. Kennedy, consulting engineer and L. G. Nilson, Nilson-Miller Co., was in the nature of a preliminary report. It was divided into three divisions, read respectively by the different members of the committee. The first dealt with the nature of the work and the method of carrying out the investigation; the second dealt with the methods of classification and the description of the different systems which fell under these classes and the third, went into the history of the development of the gasoline-electric drive and the patent situation.

Twofold Classification

David Beecroft, who spoke of the methods used in carrying out the work, pointed out the difficulties in the way of busy men in bringing the results to a satisfactory close. He stated that the gathering of the data was more readily accomplished by the committee than the large amount of clerical work involved in its tabulation. He also pointed out the desirability of having the Society as a whole support financially the work of these committees. Mr. Kennedy pointed out the method of classification which was primarily twofold. The first classification included those vehicles in which the energy of the motor is completely transformed into electrical energy. The second classification included those drives in which a portion of the energy only is converted into electrical and the remainder is delivered mechanically. The committee was somewhat puzzled over the reception that would be given to the including of magnetically transferred drive into the second class as it was feared that many of the members would not agree with the members of the committee in terming a magnetic transmision one such as is used in the Entz, where the fields are positively connected to the motor shaft and the magnetic drag of these is relied upon to transmit the power. The slip in this case is the only portion of the drive which is transferred into electrical.

Thirty-six Gasoline-Electric Patents

Mr. Nilson in his discussion of the patent situation pointed out that no less than thirty-six American patents relative to gasoline-electric systems of transmission have been considered by the committee in the course of its investigation. In addition many modern patents have been gathered and descriptions of a number of systems which have never found their way into the patent office. The probable inception of the work was traced back by Mr. Nilson to W. A. Patton, in 1889.

The body of the report of the committee was that part rendered by Mr. Kennedy as follows:

In gas-electric vehicles, the transmission may be entirely electrical, that is, all the mechanical energy delivered by the engine is (by means of a dynamo) converted into electrical, and then again transformed into mechanical by means of one or more electric motors, connected in any suitable manner to the driving wheels. Or it may include a great variety of modifications using mechanical or electro-mechanical clutch devices and drives, in which case only a portion of the engine power would be transformed into electrical energy or the power of the engine may be entirely transformed into electrical energy for a part of the time in the operation. Storage batteries may also be used in connection with practically any of the combinations having D. C. machinery.

So many combinations have been used and proposed, that some scheme of classification must be made before studying or comparing the different systems.

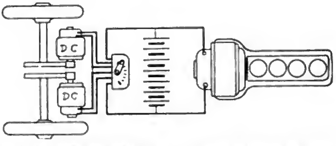


Fig. 1—Complete conversion system 1-A used in connection with a battery

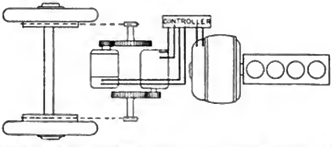


Fig. 2—Complete conversion system 1-B in which no battery is employed

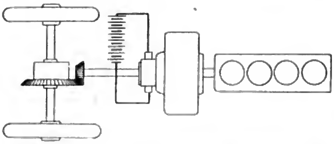


Fig. 3—Electro-mechanical system 2-A in which a battery is connected across generator terminals

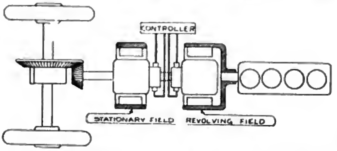


Fig. 4—Electro-mechanical system 2-B generator performing the function of the clutch

We would, therefore, divide the gas-electric systems into two main classes as follows:

First.—Complete Conversion Systems.
Second.—Electro-Mechanical Systems.

Complete Conversion Systems

The first—Complete Conversion Systems—include all equipments where, by means of a dynamo-electric machine, all the mechanical energy delivered by the engine is transformed into electrical energy, transmitted as such to the place wanted and then by means of electric motors reconverted into mechanical energy and delivered to the driving wheels.

Electro-Mechanical Systems

The second—Electro-Mechanical Systems—Comprise all the equipments in which the shafts of the engine, dynamo and motor are all in direct alignment, so that such portion of the engine power which is not converted into electrical energy may by means of some clutch mechanism be transmitted to the driving wheels.

The clutch mechanism may be entirely mechanical or it may be electro-mechanical; or the drag between the field and armature of the generator may act as a clutch; but, however that is done the final drive is electro-mechanical; a portion of the engine power may be transmitted to the propellor shaft without being first turned into electrical energy and reconverted into mechanical energy or the energy of the engine may be used electrically for starting or a temporary portion of the operation.

Each of the above main divisions can be divided into subclasses. For instance: the "Complete Conversion Systems" can be divided into sub-classes A and B; and the second main division "Electro-Mechanical Systems" can be divided into sub-classes A, B, C, etc.

As an illustration, we now have in Fig. 1 an example of the Complete Conversion System sub-division 1A, which consists of an internal combustion engine directly coupled to a D. C. generator, two electric motors mechanically connected to the driving wheels, a storage battery connected across the main leads between the generator and the motors; and the necessary switches and rheostats. The speed of the engine and the voltage are approximately constant, the maximum variation usually being from 20 to 33 per cent. The speed of the vehicle is governed by a controller the same as that of the conventional trolley-car or electric vehicle.

Fig. 2 represents sub-class 1B and shows the engine, generator and motors used mainly for cutting out, series-parallelling and reversing the motors. The speed of the vehicle is usually controlled by changing the voltage of the generator which can be accomplished by operating the throttle so as to change the speed of the engine. A rheostat can also be placed in the shunt circuit of the generator for controlling the field strength of same and used in conjunction with the throttle. Sometimes a separate exciter is used for controlling the field of the generator.

We now come to the second main division "Electro-Mechanical Systems" in which the total energy of the engine is not converted (for final employment) into electrical energy, only a part being so converted and the remainder transmitted to the driving wheels by other means. We have a number of variations in this division.

Fig. 3, 2-A represents the first sub-division of electro-mechanical systems combustion engine directly connected to a D. C. generator, the shaft extending through a system of gears to the driving wheels very much as in a conventional gasoline-propelled car. A storage battery is connected across the generator terminals, the idea being to have the electrical machine act as a generator charging the batteries when there is power to spare, and then again automatically changing into a motor to assist the engine whenever same is being overtaxed. For reverse running a coupling between the generator and the engine can be released and the generator operated in a reverse direction as a motor, or the engine and the generator may be connected permanently and a mechanical reverse used the same as in a conventional gasoline car, neither of these devices being shown in the illustration.

Fig. 4 illustrates the second sub-division 2 of electro-mechanical systems. In this case there is no actual mechanical coupling between the engine and the driving wheels, but the generator performs the function of a clutch for transmitting the engine torque to the driving wheels. The generator has the field magnets mounted directly on the engine shaft revolving around its armature. The armature shaft is extended and connected by means of the necessary gearing to the driving wheels. On this same generator-armature shaft there is mounted the armature of an electric motor sur-

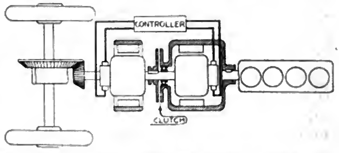


Fig. 5—Electro-mechanical system 2-C which is provided with a friction clutch

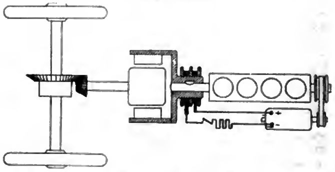


Fig. 6—Electro-mechanical system 2-D—magnetic clutch principle without engine torque increase

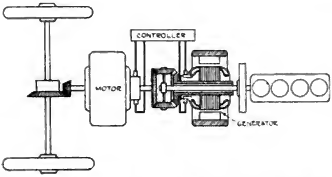


Fig. 7—Electro-mechanical system 2-E having a continuous mechanical connection

rounded by a stationary field frame. The speed of the vehicle is controlled by the speed of the engine, as well as by the amount of slippage allowed between the revolving field and the generator armature. On high speeds the electric motor is inactive, but the generator is short circuited, reducing the slippage to a minimum. On lower speeds when additional power is needed, the electrical energy produced by the generator is applied in the motor, which then acts as a booster increasing the torque.

Fig. 5 represents the third sub-division 2-C of electro-mechanical systems and is in general similar to 2-B except that a friction clutch is added for locking together the armature and field of the generator, entirely eliminating the electrical losses when running on high.

Fig. 6 of electro-mechanical systems and class 2-D of electro-mechanical systems is an example of the employment of the magnetic clutch principle but without provision for increasing the engine torque. A separate exciting dynamo is used, energizing the revolving field of the generator keyed to the propeller shaft. By means of a controlling rheostat in the circuit of the exciting dynamo the degree of magnetization of the revolving field is changed, producing any desired torque within the capacity of the engine.

Fig. 7 shows the fifth sub-division 2-E of the electro-mechanical system. In this case there is a continuous mechanical connection between the engine and the driving wheels, but continuous co-operation of the generator and motor is necessary for moving the vehicle. The engine shaft is extended to the spider portion of a differential on which are mounted the conventional bevel pinions meshing with a crown gear on each side. One of the crown gears is keyed to the hollow armature-shaft of the generator located between the engine and the differential. The other crown gear is keyed to the armature-shaft of an electric motor located between the differential and the driving wheels. This armature shaft is by means of suitable gearing connected to the driving wheels.

It will be noticed that the torque of the engine is evenly divided between the two electrical machines, so that the speed of the generator added to the speed of the motor is always double that of the engine. If, for instance, the motor shaft were locked, the generator armature would revolve at double the engine speed. The speed of the vehicle, therefore, depends upon the differential action between the generator and motor. By suitable control the field strength can be changed so that the speed of either machine can be made to vary between zero and double the engine speed. The current produced by the generator is applied on the motor which adds additional torque to that produced directly by the engine.

Discussion on Size of Motor and Generator

There was some discussion on a question raised by Louis Marburg, Marburg Bros., on the size and rating of the electric motor and electric generator necessary with the gasoline-electric drive. Mr. Nilson pointed out that the elec-

Gasoline-Electric Patents Issued

The following are some of the American patents that have been issued relative to Gasoline-Electric systems of transmission:

No.	Date	Name	Title
401,205	4/ 9/89	W. H. Patton	Street Car
424,817	4/ 1/90	W. H. Patton	Boat
475,702	5/24/92	W. H. Patton	Electric Car
489,709	1/10/93	C. Hering	Electric Motor
546,966	9/24/95	M. J. Wightman	Motor Control
614,709	11/22/98	G. DuPont and M. Johannet	Automobile Drive
671,662	4/ 9/01	H. P. White	Electric Motor
629,872	8/ 1/99	J. T. Robson	Electric Motor
675,846	6/ 4/01	A. Benson	Motor Control
675,847	6/ 4/01	A. Benson	Motor Control
675,848	6/ 4/01	A. Benson	Transmission
687,623	11/26/01	J. B. Hall	Transmission
714,154	11/25/02	A. G. Davis	Electric Distribution
732,062	6/30/03	J. B. Entz	Transmission
732,944	7/ 7/03	C. Jenatzy	Transmission
781,968	2 /7/05	J. Sachs	Dynamo System
786,376	4/ 4/05	L. G. Nilson	Gas-El. Vehicle
786,775	4/ 4/05	L. G. Nilson	Motor Control
801,355	10/10/05	E. J. Berg	Gas-El. Vehicle
801,823	10/10/05	E. J. Berg	Gas-El. Vehicle
801,898	10/17/05	H. McNulta	Transmission
805,188	11/21/05	H. E. Dey	Motor Control
808,263	12/26/05	E. Thomson	Gas-El. System
827,766	8/ 7/06	A. Weiss	Gas-El. System
829,827	8/28/06	E. H. Anderson	Gas-El. System
833,051	10/ 9/06	A. W. Harrison	El. Mech. System
895,618	8/11/08	L. K. Clark	Clutch-el. Idea
932,312	8/24/09	L. G. Nilson	Gas-El. System
1,080,447	12/ 2/13	A. H. Hoadley	Drive System

Main Division 1—Complete Conversion System

1—A With Battery*		1—B Without Battery*	
Patton	Krieger (1903)	North Eastern R. R.	Greenwood Battery
Fischer	C. B. & Q. R. R.	Fifth Ave. Coach Co.	Electrogenia
Strand	Hicks	General Electric	Alden Sampson
Neftel	C. & A. R. R.	Lohner-Porsche	Couple-Gear
Milde		De Dion Bouton	Blount & Lovell
		Gibbs	Hexter
		British T. H.	La France
		British Westinghouse	American-British
		Hart	Rankin Kennedy
		Tilling, Stevens	Krieger

Main Division 2—Electro-Mechanical Systems

2-A: Engine directly connected to D.C. generator, the shaft extending through a system of gears to the driving wheels-storage.

2—A*	2—B*	2—C*	2—D*	2—E*
Munson	Entz	Clark	Jenatzy	Carolan
Pieper	Renault	Hart-Durtnall		Thomas
Dowsing	Germain			
Astle-Wallis				
Farrow				
Thury				
Daimler (Caventus)				

---

*For explanation of these sub-classifications see accompanying text.

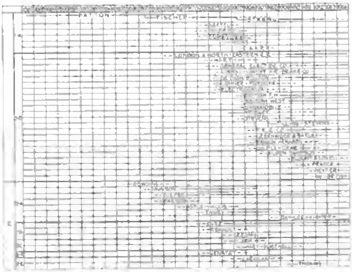


Fig. 8—Showing the chronological arrangement of the patents above listed

trical units can be small as they are not required to take the full load and furthermore the horsepower rating of the gasoline motors employed are frequently in excess of the power delivered. As an example he mentioned the use of a 3-kilowatt machine for a 15-horsepower engine used on a 1-ton truck.

Considerable discussion also hinged upon the point as to whether or not drives such as the Entz could be called mechanical. In this drive the only connection between the engine and the driving shaft is that provided by the magnetic attraction of the rotating fields for the driven armature. In answer to this Mr. Nilson pointed out that although the connection is not a positive one it is nevertheless mechanical in the same sense as the connection in a dynamometer in which the drag of the fields upon the armature or the armature upon the fields is taken as the measurement of mechanical horsepower. He furthermore showed that the only electrical energy created is that due to the slip between the fields and the armature.

The Efficiency Question

In regard to a question asked by Prof. W. C. Marshall on the efficiency of the gasoline-electric system, Mr. Nilson stated that no definite figures are available covering the entire apparatus. For instance, where a battery is used there is a 25 to 30 per cent. loss in charging and discharging and there is also a variation in the percentage of energy that is used for storing the battery.

Problems of the Eight Discussed

Engineers Consider Features Comparatively with Other Types—Decide Eight Makes Special Manufacturing Proposition—Must Be Well Made if Qualities Are To Be Brought Out

THE impression gained by reading the first brief reports of the discussion on the eight-cylinder motor held recently by the Indiana Section of the S. A. E. was that a large amount of extremely important work had been done. Subsequent conversations with several of those present, however, suggests that very few points of real novelty were brought out, and that knowledge concerning the eight was not advanced very much.

Reasons for the Eight

The main theme of J. O. Heinze's paper was that the eight-cylinder motor should be regarded as a step forward, on account of its greater evenness of torque, this being especially noticeable below road speeds of 15 miles per hour. Mr. Heinze said that what the automobile public desired was the nearest possible approach to a turbine, or truly rotary power producer, and that the eight must therefore be regarded as the best type yet because it approximates most closely to the turbine ideal.

Neither Mr. Heinze, nor the speakers in discussion, seems to have brought out the obvious point that in endeavoring to approximate to a rotary power producer there must be a limit beyond which it does not pay to go, because most of the arguments advanced by the author would have applied with equal force in stating a case for the 12, 24, 48, or any other number of cylindered motor. No doubt Mr. Heinze really intended to emphasize his opinion that the eight-cylinder had not been produced solely for the purpose of supplying something new for the public to buy, but that it was an engineering product the reasons for its appearance being sound engineering reasons.

Problems of Design

Mr. Heinze then proceeded to discuss the special problems in connection with the design and construction of eight cylinders. First, he explained by means of diagrams the already well understood difficulty in proportioning the oil so that both sets of cylinders receive an adequate supply without one set becoming over-lubricated. He then brought out the quite important point that forced lubrication, in which all the bearings except the piston pins are supplied through a drilled crankshaft, makes the best possible form of oiling; so that this feature of the eight-cylinder motor is incontestably a step forward.

He then dealt with the question of connecting-rod bearings and showed that the forked connecting-rod gave a larger bearing surface in proportion to the length of the motor and the dimensions of the crankshaft than it was possible to get by means of staggering the cylinder; or by any other means arranging two ordinary large ends side by side on the same crankpin.

A point brought out which has not been appreciated fully is that in the eight the crankpin is very much larger in proportion to the cylinder diameter than it has been made for four-cylinder motors; that is to say despite the forked connecting-rod a much larger bearing is provided for the large ends than is usual for any other type of motor. This should, of course, improve the durability of the bearing and Mr. Heinze stated that this should be regarded as highly important since to take down an eight would be very much more troublesome and far more costly than to deal similarly with a four-cylinder motor.

Cost of Manufacture

Discussing the cost of manufacture, he said that the reason the Northway motor had the cylinders cast in two blocks of four was that they believed it to be the cheaper way at present. He spoke in appreciative terms of the Ferro motor and said that possibly other concerns were mistaken in not casting all eight cylinders in one piece. That, however, is a point which time would have to decide.

He considered that the overhead valve type was distinctly attractive from several angles but that it would be much easier to obtain quietness in operation from the L-head cylinder and normal style of valve.

The next point dealt with was the two systems of valve operation. It was the author's opinion that using a single cam for opposite pairs of cylinders with the necessary interposition of rockers gave opportunities for error in timing which might be serious. The proportions of the rockers and the locations of their centers must needs be extremely accurate if the timing is to be true. It was for this reason that the Northway company preferred to use sixteen cams and direct push rods for the valves.

Carburetion, he said, was one of the principal troubles and he believed that at speeds below 1,000 r.p.m. the volumetric efficiency of the eight-cylinder is not as good as it should be; and this he thought could be accounted for by the reversal in the direction of the flow in the intake manifold. This suggests that good results may be expected by careful experimenting with different manifold designs. It may be remembered that in the early days of the six trouble owing to uneven gas distribution was very usual and that this has been overcome in several different ways.

Frictional Losses

The next point dealt with was frictional loss and Mr. Heinze pointed out that this must necessarily be greater in the eight than with any kind of motor with fewer cylinders, because there was much more piston surface in proportion to the displacement. This point was taken up by W. G. Wall, who, in a rough calculation, showed that the amount of surface in the eight-cylinder exceeded that in the four by almost 40 per cent. Mr. Wall suggested that the placing of the carbureter above the cylinders was likely to produce trouble at slow speeds through gasoline draining into the valve pockets. In his reply Mr. Heinze said that he did not quite agree with this point and his only suggestion in relation to curburetion was that it was hard to obtain the same power per cubic inch. On the point of frictional losses another speaker afterwards stated that experiment with equal sized four- and eight-cylinder motors in the same chassis showed gasoline consumptions in the ratio of 10 to 12 in favor of the four. There was no difficulty in obtaining all the flexible qualities one could get with any other kind of motor and, of course, the number of cylinders helped very greatly to improve flexibility.

Mr. Wall briefly discussed the balance of the eight and voiced the idea that the amount of vibration which could be felt was in direct proportion to the number of cylinders used. It was also suggested that a rocking vibration like that produced by the unbalanced couple in a two-cylinder or three-cylinder motor was much more important from a sensory point of view than either vertical or horizontal vibration. One or two of the speakers did not make it altogether clear whether they were considering vibration or the torsional oscillation of the whole motor in the frame due to fluctuation in torque. In concluding his contribution Mr. Wall made the remark that the word accessibility was hardly applicable to an eight, but that some eights were worse than others.

Public Demand Ungauged

It was stated that the public were not greatly interested in the automobile as a machine for doing the work economically, that is to say, gasoline and oil consumption were not treated by them as a very serious consideration, and this point was taken up by Howard Marmon. In discussion he suggested that even if this were true today it certainly would not continue to be so forever, that the thermal efficiency of the automobile as a complete machine must ultimately be the main consideration.

As far as the greater smoothness of the eight is concerned Mr. Marmon pointed out that it was a question of whether the human frame was capable of differentiating between the number of impulses per minute above a certain frequency. This, he said, was a matter which could not be decided by engineers, which meant that it remained for the public to show whether they obtained greater satisfaction when riding behind an eight then behind a six. It was anticipated that it would take at least a year for the public opinion to become recognizable.

Mr. Apperson discussed principally the possibility of uneven wear on the connecting-rod bearings, the underlying notion being that it would be impossible for the ordinary repairman to readjust or scrape bearings of the forked end type. The general opinion was that wear would be much slower than in other types of motors and for this reason trouble in adjustment need not be considered. Allowing for the improved lubrication, usually a feature of the eights, this is probably a perfectly sound position to take up and it would not be a difficult matter to put in a complete new bushing to suit both the fixed and forked ends.

An Experimental Twelve

C. P. Grimes supplied some details concerning the twelve-cylinder V motor built by George Schebler for his own personal use. This had two sets of six-cylinders arranged V fashion and having a main crankshaft bearing between each throw of the crank. Instead of using either staggered or forked connecting-rods Mr. Schebler mounted a pin something like a piston pin at the lower end of one rod, the pin fitting in a bushing arranged for it at the lower end of the other connecting rod; that is to say six of the connecting-rods carried little lugs to one side of, and just above, their large ends, the other six connecting-rods being attached to these lugs. This provided large end bearings which could be adjusted limitlessly and the lower ends of the second connecting-rods can be regarded and treated exactly like piston pins. Mr. Grimes said that a trouble with this motor had been to prevent wear on the valve guides and that in a new design of twelve-cylinder, which was now being made, all the valves were arranged vertically with the object of overcoming this trouble. It was originally intended by Mr. Schebler to use the two sets of cylinders independently, keeping one set normally in reserve.

The remainder of the discussion ranged around the subject already dealt with, but did not extract much additional information. The principal new point brought up was that, if an ordinary four-cylinder magneto were used, owing to the fact that it has to run double the speed necessary for a four-cylinder motor, the ignition advance permitted is reduced to half. It was also suggested that some magnetos have not shown very good efficiency at extremely high armature speeds. There is, of course, no trouble with timer ignition.

The need for consideration of true economy was insisted upon by some other speakers and the author of the paper in reply said that he quite expected the efficiency of the eight to be brought up to standard.

It was questioned whether the cost of manufacturing the eight could possibly be as low as that of making six of equal displacement. Mr. Heinze in reply stated that ordinary improvement in manufacturing knowledge would enable eight-cylinder cars to be produced at prices no greater than those which were now being paid for six cylinders. He did not go deeply into the obvious question arising from this statement, namely, if improved methods of manufacture enable the eight to be produced for a definite sum, would not the same methods applied to sixes or fours allow a still greater reduction? Of course minimum price is not the most important consideration especially in considering the six-cylinder car and, as Mr. Heinze showed, the amount of money saved on the crank-case and crankshaft of the six-cylinder can be set against the cost of an extra cylinder block, extra pistons, and connecting rods, etc., required for the eight.

Seven Leading Points

Summing up the meeting the chief points made seem to be:

1. That carburetion is not perfectly simple and calls for experimenting.
2. That there are arguments in favor of the use of 16 cams instead of 8.
3. That the amount of piston friction in an eight is very high in proportion to other motors of equivalent displacement.
4. That the forked connecting-rod gives ample bearing surface and should provide excellent durability.
5. That engineers and salesmen are still undecided as to how the public will receive the eight.
6. Some special arrangements will be necessary to take care of the ignition.
7. Accessibility in the average eight leaves much to be desired.

Farmers of Southwest Could Buy 94,000 Cars at $1,000 Each

Kansas, Nebraska, Oklahoma and Missouri Have 68,144,200 Bushels of Wheat Worth $94,401,880, Still in Farmers' Bins—Other Crops Also Indicate Large and Continued Car Buying

¶ *This article begins a series of monthly industrial reviews on conditions in the southwestern territory embracing such states as Kansas, Missouri, Nebraska and Oklahoma, comprising an important section of the Mississippi valley, one of the greatest grain-producing regions in the world. Higher grain prices now in effect render this region a more promising automobile market than ever before.*

¶ *The author is one of the most widely-recognized authorities in this territory, having watched the progress of these states for 25 years while in daily contact with their leading financial and industrial movements.*

KANSAS CITY, MO., Feb. 27.—There are four great economic matters that will have a bearing on the ability of the big grain and stock states of the Southwest to continue and increase their purchase of motor factory products this summer and fall as they have in the past. These are:

1—The price the winter wheat crop still on hand continues to bring.

2—The acreage and condition of the winter wheat crop—now in the ground—that will be harvested the middle of this summer.

3—The size of the coming corn crop.

4—The livestock situation as affected by the quarantines that have resulted from the outbreaks of the foot and mouth disease.

Buying Will Increase

After a careful investigation among western bankers, grain associations and livestock men, it is apparent that Kansas, Missouri, Oklahoma and Nebraska—the big four of the Southwest—will not only continue to buy automobiles, but should continue to show an increase in buying. The other grain and stock states of the Mississippi and Missouri valley will show the same general conditions, with certain variations as, for example, in northern states where spring wheat is the heavy crop instead of winter wheat.

The Southwest has bought automobiles and is still buying cars on the winter wheat that was harvested last summer. Still in Kansas, Nebraska, Missouri and Oklahoma, it is estimated by grain men that there remains nearly 20 per cent. of that crop. Some of it is going to market gradually, some of it will be held until the new crop is close by. But the farmer himself right now is getting for all he is selling between $1.40 and $1.50, depending on his location.

What he may get if he holds on to the fifth of the crop he still has in his bins, of course, depends on war conditions. Indications are this week that he is holding pretty well, too. The exporters are sending grain that is in second hands and the farmers are sending less of their crop to market than they were at this time a year ago. Then figuring $1.40 a bushel (to be conservative) we have in the farmers' bins in Kansas, Nebraska, Oklahoma and Missouri this much wheat, worth as follows:

State	Bushels Still in Farmers' Bins	Value
Kansas	36,260,000	$50,764,000
Nebraska	13,623,200	18,072,480
Oklahoma	9,595,000	13,433,000
Missouri	8,666,000	12,132,400
Total	68,144,200	$94,401,880

The farmers apparently are so comfortable that they are in no hurry to sell this wheat. A large part of that is surplus, and surplus means automobiles everywhere. Enough wheat left over to buy 94,000 thousand-dollar cars in these states alone!

The winter wheat now in the ground: With the exception of Kansas, which shows only 2 per cent. less acreage than for the great wheat crop now selling, the states mentioned show a greater acreage. The report, with the exception of Nebraska, was not so good compared with the year before, but since that time conditions in both Kansas and Oklahoma have greatly improved. The war is still on. Kitchener says it will last 3 years. These great wheat states are prepared. Herewith is a table on the winter wheat crop—now in the ground—in the southwestern states.

Corn Is a Great Crop

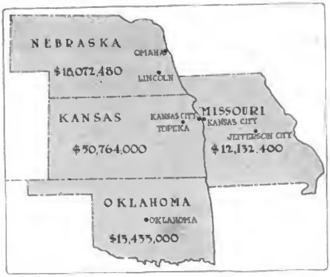
Corn is a great crop in these four great southwest states. The corn crop means fall buyers. The preliminary condition is first class. The corn belt has had moisture and lots of it this spring and the indications are that the ground will be in prime shape for planting, a matter of no small consequence when the farmer is figuring the chances for his crop.

The animal industry is a trifle less pleasant to view at this time. Cattle only are affected by the quarantines established by the government and states because of the foot and mouth disease. At this time only Kansas and Missouri are open to stocker and feeder—breeding cows and cattle to be fed—shipments. There is a tendency, however, on the part of large stockmen and bankers handling cattle paper to view the slowing up of cattle shipments to market with equanimity. W. K. Kemper, president of the Commerce Trust Co., Kansas City, which handles much cattle paper, says regarding this:

"The drouth in Kansas, Nebraska, Oklahoma and Missouri two years ago took thousands of head of cattle out of these states as well as out of New Mexico and Texas. It shortened the breeding stock on the farms and ranches. The stock cattle that the Southwest does not ship to market this winter will be ready for market in the fall and where there was then a cow, in the fall there will be a cow and also a calf. The quarantine won't hurt; it will help to restock the Southwest and it's a creation of a new wealth in a very few months."

Crops Worth $1,113,036,000.

Adding to the interest of the man who makes automobiles is a look into the general wealth of the farm producers in the big grain and stock raising states. For example, take the value of all farm produce in the United States. Without the $3,828,000,000 for animal products, the total compiled from the 1914 figures of the Department of Agriculture is $6,044,000,000. In five states of the Southwest this year the value of thirteen field crops, corn, wheat, oats, barley, rye, buckwheat, flaxseed, rice, potatoes, sweet potatoes hay, tobacco and lint cotton is $1,113,036,000. This means of course that most of it is in wheat and corn, excepting Texas, where cotton counts, although cotton prices this year put Texas



Map of Kansas, Nebraska, Missouri and Oklahoma, showing value of wheat still held in farmers' bins

lower than the 5-year average. Here are the five states:

State	1914	5 Years' Average
Kansas.	$287,662,000	$164,844,000
Texas.	288,335,000	336,725,000
Nebraska	210,099,000	153,869,000
Missouri	192,981,000	188,689,000
Oklahoma	134,159,000	117,618,000

And this does not include the crops of Minnesota and the Dakotas. Of course there is duplication to a certain extent in the department figures caused by the fact that it is hard to say what part of the value of animals is made up of hay and grain fed. However, it is sufficiently close to cause amazement at the comparison that may be made between the total of these five states and the entire country on farm products.

The banks as a barometer of business conditions in the Southwest make a good showing. Money is easy and abundant in the banks of Kansas City as well as all of its trade territory. December 31, the date of the last call on the national banks, the Kansas City banks showed deposits of $110,000,000, which was $9,500,000 in excess of the same time last year. It is estimated that since that call the deposits in Kansas City national banks have increased to $118,000,000. The bank clearings show an increase of from 25 to 45 per cent. as compared with the same time last year.

The next week or two probably will see tremendous strides taken in the jitney business and tremendous efforts as well to put the jitney out of business. In this city there has been a steady increase in the number of machines operating. Last Saturday, always a big transportation day, the jitneys in Kansas City handled 40,000 to 50,000 passengers. This meant from $2,000 to $2,400 was cut off of the Metropolitan street railway receipts that day.

The Jitney Still Grows

E. K. Carnes, traffic manager of the jitney station, estimated that 225 cars were engaged on the Saturday trips and that of this number about fifteen were buses, seating from eight to twelve passengers. The jitney carried the straphangers down in the morning and on account of the large number of Saturday shoppers coming down in the early afternoon and going home before the rush hours, kept busy carrying both ways all day.

It is still too early to figure the outgrowth from this jitney business, whether it will be transformed into a bus seating from eight to ten persons or whether the small five-passenger cars will continue to do a large part of the business. Jitney buses seem to have a clear profit when they report fares averaging $16 a day. However, the $8 average of the small touring cars, in the estimation of local dealers, will pay good wages to the owner of a small car and take care of his expenses and depreciation.

The big question that is affecting the jitneys is the preparation of ordinances in Western cities to regulate them. The street railway influences are strong and not stronger elsewhere than here. Telegrams from coast cities and Texas cities where the jitneys are thriving say that to date no ordinances have been adopted, but that the jitney drivers and their patrons are watching every move of the street railway interest to put them out of business by the demands for liability bonds and heavy license fees. In Kansas City the street railway has appealed to friends in the city government which recently granted a 30-year street railway franchise. The ordinance will be taken up in council committee this week and the first week in March probably will see some sort of regulation. The city counselor's office, it is feared by the jitneys, will force a $10,000 liability bond for each car and a $10 license fee with a $5 occupation tax.

Of this the bond is the most serious as the jitney livery business will be put as a high risk by the insurance companies, if obtainable at all. This in view of the fact, too, that the street railway company has not paid a damage claim in 5 years as a result of its receivership. It has been unable to finance its new franchise on account of the war and the indications are that the jitneys will keep it in a receivership for a while longer. Just how serious a view the street car companies are taking of the jitneys may be had from this abstract from the *United States Investor:*

Winter Wheat Now in the Ground in Four States*

State	AREA SOWN			CONDITION, DECEMBER 1		
	Autumn, 1913. Acres	Autumn, 1914		1914. Per Cent.	1913. Per Cent.	10-Year Average. Per Cent.
		Compared with 1913. Per Cent.	Total Preliminary. Acres			
Missouri	2,585,000	110	2,844,000	87	98	90
Nebraska	3,464,000	105	3,637,000	90	86	93
Kansas	8 958,000	98	8,779,000	80	100	90
Oklahoma	2,577,000	120	3,092,000	83	103	87

*From the Farmer's Bulletin, 645, United States Department of Agriculture

"Meeting with the popular approval as this jitney business has, if a movement is made to suppress them, some form of popular referendum will be invoked. The sentiment of the West does not furnish a very cheerful outlook for the street railway companies. The street railway companies are face to face with one of the greatest problems they have ever been called upon to face."

The United States Investor is friendly to the street car companies. It warns them of what to expect, and is it not to be expected that the street car companies will turn every stone to put this new motor industry out of business?

The Automobile Show

With the close of the motor show, it is possible to make comparisons with the show last year. The paid attendance showed an increase this year of 39 per cent. over last year and 75 per cent. over the 1913 show. The total number of attendants was 140,000. The show committee has always kept the amount of money actually taken in a secret, but it is understood that the paid admissions amounted this year to $21,000.

As all of the proceeds of the show go to finance the show of the succeeding year, 1916 will see a demand for space that Convention hall with its 50,000 square feet will not be able to take care of. The dealers' association is planning the installation of a second balcony. Dealers do not wait for the show, but order cars months in advance.

Spark Advance Should Be Function of Flame Propagation

Curve of Advance Drawn in Proportion to Motor Speed Does Not Coincide with Best Results Obtained Experimentally

By Francis R. Hoyt,
Engineer Simms Magneto Co.

THE amount of spark advance or retard necessary for correct ignition, in a variable-speed, internal combustion motor, is the product of two time factors. First: The lag of the spark itself. Second: The rate of flame propagation of the combustible mixture.

The lag of the spark itself is a constant, and is in direct proportion to the speed of the ignition device, consequently of the motor. The rate of flame propagation, however, is decidedly variable, and follows no fixed law, constant or proportion, making very clear the obstacles which must be overcome when trying to compensate by a mechanically-operated spark advance, the physical and chemical irregularities which regulate the propagation of flame in gases.

Spark Lag

The statement has often been made, that "modern ignition devices have no appreciable lag." This subject cannot be handled broadly here, but from the illustration, Fig. 1, we can discover a lag in this specific case. This is an oscillogram showing the primary current, flowing in a battery ignition system induction coil, of the type commonly used with automatic advance. The line O represents zero amperage or current flow. Beginning at the left, the contact points are separated, showing a zero current flow, the points close at A and their action is accompanied by a growing-current curve, A to B. The shape of this growing-current curve is regulated by the design of the coil, and shows the inevitable result of self-induction, or that inherent property of an electrical circuit containing concentric coils of wire, and particularly an iron core, to oppose change; it is what might be termed an electric-magnetic inertia. At B the contacts open and the current falls to zero at C. The duration of time occupied in these changes is represented by the horizontal distances A-B, B-C, which, as shown, are .003 and .001 of a second for the growing and decaying currents respectively. The decaying current falls to zero in a very much shorter time than that occupied by the growth of the current on make, due in this case to condenser action, and the tendency of self-induction on break to aid by its own effect the rapid emptying of the coils. Each current change in the primary is accompanied by a corresponding change in the secondary of an induced current of higher voltage and lower amperage.

Lag of the Primary

Neglecting for the time being the secondary, and taking only the lag of the primary, we find an interval of .001 of a second between the actual opening of the contact breaker and the time taken by the current to fall to zero. As it is impossible for the secondary current to reach its maximum value until this electrical function has been performed, the amount of time consumed in this operation becomes an effective lag. This, however, is only primary lag, and, as the secondary must go through the same series of cycles, and also through the effect of mutual induction, we must have a secondary lag of at least as much, at a very minimum. Fig. 2 will show clearly the secondary lag, separately. In this test of which Fig. 1 constitutes a part, two galvanometers were used simultaneously, one for recording primary wave form and the other for the corresponding secondary wave.

Intervals of time are still represented on the horizontal line as in Fig. 1, so that by following down from B or the point of circuit interruption, to the secondary wave, a lapse of .002 second will be found between B and the actual occurrence of the spark, this being .001 second greater than the lag of the primary, and representing the total electrical lag in this case.

While this apparently small interval of time seems negligible as a quantity, yet in degrees of crankshaft travel it represents a necessary advance of .012 degrees for each revolution per minute increase in speed, in order to compensate spark lag alone. Or in other words, an advance of 6 degrees at 500 r.p.m., and 12 degrees at 1,000 r.p.m. The curve E of Fig. 3 shows the necessary advance for spark lag compensation for the coil shown here, with the different motor speeds.

Mechanical Lag

In addition to the actual spark lag as shown by the oscillograms, there is an interrupter lag encountered which is peculiar to the system from which these tests were made, and while it is purely a mechanical lag, and incidentally is exactly equal to the spark lag in this particular case, it is important that it be discussed separately, to avoid any possible confusion between the two.

The mechanical lag is shown by curve D, Fig. 3, and is due to the form of construction of the interrupter, this being so arranged that the cam which operates the breaker mechanism is rotating rapidly away from the lever actuating the break, which it sets in motion, that a certain small time lapse is entailed.

To go into the question of the rate of flame propagation: As was stated before this follows no regular law, constant or proportion, and consequently becomes a difficult proposition to analyze in figures; the only way in which it can be handled is to refer to the rate of flame propagation of the mixture at some given speed, which we have to determine

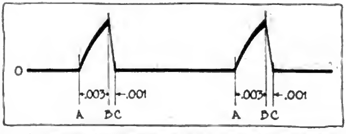


Fig. 1—Diagrammatic illustration of the current lag in the primary

by the correct spark advance necessary for maximum horsepower at this speed. At A, Fig. 3, is shown a r.p.m.-spark advance curve.

This curve was carefully complied from data secured by accurately calibrated laboratory instruments, and each reading was checked several times.

Determining Correct Advance

The motor tested was a four-cylinder, 3 5-8 by 4 7-8 inches, giving by the conventional S. A. E. formula, 37 horsepower. The ignition system used was the same as that from which the oscillograms were made, and while determining the actual amount of advance necessary for maximum horsepower, as shown at A, Fig. 3, the automatic advance attachment was prevented from moving, so that the spark was hand controlled, and the degree of advance noted from an indicator on the body of the timer housing, which moved over a sector calibrated in degrees, attached to the engine casting. This was originally set and checked throughout its range by a magnetograph. The revolutions per minute were recorded by a Weston electric tachometer, and the horsepower taken from a Sprague dynamometer.

The tests were all made with a fixed carbureter setting, without change of adjustment, and exhaust gas analysis tests with an Orsat apparatus, at a motor speed of 1,000 r.p.m., gave the following:

12.5 per cent. CO_2
2.5 per cent. CO
0.3 per cent. O

with a ratio of air to gas, by weight, of approximately 12.8 to 1; it having been demonstrated conclusively that the rate of flame propagation is at its maximum, other things being equal, at about a 12.5 to 1 ratio.

Exhaust gas analyses were made simultaneously with the power readings throughout the tests, but in order to arrive at some constant, such as is necessary to illustrate straight line automatic advance, the one analysis at 1,000 r.p.m. is given, which is as near an ideal flame propagation condition as can be reached.

If Advance Were Proportional to Speed

Referring to A, Fig. 3, we find an advance of 38 degrees necessary for maximum power at 1,000 r.p.m., or, in other words, a total rate of flame propagation—for the time being carrying all lag under this head—of 1-158 second at this speed. Suppose now this motor with a lag of flame propagation of 1-158 second at 1,000 r.p.m., to be running at 200 r.p.m., this would be 3.33 r.p.s., and 1,199 degrees on the flywheel would pass a given point per second. In 1-158 second—the time taken for flame propagation, assuming the rate to be constant regardless of motor speed—the piston would have traveled a distance corresponding to 1,199-158, or 7.6 degrees of crank travel; thus, the spark must be advanced 7.6 degrees at 200 r.p.m. to compensate this lag; and by the same course of reasoning, it must be advanced 57 degrees at 1,500 r.p.m., or, in other words, the spark must advance in a direct proportion of .038 degrees for each revolution per minute increase in speed.

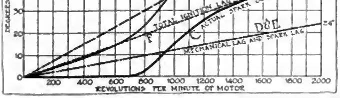


Fig. 3—Curves showing different conditions of advance and lag factors. Note variation between curve A obtained experimentally and curve B showing straight line advance

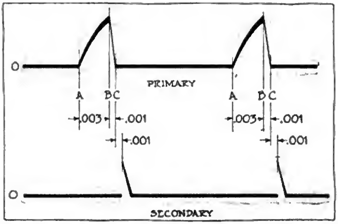


Fig. 2—Oscillograph chart of the current lag in primary and secondary concentric coils

From the above, the curve B, Fig. 3, is plotted. A comparison of curves A and B shows at a glance that an advance such as given by B would fail to accomplish even fair maximum results. Careful analysis of curve A will also show a variation in the rate of burning of gases, which is typical of practical motor conditions.

Were the spark advance purely a function of speed, then the rate of flame propagation would necessarily be a constant, but inasmuch as it is not, and as there is no way in which it can be made to follow any prtdetermined form, it is obvious that the amount of advance must be regulated to suit the rate of flame propagation, as certainly the flame propagation cannot adapt itself to a predetermined advance.

In the explanation just given, descriptive of curve B, Fig. 3, the entire lag of the system was included in the lag of flame propagation for convenience of illustration. Examination of curve F, Fig. 3, however, will show that 24 degrees of advance are needed at 1,000 r.p.m. to compensate spark and interrupter lag. So that the difference between this amount and the 38 degrees given as necessary for flame propagation is the actual advance required at this speed for flame lag, or 14 degrees. This rule applies to any other point of the speed range as well.

Rate of Flame Propagation

The exact rate of flame propagation, therefore, is the small interval of time between the occurrence of the spark or the first ignition of the gas, and the instant of maximum pressure. This is due to progressive ignition.

Some of the more important conditions which cause this rate to be a variable, are:

First—The grade of the mixture, or the ratio of air to gas; a rich mixture, for instance, burning more rapidly than a lean one.

Second—Compression pressures have a very direct and important bearing on the rate of burning. Mixtures under high compression are more homogeneously mixed, and the molecules are in more intimate contact, allowing them to burn faster than the stratified charges of lower compression.

It is, therefore, apparent that the spark of an ignition system must not only be varied to compensate engine speed, spark lag, etc., but if correct ignition, economy or power is desired, it must also be made to vary with each change of mixture and degree of compression.

The Rostrum

Why Sleds Have Narrow Tread

EDITOR THE AUTOMOBILE:—*In reply to Dr. Wesinger in the Rostrum for February 11, will say that the reason for the 38-inch sled runner is this: The sled will have to travel in the horses' tracks. The snow in this western country is sometimes very deep and the track is 2 to 5 feet higher than the roadbed. A wide tread sled would straddle this track and slide on the cross pieces instead of on the runner. You could make the horses travel farther apart, but this would leave a soft center in the track into which the runners soon would find their way. On solid ice the 54-inch tread is all right. In a built-up track in soft snow the narrow sled has come to stay.*

Gilman, Ia. CHARLES LOUKS.

Carbon Probably Causes the Trouble

EDITOR THE AUTOMOBILE:—I have a model 6-50 Maxwell, 1913, and have had fairly good results with it, but I do not think it has the power and quick getaway it should have. The factory installed a different carbureter about a year ago, but the result is not much better. I have had a good deal of experience, this being my fifth car, also doing my own repairing, and I think the carbureter is too far away from the intake. The carbureter is on one side of the motor and the intake on the other. I think that the short manifold will give better results if the carbureter is placed closer to the intake, but on this car the magneto is in the way. What is your opinion on this?

2—Why did the factory discontinue making this model? D. C. H.

Johnstown, Pa.

—It is suggested that you remove the carbon from the cylinders as this is probably the reason for the loss of power. If the carbureter is adjusted correctly and the cylinders in good condition with good ignition this motor should be giving you satisfactory results. Relative to placing the carbureter closer to the intake, this arrangement was made in the position it now occupies so that the gas would become heated while passing between the cylinders, therefore igniting more readily and giving better results. In view of this it would be better to let the carbureter remain in its original position and to be sure that the cylinders are free from carbon, that the compression is good and ignition all that it should be.

2—The reason for the abandonment of the model 6-50 was the intention of the Maxwell company to concentrate higher manufacturing facilities on the Maxwell 25 model.

Explains Principles of High-Tension Ignition

Editor THE AUTOMOBILE:—From previous questions it is evident that there are very many men who are endeavoring to have an intelligent comprehension of the ignition systems of their cars, and there are two points which ought to be written in capital letters and kept before the eye until they cannot be forgotten.

The first of these is that there is no spark worth speaking of on the closing of the jump-spark circuit. The spark occurs only on the breaking of the circuit. With the vibrator the circuit is broken almost instantly by the magnetizing of the core in the spark coil, which attracts the vibrator head.

If there are four vibrators, one with each of the coils, it is easy to see that the slight differences in the spring tension or the character of the spring itself will produce a slight difference in the timing, and to this must be added the probability that each one of the contact points adheres very slightly owing to the incipient pitting, which shortly after the contacts have been smoothed, begins to affect the speed with which they can be separated, and long before the pitting is so bad as to hold the contacts fast together, it materially interferes with the rhythmic action of the coil.

The second point which I would emphasize is that there is no spark worth speaking of, and certainly none which would ignite gas under compression, to be had from any form of jump-spark ignition except in connection with a satisfactory condenser, connected across the contact points.

In the absence of such a pair of condensers, a heavy spark results at the contact points as they separate and almost no spark in the cylinder. It is for this reason impracticable to hold the contact points of the vibrator together and endeavor to utilize the timer on the engine to obtain a single spark. It is true that each time the timer breaks a connection there will be a slight spark at the plug, but there will be a wastefully heavy spark at the timer.

A very economical arrangement for a car using dry cells is that of a system utilizing a relay and a single vibrator, which for ordinary running allows but a single spark and yet cuts off nearly all the current almost immediately. With this system a single set of dry cells might be expected to outlast a season's running, even though used constantly and to the exclusion of any other means of ignition.

New York City. CHARLES E. MINIERRE.

—If the system is a non-vibrating one, there can be absolutely no spark at the closing of the circuit inasmuch as there is no energy present in the coil until the circuit is closed and the closing of the circuit does not change the intensity of the magnetic flux. It is this changing of the magnetic intensity that induces the current in the secondary coil, thus it can readily be seen that no spark will occur on the closing of the primary circuit.

Your assumption that the difference in spring tension or the character of the spring itself will produce a slight difference in the timing, is correct. There is generally a lag present in a battery system due to the factors mentioned by you. In general practice this lag is due to the rapidity with which the core becomes magnetically saturated, it also depends upon the distance that the armature is from the pole shoe and the voltage applied to the coil. All of these factors augment both mechanical and electrical lag.

It does not seem necessary to employ a pair of condensers when a single one would suffice. This condenser is often so arranged that it is in parallel with the contact points when the contacts are closed and in series with them when open. In other words, such an electrical connection is made that it is possible for this condenser to take care of the rush of current which would take place at the time of opening the points.

Regarding the amount of current that single spark and vibrating spark systems will draw, it would seem that the biggest factor in the determination of the amount of current that any coil consumes would be the length of time that the contact points are together.

Uses Gasoline Mixed with Water

Editor THE AUTOMOBILE:—Some time ago I was told that a certain garage man in a neighboring city was using a mixture of water and gasoline to wash his cars with. The object of the gasoline was to cut the grease. That is all the information I have been able to obtain about the matter. Do you think that such a mixture will help cut the grease to any appreciable extent? If it will, how should it be applied?

2—Wouldn't a spray be the best form in which to apply it? Or would it be best to use a sponge?

3—Have you ever heard of gasoline being used in this way? If so, have you any arguments pro and con? I would be interested to hear them.

Ware, Mass. PERRY T. NAYLOR.

1—No doubt the addition of gasoline to the water in connection with sponging the car will efficiently aid in the cutting of the grease. It would have to be applied either in a spray or sponge as these are the only two practical methods of mixing it in such a way that it would combine closely enough to form a suitable mixture for cleaning.

2—The spray or sponge as explained would be the best method but it would have to depend upon the particular job as to which were the better method to employ. For cutting away an accumulation of dirt and grease the spray would doubtless be more efficient, but for cleaning a surface which had but a small deposit of grease, sponging would suffice.

3—THE AUTOMOBILE has no record of any discussions on the use of gasoline mixed with water and would say that beyond the precautions necessary for the use of exposed gasoline, there should not be any objection to its use. Kerosene is frequently used in this manner with good success.

Wants to Lighten 8-Pound Piston

Editor THE AUTOMOBILE:—I have a four-cylinder 5.375 by 5.5 L-head motor, the pistons weighing approximately 8 pounds, which I think is unduly heavy for a piston of this size. The heads of the pistons, which are concaved, are .375-inch thick and I would like to know how far it would be safe to go in making same thinner in order to avoid undue heating and possible pre-ignition.

I also contemplate drilling out the skirts of pistons, or turning them out on the inside. Would it be safe to reduce the walls to 1-8-inch or less?

The motor is supposed to have, when in perfect condition, a rated compression of about 90 pounds which I am thinking of lowering to possibly 65 or 70, all of which I presume would have a marked bearing on the possibility of reducing the piston head thickness.

To sum up, if I am able to lower the weight of pistons to approximately 6 pounds, do you think there would be enough gain in engine speed and elimination of vibration to warrant these changes?

I might add that I, of course, intend to carefully balance all reciprocating parts and possibly drill out the webs of connecting-rods to save weight of these parts.

I believe the maximum speed of this motor is approximately 1,800 r.p.m. and I am wondering whether in lowering the compression the speed or power of motor would be noticeably affected.

Garwood, N. J. C. L. EMMONS.

—If you intend reducing the compression there is no doubt that the pistons can be lighter because the strain upon them is less. Where the weight should be taken off, greatly depends upon the webbing and unless the head is well supported it would not be wise to take much, if any, from the head of a piston of this diameter. Probably it would not do any harm to cut down on the thickness of the skirt, but this should be done on a taper and not straight. It would seem safe, as far as can be told without examining the pistons themselves, to reduce the wall thickness to 1-8 inch at the bottom of the piston with a gradual slope to its present thickness at the wristpin boss. You do not state the arrangement of the rings, so this instruction can only be taken in a general way. Another point to remember is that when you are reducing the compression you are also reducing the maximum power output at high speed.

Drilling holes through the skirts of the piston will probably not do any harm, provided that these are spaced some distance apart. They must be so spaced for two reasons: one is that they act as reducing agents on the amount of oil which reaches the upper part of the piston, and another is that if they were too closely spaced they would weaken the continuity of strength of the piston structure.

In reducing the weight of the connecting-rods by drilling out the webs care must be taken not to materially weaken these rods which bear the entire thrust of power transmission from the pistons to the crankshaft and care must also be taken to keep the center of gravity of the rod in the same relative location. It must be remembered that the connecting-rod has a three-fold relation to the balance of the motor. The lower end is a rotating force, the central portion is oscillating and reciprocating and the upper end is a pure reciprocating mass. Therefore, to alter the center of gravity of this complicated balance feature, would be to introduce problems which would be, to say the least, somewhat complicated.

Timing of Autocar 1906 Runabout

Editor THE AUTOMOBILE:—I would like to get some information concerning the motor in the 1906 Autocar runabout, which has, as you probably know, a two-cylinder opposed four-cycle engine. The cylinders are about 3 3-4 inches by 4 and the intake valves are automatic. What should the timing of the exhaust valves be?

2—At what speed could the motor be run before the power curve falls off? For the service in which this motor will be used, it will be almost necessary to get 1,400 to 1,600 r.p.m., though for short runs only. If you do not believe that the motor can run at this speed

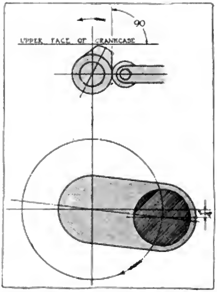


Fig. 1—Diagram showing position of the crank arm and cam in timing auto car horizontal double-opposed motor

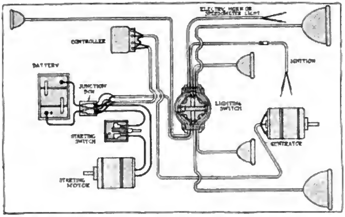


Fig. 2—Wiring diagram showing the installation of the Ward Leonard starting and lighting system as used on the Henderson car

please offer suggestions to remedy it by increasing the speed.

3—I also have a four-cylinder four-cycle T-head motor cast in pairs with cylinders 4 by 6 having 2 1-4-inch valves of the poppet type. The clearance at the top of the stroke is 5-8 inch, so the compression must be fairly high. What should the valve timing be for 1,500 r.p.m.? Do you think that the 1 1-4-inch Schebler carbureter is large enough, and also is a manifold 1 3-8 inch internal diameter large enough?

4—Do you believe that the two-plug system would give an appreciable increase in power over a single plug.

Ithaca, N. Y. Robert S. Bassett.

—The timing of the 1906 Autocar runabout with two-cylinder opposed motor is as follows: The inlet valves are automatically closed by a spring which has an initial pressure of 2.5 to 2.75 pounds varying with the suction pressure of the motor. Both cylinders must be set the same. The exhaust valve closes at 18 degrees past upper center, as illustrated in Fig. 1. After setting the crankshaft so that the center of the crankpin is .25-inch past dead center, the after face of the exhaust cam should be perpendicular or at 90 degrees with the upper face of the crankcase.

2—The exact speed at which the power curve will begin to fall off will depend upon the condition of the motor but you should not have any trouble in getting 1,400 r.p.m.

3—For a good timing for the motor you describe, it is only possible to determine the time of opening or closing of the valve because the shape of the cam will determine the other function when one of these has been decided upon. The inlet valve should open at about 10 degrees past top center and the exhaust valve should close at about 5 degrees after top center. With these two points fixed the shapes of the cams in your motor will take care of the other function. Commonly the exhaust valve opens at about 45 degrees before lower center and the inlet closes at about 35 degrees past lower center.

4—It is probable that a two-point synchronized ignition would give an increase in the power curve.

Difference Between Two- and Four-Cycle

Editor The Automobile:—What am I to understand by a two-cycle and a four-cycle motor? What does the automobile manufacturer mean when he specifies two-cycle motor or four-cycle motor?

Pittsburgh, Pa. Jas. R. Galbraith.

—By the word cycle is meant a complete cycle of operations in the cylinder. In one complete cycle it is necessary for a gasoline motor to take in a charge of gas, to compress it, to fire it, to expand it and to exhaust it. If this cycle is completed in one revolution, or in two strokes, since there are two strokes to a revolution, one out and the other in, the motor is a two-stroke cycle. If it takes four strokes, or two revolutions, the motor is a four-stroke cycle. The word stroke has been dropped in common parlance and the abbreviated names two-cycle and four-cycle used instead.

In a two-cycle motor starting with the compression stroke, which is the up-stroke, the gas is compressed in the combustion chamber, fired at the top of the stroke, expanded on part of the down-stroke, exhausted on the remaining part of the down-stroke at the same time that fresh gas enters the cylinder, thus on the next up-stroke it is again compressed and fired. To complete a cycle it is only necessary to have two strokes for a motor of this type.

In a four-cycle motor starting with the up-compression stroke, the gas is compressed on one stroke, fired and expanded on the second, exhausted on the third and sucked in on the fourth.

Henderson Changed Electric Wiring

Editor The Automobile:—In the Ward Leonard generator as is installed on the 1914 Henderson, should a spark occur when a contact is made between the outside covering or frame of generator and copper springs that hold the brushes located just under cover plate of generator? I noticed a spark when I attempted to put a few drops of gasoline on the part where the brushes rub, the generator was not running. The battery has run down and I rather suspect that there is a short in this system.

Modoc, Ind. F. C. Kabel.

—Unfortunately, during the time the Henderson company was manufacturing the car it made several changes and each time there was a different type of lighting and starting system made by the Ward Leonard company for this concern. This makes it rather difficult to give detailed information, but you will probably understand the system by referring to the accompanying diagrams, Figs. 2, 3. The Ward Leonard system is an ungrounded outfit and there should not be any spark between the frame of the generator and the brush springs, unless the primary of the ignition circuit is grounded, in which case a connection made from the opposite of the line to the ground will give a spark under any circumstance.

If you will disconnect the ignition ground, if there is such a ground, and disconnect the horn ground, if there is any, there should be absolutely no spark between any live part of the lighting circuit and the frame of the car. If there is, this should be traced and remedied by an electrician.

Imperial Had Four 1914 Models

Editor The Automobile:—Will you please give me some information regarding the 1914 models of the Imperial Automobile Co., as to number of the model, style and price of same?

Owego, N. Y. F. L. Rider.

—The 1914 Imperials were four in number. There were

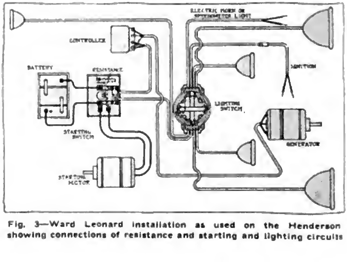


Fig. 3—Ward Leonard installation as used on the Henderson showing connections of resistance and starting and lighting circuits

two fours and two sixes. The two fours were known respectively as models 32 and 34 and the two sixes as 44-6 and 54-6. The Imperial 32 sold for $1,500, the 34, $1,650, the 44-6, $2,000 and the 54-6 $2,500. The 32 is a 4.25 by 5.25 L-head block; the 34, a 4.5 by 5 L-head cast in pairs; the 44-6 a 3.75 by 5.25 L-head with the cylinders in threes and the 54-6 a 4.125 by 5.25 L-head with the cylinders in threes. All these cars are distinguished by unit power plants, helical camshaft drive, pump water circulation, Remy dual ignition, Stromberg carbureter, Northeast electric lighting and starting, disk clutches, three-speed gearboxes, bevel drive with a 3.5-1 final reduction. The wheelbase for the smaller four is 114 inches, for the larger 118, for the smaller six, 126, for the larger six 137. The tire sizes are 34 by 4 for both fours and 36 by 4 1-2 for both sixes. All had center control and all but the model 34 had left drive.

Long Stroke Used for Racing

Editor THE AUTOMOBILE:—1—Are the long stroke or short stroke engines used in automobile racing?

2—What is the bore and stroke of the Mercer, winner of the Corona race?

3—What does S. A. E. stand for in figuring the horsepower?

Cleveland, O. J. PARKS.

1—Both long stroke and short stroke engines are used in automobile racing although the tendency in the last few years has been very strongly towards the long stroke motor.

2—The bore was 4 13-16 and the stroke 6 3-16.

3—The initials S. A. E. stand for the Society of Automobile Engineers and the S. A. E. horsepower is meant to indicate horsepower figured by the formula which has been named the S. A. E. formula. This formula is $\frac{D^2N}{2.5}$ where D is the bore in inches and N the number of cylinders.

Schebler Carbureter Should Give Satisfaction

Editor THE AUTOMOBILE:—I have a 1911 Overland car model 56 which is equipped with a Schebler carbureter model R but it has never worked satisfactorily. Would you kindly advise me what to do.

Also, kindly let me know in the Rostrum how to wire a Master vibrator on a Ford. Or in other words, how to connect a Master vibrator to a Ford car.

Isanti, Minn. E. B.

—There must be some reason other than the carbureter itself for your trouble, because there are thousands of these cars in use equipped with the Schebler R carbureter that are giving great satisfaction. There is a possibility that you are troubled by air leaks in the intake line which thin the mixture to such an extent that it weakens the force of the explosion. It would be wise for you to examine carefully the manifold and carbureter connections and also the joints about the valves, spark plugs, etc.

A typical method of wiring a Ford Master vibrator is that shown in the accompanying diagram, Fig. 4. The vibrator is mounted in a convenient place on the dash, generally just above the steering post on the left side, as shown in the diagram. The switch of the vibrator is used to start and stop the motor and the switch on the coil is thrown over on the lead that connects to the vibrator. None of the timer leads or spark plug wires are disturbed. The vibrators on the coil are then screwed down tight to throw them out of operation or they are short circuited by using small bridges of copper wire, as illustrated.

Wants to Make Short Tube Bends

Editor THE AUTOMOBILE:—As a subscriber to THE AUTOMOBILE will you kindly tell me how the manufacturers are successful in bending the gasoline and other tube lines in short arcs without the pipe flattening?

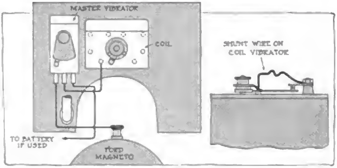


Fig. 4—Wiring diagram showing the method of putting a master vibrator on a Ford car

I have done considerable difficult work on cars, just for the fun of the thing, but my 5-16-inch copper tubing from tank to the Stewart vacuum and then to carbureter looks like a botch. The pipe always kinks at a short bend.

Philadelphia, Pa. WM. T. DICKSON & Co.

—Copper tubing of small diameter can be readily bent into short curves by melting rosin and pouring it into the tube. When this becomes cold it solidifies within the tube and the tubing can be bent like a piece of solid copper. After the desired bend has been obtained, the rosin can be run out by heating the tube with a blow torch. Another method sometimes used is to fill the tube with sand, but the rosin method gives the better results.

Instruction Books Furnished at Factory

Editor THE AUTOMOBILE:—Will you please publish a drawing or tell me where I can purchase a book of instructions about the 1915 Packard car? I seem to be unable to get one from our Worcester Branch. I should like to know the method of starting and what the appliances are on the switchbox of steering column.

Worcester, Mass. A CONSTANT READER.

—The instructions for the 1915 Packard car can be secured from the Packard Motor Car Co., Detroit. The method of starting the car is as follows: Place the change speed lever in neutral position, engage the hand brake, open the throttle 1-3, turn the auxiliary air valve hand wheel on the control board towards the position marked Gas and if the car has been standing for some time use the hand pump to obtain initial pressure in the gasoline tank.

Turn the ignition switch to M, set the spark lever just past mid position, and start the engine with the electric starter. The starting switch is attached to the crankcase and is operated by pressure on the heel button which is located on the level front floor board and connected to the electrical mechanism. The starter is operated by pressing down on this heel button slowly but firmly, the full length of its stroke. If the starting gears do not mesh properly at first, do not try to force them into mesh but release the pressure on the starting button and wait until starting motor stops spinning before again pressing on the heel button.

After the motor starts, turn the air valve wheel on the control board toward Air and set it at the point at which the motor runs best. Close the throttle until the motor runs slowly. To start the car in motion, release the hand brake, push forward the left pedal, disengaging the clutch, move the change speed lever backward into first speed position, increase the speed of the motor slightly and engage the clutch. This will start the car forward and after this the gear changes are made and the speed of the motor controlled in the usual manner.

The appliances on the switch board of the steering column are as follows: Speedometer lamp switch, headlight switch, auxiliary headlight switch, side light switch, tail light switch and electric signal button.

Recharging Magneto Magnets

Apparatus Required for Quick and Efficient Work—Methods of Testing for Strength—Pounding and Rubbing the Magnet During Charging Discredited

By R. J. Everest

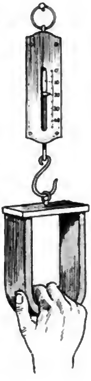
MAGNET charging is a subject that is, as a rule, misunderstood, and one seldom touched on in automobile publications. As this is an important feature in the automobile trade, more reliable information should be obtainable and it is the purpose of this article to try to correct some of the absurd methods now in use.

Practical Charging Coil Required

In order to do satisfactory and quick magnet charging, the proper kind of equipment is necessary. That is, a charging coil that is designed on a practical basis and one which will be of sufficient strength to thoroughly saturate the magnet without consuming an undue amount of current. The design must also be such that an instant application of the current will be sufficient, as time means money in a repair shop.

Unsatisfactory Chargers

There are several different models of chargers in use and some are very unsatisfactory, but which are being used because a more efficient apparatus is lacking. One of the most inefficient of these is the wiping type. With this type the coils are wound on long, heavy iron cores, shaped into a U, the current generally being supplied by a 110-volt direct current line. The magnet to be charged is placed on the poles of the charger and pulled away from it. This is repeated until the magnet reaches its maximum strength. However, with a great number of chargers of this type the magnetism is insufficient to properly saturate the magnets, therefore failing to bring them up to their possible strength.



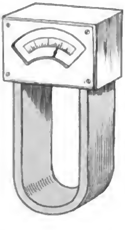


Fig. 1—Left—Testing the strength of a magnet with spring balance

Fig. 2—Right—Testing with a magnetmeter

Another type in common use has the two coils wound on short iron cores, the cores projecting through and flush with the tops of the coils, with a bar across the bottom to complete the magnetic circuit. The magnet to be charged is placed with its poles to the cores of the charger. The chief disadvantage of this type is the long magnetic circuit necessary, requiring an excessive amount of current to properly saturate the magnet, due to the high reluctance of the circuit.

Shorter Magnetic Circuit

An improved model of this type has the cores extending only half way through the coils, and joined at the bottom with a heavy iron bar to complete the magnetic circuit. This model is a great deal more efficient as the magnet to be charged extends into the coils also, making a shorter magnetic circuit, an important factor in repair shop work, because she shorter the magnetic circuit required for each magnet, the more magnets can be recharged in a given time.

Considering these designs from a practical and technical standpoint, a charger of the solenoid type is the ideal design for all purposes. The coils are wound on hollow spools, with the holes in the center nearly the size of the magnets to be charged and an iron keeper is placed across the bottom of the coils to complete the circuit. This design gives the shortest possible magnetic circuit; therefore it takes the minimum amount of current to saturate the magnets.

Efficient Charger Design

An efficiently designed charging coil is shown in Fig. 3. The coils are adjustable to any size of magnet by providing one of them with a means of sliding along the base, allowing the holes in the coils to be comparatively small. An iron keeper is embedded in the wooden base immediately under the center of the coils so as to complete the magnetic circuit when the magneto magnet is in position. The wires are connected up as shown to two binding posts. A push button or switch may be inserted between one of the coil wires and the binding posts for convenience, but this is not absolutely essential, as the same result can be achieved by connecting the feed wire to only one of the two binding posts, touching the other binding post with the remaining feed wire when applying the current. A second's application of the current is all that is necessary to this type of charger.

This design will operate very satisfactorily, either from a 110-volt direct current line or from a 6-volt storage battery, the winding of course being suitable for the voltage intended. As a 6-volt storage battery is available in most garages, this source of power is most frequently used.

As a coil to magnetize permanent magnets is one of the oldest discoveries in the electrical field, the designing of one is purely a matter of furnishing a coil to thoroughly saturate the magnet with the minimum amount of energy.

In order to do proper recharging, a reliable means of testing the strength of the magnets must be had, as without this it is purely guesswork, and guesswork is rapidly disappearing from the automobile trade. A scale and keeper may be used as in Fig. 1, or a magnetmeter is still better and more accurate. When a spring scale is used, the keeper is placed squarely across the poles and the scale is hooked onto the center of the keeper. The magnet is now drawn away until the keeper is pulled from the magnet and the pull in pounds noted at the time of break. This should not be repeated as a slight loss of strength occurs after each break, due to the sudden change in the magnetic circuit.

When Magnetmeter Is Used

When a magnetmeter is used the magnets are placed with their poles to the side of the meter, Fig. 2, when the needle instantly moves to the correct strength. This is by far the most accurate method of testing, as no magnetic circuit is made and therefore there is no loss of power when the magnet is removed, no matter how many times this action is repeated.

When recharging magnets, they are placed in the coils with the N pole of the magnet to the S pole of the charger. This may be found with a compass or by holding the magnet over the coils, and at right angles to them, and applying the current an instant, when the magnets will tend to swing towards their proper polarity. The magnet is now placed in the coils and the current applied for an instant, when the magnet will be found to be fully charged. Any further application of the current is unnecessary.

Pounding Magnet Is Superfluous

The general practice and one that is advised by many electrical books, is to pound the magnet while charging. This will be found entirely superfluous, and a waste of time. This may readily be proven by charging a magnet in the usual way and testing its strength with the meter, then recharge it, pounding while doing it, and again testing, when the strength will be found to be the same as when charged the first time.

Another practice recommended by the same authority is the use of keepers after charging. As this is one of the oldest theories in regard to permanent magnets, it is hard to accept an opposite belief. However, like a great many other theories it has proved erroneous. *The use of keepers will be found to be a waste of time, as no loss is incurred through the absence of their use. In fact, a magnet may be laid away without a keeper of any kind, and remain full strength for weeks or months; this will be easier to believe by a little experimenting.*[*]

In some cases where magnets are thrown around among pieces of iron or steel on the bench, it is well to place a keeper on them, as it protects them from magnetic disturbances.

Incorrect Use of Keeper

An ignorant use of a keeper is most harmful, particularly when a keeper is removed from the magnet by sliding it from the poles towards the top. This is easily seen by charging a magnet and pulling the keeper off in this manner and again testing, when it will be found to have lost nearly half of its original strength. The result of this practice can be easily seen and great care should be taken to avoid it, as a great loss is sure to occur.

Keeping Strength After Recharging

When the magnets are recharged and ready to replace on the magneto, they should be placed on the bench with all of their like poles together, that is all N poles on the same side. After placing the magnets in this position they should not be separated again, as they will lose some of their strength when the break occurs.

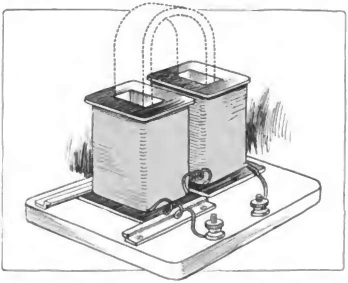


Fig. 3—Apparatus for charging magneto magnets. One of the two coils is provided with a means of sliding along a base between two guides, so that the centers of the coils can be adjusted to any size of magnet. The magnetic circuit, when charging, is completed through an iron keeper embedded in the base beneath the centers of the coils

They should now be replaced on the magneto, still in this position, carefully forcing them all down evenly, and the screws replaced. Where magnets are replaced separately a loss occurs when one magnet is drawn past the other, due to the distortion of its magnetic field, thus consuming a part of the energy.

Some authorities recommend placing a keeper on the magnet until it is replaced on the magneto, then removing it by drawing it off towards the top. As explained before, this is very harmful. The purpose of this operation is to maintain an unbroken circuit of the magnetic field and a greater strength. Even if this were so, the strength thus gained would be lost when the armature was revolved a few times, due to the partial opening of the circuit and the resultant change in the magnetic circuit.

When New Magnets Are Needed

Some magnets will be found that cannot be charged to a point where practical to use them. When magnets fail to come up to their proper strength they should be discarded and new ones used. When they fail to receive a proper charge when first charging them, no amount of charging will raise them above this point.

U. of Wisconsin Gives Automobile Course

Madison, Wis., Feb. 26—The University of Wisconsin, through its Extension Division, is giving a course of ten lectures on the mechanical principles and operation of automobiles. Many owners and drivers have applied at the university for such a course and the university hopes to reach most of the important cities throughout the state of Wisconsin. Six experienced mechanical engineers on the staff of the Extension Division are available to give the course in different parts of Wisconsin.

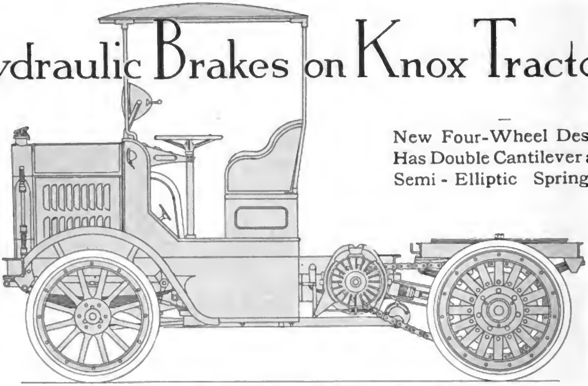
The work was planned by Professor Earl B. Norris, who is in charge of the Mechanical Engineering Works of the Extension Division. Professor Norris was at one time experimental engineer with the Reo Motor Car Co., and he has as his assistants George W. Hobbs, formerly with the Buick company and Weston-Mott axle company and B. G. Elliott, formerly of the McKeen Motor Co.

---

[*] Editor's Note—This is at variance with the universally accepted theory on the use of a magnet keeper. According to most engineers the flow of the magnetic line from pole to pole across the air gap between these poles causes the magnet to do a greater amount of work than is necessary through the easier path provided by a keeper. The performance of work against the resistance of the air gap dissipates some of the magnetic energy and at the same time there is a tendency for the lines of force to be scattered to some extent and lost in the air surrounding the magnet. With a keeper, it is generally believed that the magnetic lines are confined to this path of least resistance.

Hydraulic Brakes on Knox Tractor

New Four-Wheel Design Has Double Cantilever and Semi - Elliptic Springing



The tractor without the trailer attached, showing the cab, control mechanism, drive and fifth wheel

THE tractor which the Knox Motors Co., Springfield, Mass., has been engaged upon during the past few months has just been announced and shows itself to be an example of exceptional originality in this field. Rated at the unusual capacity of 10 tons, it is the result of the experience gained by the Knox company with their three-wheel tractor, to which are added features which are radical departures from the previous design.

Has Four Wheels

The new tractor has four wheels, whereas the previous Knox tractor had three. In addition to this there are new features which have not been seen heretofore, such as hydraulic brakes, a simple interlocking differential lock, a complete control board forming a brace between the top of the steering column and the dash and incorporating the speedometer oil pressure gauge, ammeter, lighting switches, ignition switch and fuses all in a position handy to the operator, a new design of gear oil pump mounted on the upper half of the crankcase and an automatic locking device for the jackshaft brake.

Throughout the design it will be noted that accessibility, exceptional strength and simplicity are the keynotes. The Knox tractor is characterized principally by its method of supporting the front end of the trailer. This is similar to the ordinary horse wagon except that the fifth wheel rests upon the tractor instead of on a front axle. The turntable upon which the trailer rests is mounted on a steel frame and supported from the tractor axle by heavy, semi-elliptic springs which are entirely independent from the rest of the tractor, and therefore renders the load of the forward end of the trailer entirely a matter of sprung weight. The tractor has its own springs which take care of the load at this part of the vehicle. These are of the cantilever type.

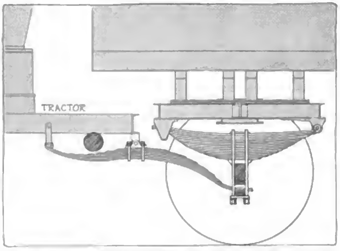
Design Is Compact

Another improvement of the present Knox tractor over the previous models turned out by this concern is in the general compactness of design. Although the same style of power plant is employed, the engine hood has been considerably shortened and the axle has been brought well back to the radiator. In order to accommodate the full length of the motor with this arrangement the power plant extends slightly back into the driving compartment within a slightly curved inclosure.

Left Drive and Center Control

Left drive and center control are used on the new car, the steering column being vertical and having the triangular shaped control board with the instruments as previously enumerated. The control levers are placed between the two independent seats for the driver and his helper and are standard in every particular except for the small heel pedal which controls the differential lock. This has been rendered foolproof by the use of an interlocking mechanism which prevents the differential lock from being thrown into action unless the gearset is in neutral. After this has been thrown into engagement any of the speeds can be used in the customary manner.

The handbrake lever is mounted next to the gearshift lever in the usual posi-

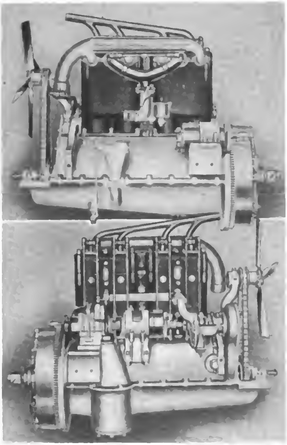


View of spring suspension, showing use of cantilever for the tractor and semi-elliptic for the trailer tion but instead of operating a series of linkages, it operates a hydraulic oil pump by means of which a great reduction is obtained and at the same time allows the operator to have a very delicate control. The brakes which are operated by this hydraulic system are exceptionally large, having a diameter of 20 inches and a face width of 6.5 inches.

Overhead Valves Continued

The Knox company has not departed from its overhead valve practice in bringing out this new tractor. The motor has its four 5 by 5.5 cylinders cast in pairs and is so timed as to have a quick acceleration to approximately 1,000 r.p.m. Beyond this point the speed horsepower curve shows a rapid decrease. This arrangement has been worked out on the theory that when running under full load the speed will be limited, because the maximum power necessary to carry the load cannot be obtained at speeds which will shorten the life of the tractor. When the tractor is run without load it may be driven at higher rates of speeds without damage and this condition is taken care of by the fact that a small power output only is necessary under these conditions. Thus, an automatic governing feature is provided which cannot be removed to suit the desires of an irresponsible operator for speeds above normal.

Although the overhead construction is used, valve cages have been eliminated and the valves are carried in detachable heads bolted to the cylinder castings. The principal change in the valve mechanism is in the use of ball bearings instead of plain bearings for the rocker arm. The valve mechanism is exposed and hence readily accessible. The auxiliaries are also mounted accessibly, being as high upon the motor as is practicable. This applies to the carbureter, magneto, generator and starting motor; the lowest point of any of which is 31 inches from the ground, thus allowing the tractor to pass through a considerable depth of water without allowing moisture to penetrate any of these instruments.



Top, left side of motor; bottom, right side of motor, showing mounting of carbureter, generator and linkage for overhead valves

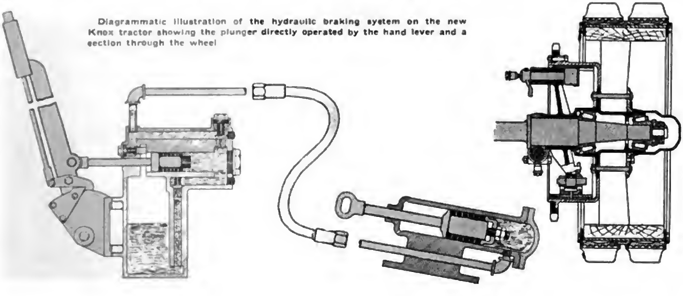
Oiling Is Refined

The oiling system has been considerably refined and is a high-pressure force feed scheme in which the main lead is a steel pipe cast within the crankcase and from which drilled holes communicate with all the bearing surfaces. There is a device which regulates the pressure on the oiling system, allowing surplus oil to be discharged into the timing gearcase, thus lubricating these gears. The oil pump hangs from the upper half of the crankcase and there is a large screen which entirely covers this and through which all the oil passing through the system must go before circulation. By removing six nuts the screen may be withdrawn for cleaning without disturbing any of the mechanism.

The electrical equipment of the car includes a Mea magneto, and a Bijur starting and lighting system. The Bijur generator and the Mea magneto are mounted on the same longitudinal shaft. The spark position is fixed. Starting engagement is secured by sliding a pinion mounted on the armature shaft of a cranking motor into engagement with the geared flywheel. The starting motor is carried on the crankcase.

Vacuum Fuel Feed

The fuel system includes a Stewart vacuum feed from a 25-gallon square tank located below the frames and behind the right running board. In this position it is accessible for filling, its weight is carried low and in a good position in



Diagrammatic illustration of the hydraulic braking system on the new Knox tractor showing the plunger directly operated by the hand lever and a section through the wheel

View of the complete vehicle, tractor and trailer, in active service with a heavy load of milk

relation to the center of gravity of the entire car; the load being kept off the back axle as much as possible. The small tank from which the fuel is fed by gravity to the carbureter is mounted behind the dash and is of such a height above the motor that a positive fuel feed is given on any practicable grade.

The cooling system is operated by a centrifugal pump, the water being taken through a U-shaped casting bolted to the side in such a manner that the water joint is eliminated when the head is bolted to the cylinder.

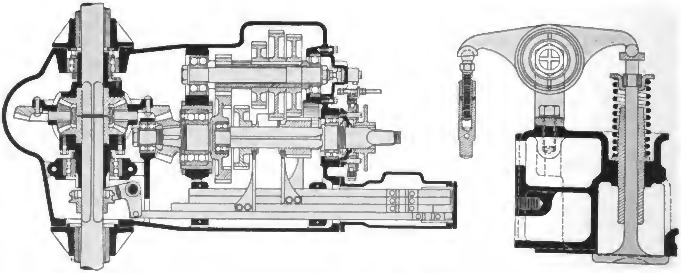
Clutch Is Larger

Cork inserts are used in the same design three-plate clutch as previously employed. The clutch is larger, however, in order to take care of the heavier loads and to furnish a positive engagement for the sudden efforts necessary in tractor work. The three-speed selective gearbox is incorporated with the jackshaft. It is provided with an interlocking differential lock incorporated in the gearbox and operated by a heel button at the driver's seat. The purpose of the interlocking device is to prevent the differential lock to be used except when the gears are in neutral. This has been done owing to the experience gained in previous locks in which brakage was caused by the engagement of the lock during the transmission of power through the gearset. The trouble has been caused by using the lock when one wheel is spinning at a high rate of speed while the other remains practically stationary. With this device, the spinning wheel is stopped before the lock can be engaged. The entire gearset is carried on double row annual ball bearing. The gears and shafts are nickel-steel and the gearcase is a barrel design with the aperture for the bearing bored through the case. The top of the gearcase is located between the two seats to the right of the driver, giving a convenient layout for the central control.

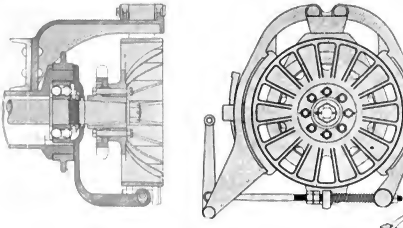
The drive of the tractor, including the power plant, front wheels and body is through the rear axle to the distance or strut rods, thus allowing the trailer to really become a part of the power-driven vehicle with a front-wheel drive. This is ideal for allowing the truck to climb over obstructions because it places most of the load on the driving wheels. The light load of the tractor which is pushed ahead of the driving wheels simply furnishes traction for steering effort.

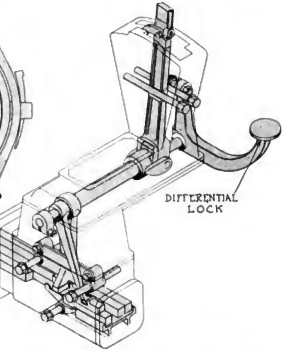
Although the wheelbase is but 108.5 inches, the principles incorporated in the design of the tractor are entirely different from those in what may be termed a short-wheel base truck. This is due to the method of spring suspension which has previously been described. The chassis proper, including the transmission, motor, cab, etc., is carried on springs which are about 30 per cent. as stiff as those on the ordinary 5-ton truck. Thus the driver need not operate a vehicle which is, from his standpoint, practically without springs. As will be noted from the illustrations, the frame does not extend back as far as the rear axle and the rear axle is entirely separate from the chassis of the tractor.

From the jackshaft, the drive is taken through the rear wheel by chain in the usual manner, the rear axle being allowed to rise and fall in the arc provided by the rear bracket of the strut rods. A draw-bar device with springs is attached to maintain the trailer platform in a horizontal position when running without the trailer attached. The rear axle is a solid steel forging of rectangular 2.75 by 4.375-inch section and the entire vehicle is standard tread. The tires in front are 36 by 4 single, and in the rear 38 by 6 dual. The rear wheel construction is exceptionally heavy, and in fact the Knox company claims that it seems to be



Left—Gearshifting and differential locking mechanism in sectional view. Right—Sectional view of the ball bearing overhead valve operating mechanism





Left—Two views of the jackshaft brakes, showing method of support and adjustment. Right—Gearshifter control and differential lock operated by heel button

heavier than any as yet built. The lowest point of clearance is 10.5 inches, this being under the front axle. The maximum load on the front tires is 3,400 pounds regardless of the load on the trailer.

Reductions are such that at 1,000 r.p.m. the truck will be traveling 9.4 miles per hour, on second speed, 3.9 and on low speed 1.6 miles per hour. By changing the jackshaft sprocket and making other slight alterations the speed can be increased to 33 miles per hour for use for fire apparatus, wrecking purposes, etc.

The Hydraulic Brakes

The hydraulic rear wheel brakes are internal, being Raybestos-faced with 20 by 6.5-inch drums. The hydraulic cylinders are carried on the radius rods and are connected to the pump which supplies the hydraulic pressure upon the manipulation of the operating lever, by flexible tubing. The pump consists of the cylinder, fitted with a piston attached to the operating lever. As this is worked backward and forward, oil is forced through the cylinders and expands the brakes. The pump is self locking and has a latch in addition to guard against accidental release. The release of the pressure is effected by moving the lever to its extreme forward position which opens a by-pass, allowing the oil to return to the reservoir.

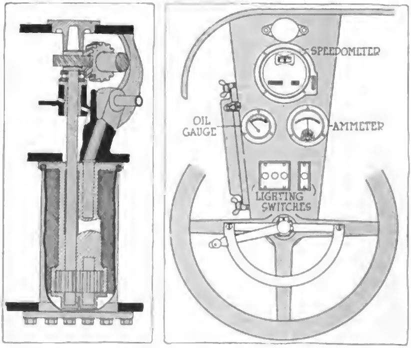
Foot Brake Can Be Locked

The car is generally stopped by one stroke of the piston or one movement of the hand brake, but when it is desired to apply more pressure, additional strokes may be made. Another feature which is unusual in brake construction is that the foot brake can be locked.

The equipment includes the trailer platform with its springs and circular plates, electric starting and lighting with a large searchlight, two heavy jacks for removing the trailer, fire extinguisher, speedometer, cab and side curtains, a hand-operated horn and all the standard tools and parts. The guarantee on this tractor is given for a year, instead of the usual 90 days, and no limits are placed upon the speed at which the motor may be driven.

The primary idea which is behind the marketing scheme for the new Knox tractor is exactly in line with the policy of the more advanced motor truck companies to sell service rather than trucks. The price of this tractor with standard equipment is $4,500 f.o.b. Springfield, Mass. This includes the full equipment which has been mentioned.

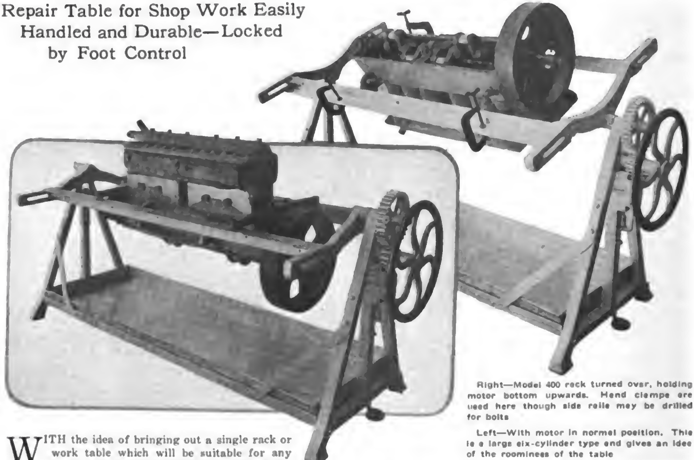
The claim of the manufacturer is that the tractor and trailer method is the most economical way of hauling very heavy goods and hence it is the object of this concern to bring the new trailer to the attention of lumbermen, coal dealers, brewers, contractors and other trades in which the hauling of heavy materials is involved. A complete set of data regarding the costs of various hauls as compared to the horse and motor trucks method has been compiled. The machine will be marketed through the company's seven established branch offices and through a corp of transportation engineers who have already been trained in this work or who will be educated by the Knox company. The company contemplates establishing a training school for this purpose.



Left—Oil pump mechanism with helical drive, showing strainer in position. Right—Control board mounted between the steering wheel and the dash, rendering all instruments accessible from driver's seat

Rack Holds Any Motor in 32 Positions

Repair Table for Shop Work Easily Handled and Durable—Locked by Foot Control



Right—Model 400 rack turned over, holding motor bottom upwards. Hand clamps are used here though side rails may be drilled for bolts

Left—With motor in normal position. This is a large six-cylinder type and gives an idea of the roominess of the table

WITH the idea of bringing out a single rack or work table which will be suitable for any eight, six or four-cylinder motor, the St. Albans Foundry & Implement Co., St. Albans, Vt., has announced an adjustable device which incorporates many features unique in this field.

This table is intended for a universal machine. It can not only handle any size motor but is so arranged as to be able to support any of these motors in any desired position. The device can be placed close beside the car and the motor lifted from it and swung into position into the rack with the ordinary type of chain hoist. It is possible to lock the work table in thirty-two different positions. The locking device is operated by the foot, permitting the free use of the hand during the revolving of the engine. The table itself revolves easily; and with it a heavy engine may be adjusted to any position with one hand operating the hand wheel. This is accomplished by the reduction gears shown in the accompanying illustration.

This machine is constructed entirely of iron and steel and can withstand the wear and tear of ordinary service. In the illustrations the table is shown with the motor mounted in upright and reversed positions. The side rails, which are removable, can be extended to take care of wider engines and for narrow engines there are supplementary rails inside the main frame. The side rails are angle steel 1.5 by 2.5 by .25-inch. Generally the engines are fastened to the table by hand clamps, but if it is desired the side rails can be drilled to take the ordinary engine bolts.

The length of this table overall is 7 feet. This is sufficiently great to take care of the ordinary motor and flywheel attachments. The height is 3 feet, giving a firm base with little danger of tipping. At the same time the motor is brought to the height at which it is most convenient to work upon. The width is 3 feet overall, the table being 17 inches wide with the side rails contracted and 10 1-2 inches wide using the extra rails. The width of the table with the side rails extended is 30 inches and when extended with the interior extra rails a 27 1-2-inch width is given. The table length is 64 inches. The diameter of the hand wheel is 17 inches. The weight of the entire table completely assembled is 325 pounds. When the pan is removed it is 310 pounds. In the normal position, the table is 30 inches above the ground. When it is reversed it is 37 inches.

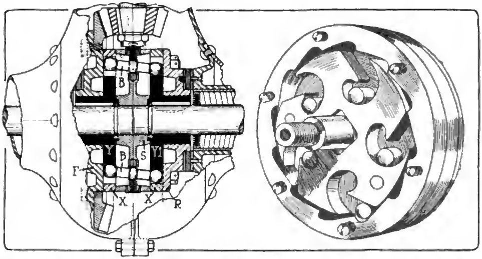
In addition to this the St. Albans company manufactures three other models of tables known as the 100, 200, and 300. The largest table just described is known as model 400. The dimensions of the other tables are as follows:

Table Model	Length, Inches	Minimum Width, Inches	Maximum Width, Inches
100	30	10	24
200	40	10	24
300*	54	10.5	30

*Extra side rails furnished with this machine.

Gearless Differential Co. Adds a Type for Ford Cars

THE Gearless Differential Co., Detroit, is still making its form of releasing clutch which is designed to take the place of the conventional gear differential. In addition to this type, a design for Ford cars has been brought out which can be fitted to the Ford axle without alteration of the Ford mechanism, the compensating gears, however, giving way to special ratchets which are a part of the Gearless assembly.



Gearless differential for Fords. Left—Fig. 1—Section showing how drive is carried from one side of axle to the other on pins B. Right—Fig. 2—Gearless differential in its original form, as designed for use on small cars and trucks

Fig. 1 shows sectionally the device installed in the Ford axle. In this form it acts on the same principle as the standard type. The left differential flange F to which the differential driving gear is bolted, the right hand flange R, the center ring S and the right and left driving sectors X—two at top and two at bottom—are bolted together, making the whole outer differential housing a unit. The right and left ratchets YY, which are keyed to their respective axle shafts are free to rotate inside the housing. The round members B are the interlocking mediums between the driving sectors and the ratchets. In the illustration the right hand end of the top pawl is in the tooth of the right hand ratchet and is being driven by the contact face of the driving sector. In the same manner the left ratchet is driven forward by the lower pawl which is engaged at the opposite end. Thus both wheels are being positively driven forward.

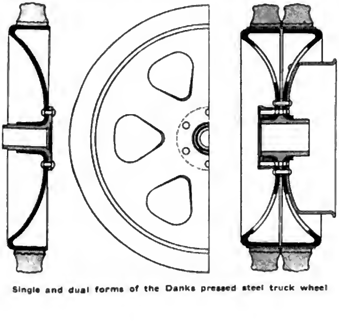
To drive backwards, the differential housing starts to move to the left and pushes the end of the pawl out of the ratchet tooth. This throws the opposite end of the pawl down into the tooth of the opposite ratchet. The lower pawl acts similarly and the rotation is reversed. Imagine the car to be turning a corner to the left. The right wheel revolves faster than the left and causes the right hand ratchet to move faster than the differential housing, which can only go as fast as the inner or slower-moving wheel. The ratchet pushes the end of its pawl out of its tooth, thus allowing the ratchet to have a free movement forward. As soon as the wheels revolve again at the same speed, the spring at the center of the pawl pushes its end back into engagement and the drive is again taken up by both wheels.

The standard form is the same in operative principle as the Ford type, only instead of the walking beam form of pawls, rollers form the connection between the driving member and the driven one. Fig. 2 shows the design. The inner driving member is fixed to the shaft, and its pawl cams pick up the rollers when the rotation is reversed. These are carried towards the center of the runways by their own inertia. A similar set of parts on the opposite side take care of rotation in the opposite direction.

An English Pressed Steel Truck Wheel

A NEW pressed steel wheel for commercial vehicles is announced in the current issue of *The Automobile Engineer.* It is designed to cope with the difficulty produced by the failure of Continental supplies of steel wheels.

The single wheel is shown at the left in the illustration, and it is manufactured in the following manner. A steel plate is placed between a pair of blanking dies, and a circular disk is punched out of it. This disk is heated and placed between a pair of forming dies that press it into the formation shown in the illustration. It is then shrunk upon the hub, which is a drop-forging, and, after the holes are drilled, is riveted to it.



Single and dual forms of the Danks pressed steel truck wheel

The double wheel consists in reality of two-single wheel disks shrunk upon a drop-forged hub and no welding is necessary.

At the right of the illustration may be seen a double or rear wheel complete with brake drum and special boss—as supplied to a well-known firm of commercial vehicle builders—the latter being required to suit the special demands of the customers. For vehicles up to 2 tons capacity the rear wheel disks are pressed from 3-8-inch steel plates, and for those above this size a 1-2-inch plate is utilized, while the front wheels are in all cases composed of 1-2 inch steel plate, and in all instances the wheels are lightened by the perforating of the disks in several places, as shown.

Important features of the construction lie in the fact that the natural contracting forces, consequent upon the cooling of the heated parts, are utilized in bonding together the component parts of the wheel, and that welding together of parts, as is frequently employed in other makes of wheels, is avoided entirely while the use of rivets is only necessary for holding the disks in contact with the flanges of the hubs. Messrs. Danks & Co., Oldbury Boiler Works, Birmingham, Eng., the maker, places emphasis on the simplicity and strength of the construction.

Quick Speed Changes in New Drill Press

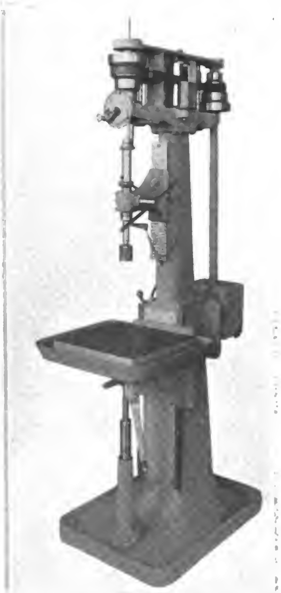
New Four-Speed Machine Reduces Speed Changes to 2 Seconds—No Twists to Shorten Life of Driving Belt

A NEW quick-change sensitive drill press which is designed to cut the time generally consumed in determining the proper cutting speed for a given drill size has been brought out by the Sipp Machine Co., Paterson, N. J. It is also intended to reduce to a minimum the question of belt arrangement by having these applied in the simplest possible manner. It is stated that, with a number of sensitive drills, belts are used that do not track naturally and hence it is generally necessary to use a number of twists and turns in the belting which generally shorten the life of the belt and result in the belt being stretched more on one side than on the other. This unequal strain destroys the fiber of the belt and results in increased slippage and after a length of time in breakage.

Another trouble which the new drill is intended to eliminate is that of the sometimes unsatisfactory hand screw device for operating the pulley centers in order to secure the proper attention on the belt. When inexperienced operators make this adjustment the centers are often determined in an unsatisfactory manner and much more strain is put on the belt than need be, with a consequent breakage of the belt transmission. While the wage of the operator continues during the time that the belt is being repaired, it must be remembered that both the machine and operator are non-producers during this period. To overcome the difficulties mentioned above the Sipp drill uses an open endless belt tracking without any twists or turns and at the same time has the centers automatically determined, thus taking up the slack and stretch of the belt. The short, straight, endless belt used on this machine can be placed in position in 10 seconds, according to the manufacturer. Belt tension is kept constant by idler pulleys on the slack side.

Speed Change in 2 Seconds

It is stated that with this new drill any speed change can be made in 2 seconds. This is a vast reduction over the length of time required with the ordinary sensitive drill. For convenience in making these speed changes and for securing the proper cutting speeds a dial showing the r.p.m., or size of drill, is conveniently placed facing the operator. The belt is shifted by a crank handle which renders it not only safe to make the speed changes but renders it possible to do this safely.



Exterior of the new quick-change speed sensitive drill press made by the Sipp Machine Co.

The construction of the spindle is of note in that provisions have been made for long bearing surface and good oiling. The feed pinion bearing is of exceptional length and is lubricated by a new spindle oiling device. Great rigidity is obtained by the use of a long steel feather on the spindle feed. When lifted to its extreme height the spindle chuck is 32.5 inches above the table, when this is in its highest position. Another feature of this machine is that it need only be bolted to the floor and the floor need not be bored since telescopic screws are used on the table elevating shaft. A groove about the table facilitates the removing of chips.

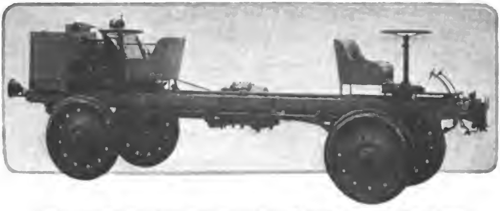
Better Cutting Speeds

It is thought that with the ease in making speed changes more efficient cutting speeds will be commonly used. All these changes and the changing of the drills themselves can be made without stopping the machine. The operator need not leave his natural working position either for changing speeds or drills, or for the purpose of raising or lowering the table.

These drills are built in various combinations from one to eight spindles inclusive. The machines have four speed changes arranged for either carbon or high speed drills. The power and speed variations are sufficient to handle high speed drills from the smallest up to 29-32 inch diameter. The use of non-friction bearings has been generous in this machine, sixteen of these being employed in a one-spindle drill. The entire belt strain of the spindle driving cone is taken on ball bearings and no strain whatever is placed upon the spindle.

Throughout the entire design of the drill Safety First requirements have been carefully noted. The belt shipper is so designed as to prevent the fingers from getting caught between the belt and the pulleys, and, although the safety requirements have been met throughout, no unsightly guards or coverings need be used.

Jeffery Reversible Army Truck



Jeffery reversible army truck which can be driven 35 miles per hour in either direction

JEFFERY has brought out the first reversible military truck to be constructed in America. It is a 2-ton, four-wheel drive chassis and the first model is to be shipped to London to be demonstrated to the military officials of the Allies.

This chassis is one of three of its type built by the Thomas B. Jeffery Co., Kenosha, Wis., in response to the recommendations of W. F. Bradley, as published in THE AUTOMOBILE for December 17, page 1101. These recommendations require the car to be run in either direction at equal speeds so that it is possible for the vehicle to be removed from a cul de sac.

The new vehicle as shown in the accompanying illustration is a stock Jeffery 2-ton, four-wheel drive with four wheel steering and braking, but has a steersman's seat at either end. The engine is guarded by a light steel plate at the rear and the starting crank is mounted behind it, being connected with a chain and sprocket to the crankshaft, and for safety's sake an overrunning clutch is fitted. Should a quick start be desired, there is a Bijur electric starter. The gearset is reversible, having four speeds in either direction. The reverse gear has been removed from the stock gearset and a fourth speed substituted. The reverse is independent.

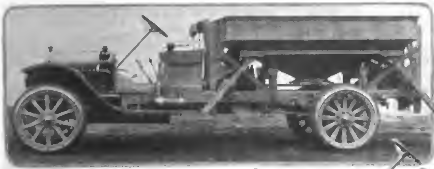
The steering wheels at the front and rear ends of the truck are interconnected, as are also the clutch and brake pedals. In military service there would be two operators in communication with one another by means of electric buzzers. Three cars of this design have so far been built. One is in New York City, another at San Francisco and the third in Kenosha. Speed in either direction is 35 m.p.h.

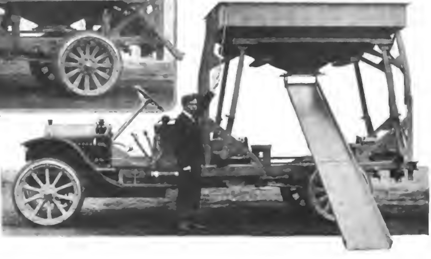
White Power-Hoisting Coal Body

A NEW type of power hoisting body on a special 1.5-ton truck for the retail delivery of coal has been introduced by the White Co., Cleveland, O. This new truck utilizes the principle of four worm-operated lever arms in the elevating mechanism. It is notable in that it is an application of the power hoisting principle to the fast moving, medium-duty coal truck. It is designed especially for the rapid discharge of coal directly into manholes, basement windows, etc.

The truck is capable of hoisting the 72-cubic-foot body in 30 seconds, and has been so designed that a chute on either side of the truck may be used. It is thus possible to deliver the coal into a sidewalk manhole without violating traffic ordinances.

Two lever arms in the front and two in the rear are attached to the ends of transverse shafts which are turned by worms and gears. The worms are driven by sprocket and chain from a longitudinal shaft and this in turn is driven by the power transmission of the truck. When the body is being hoisted or lowered, its stability is maintained by four legs which slide up and down in four guides mounted upon the frame. An automatic shutoff is provided for extreme positions.





Views of White truck with body in lowered and raised positions showing method of elevating for use of chute. The floor of the body is in the form of a pyramid, upside down, with a sheet steel sliding door in the apex, forming a hopper to regulate the feed of coal into the chute. The latter, being of the telescopic type, permits of varying the angle according to the length of the chute

3,500 Cars for Central New York This Year

$5,000,000 Business Expected—75 Per Cent. Increase Over 1914, When 2,000 Cars Were Sold

SYRACUSE, N. Y., March 1—Five million dollars of business in automobiles and allied products is anticipated for the coming season in the territory which is fed by the automobile dealers and distributors of this city, who staged their seventh annual show last week in the State Armory. A compilation of statistics obtained from the exhibitors shows that they expect to sell 3,500 cars this year in this territory as compared with less than 2,000 last year, an increase of 75 per cent. All of them are keenly optimistic.

So successful was the show from the standpoint of attendance and business that it is to run 6 days next year; this year it ran from Tuesday night to Saturday night, 5 days. The first show, 7 years ago, was 3 days.

This year 21,000 people attended and about 600 of them were dealers and salesmen of automobiles and accessories in the comparatively large territory which uses this city as a distributing center.

The Syracuse show is the main motoring event in Central New York. March 3-6 Watertown holds a show in the State Armory in that city and the week following Utica has an exhibition, but the Salt City event is the largest.

Many and Varied Industries

The Syracuse territory,—which embraces as a general rule ten counties but sometimes several more—possesses a large buying power. The cities are industrial, the manufactures are many and varied and the lines of agriculture are also of great variety. This variety and prevalence of small industries tends to preserve an evenness of conditions which does not obtain in those cities where industrial health is dependent upon one or two large factories.

In the cities of this section, which are Syracuse, Binghamton, Auburn, Rome, Oswego, Watertown, Fulton, Cortland, Ogdensburg, Ithaca and also Utica and Binghamton in some cases, there are 2,000 factories with an annual output of better than $150,000,000. There are in ten counties 7,000,000 acres divided into 50,000 farms, averaging 133 acres to the farm. The total value of the farms and farm property is $300,000,000, and this does not include the farmers' resources aside from the land, buildings and equipment. Crops and bankrolls are not counted.

One of the features of this year's show was the used car exhibit, in which twenty-six well-finished used vehicles were housed by themselves in the basement of the State Armory. This display was as carefully as the new car exhibits on the upper floor. Each car carried a placard giving the name and year of the car and, in some cases, the price.

The exhibit housed sixty exhibitors, who displayed a total of ninety new cars and chassis, eighteen trucks and twenty-six used cars, 134 in all. But seven were closed cars. Some of the dealers planned to include closed cars but did not receive them in time. Anyway, the closed car trade in this city has not progressed as rapidly as in some other cities. The Syracuse car owner seems content with a touring car, and most owners drive their own cars.

3,000 Cars in Syracuse

There are 3,000 cars running in this city and about 40 per cent. of them run all winter. Curtains serve to keep out most of the wintry blasts and that suffices. The mean temperature during the winter seldom gets far below the freezing point and the streets are at all times fairly passable. In the territory to the north, south, east and west cars are kept running wherever the roads are in any fit condition. One owner is reported to have driven recently from his home to town over the crusted tops of snowdrifts without difficulty. In the territory east of Oswego along Lake Ontario one dealer stated that there generally are not more than 60 days that cars cannot be kept in service. The general report is that in the country districts cars are driven if there is a semblance of a road open.

Population of Cities in Syracuse Territory

City	Population	City	Population
Auburn	34,668	Utica	74,419
Binghamton..	48,443	Fulton	10,480
Elmira	37,176	Oswego	23,368
Syracuse	137,249	Ogdensburg...	15,933
Watertown ..	26,730	Ithaca	14,802
Cortland	11,504		
Oneida	8,317	Total	463,586
Rome	20,497		

Factory Activities

Several factories and branches had representatives at the show laying plans for 1915 business. C. H. McCausland of the New York Kissel branch rented space, displayed cars and placed an agency; Frederick E. McEwen, territorial representative, displayed the Inter-State and placed the Syracuse dealership with the Service Boat & Engine Co., E. L. Rolfsen, proprietor; the White was represented by R. R. Stitt, Syracuse, R. H. Shimer, Utica, and Newell Lyon, New York State manager; the International Harvester Co. was represented by Maurice Stanton and S. W. Wyman, territorial managers; the Case exhibit was staged by the Syracuse branch, F. L. Allen, manager, which caters to 149 dealers.

Factory exhibits were staged by the Chase Motor Truck Co., Syracuse; the Sanford Motor Truck Co., Syracuse; H. A. Moyer & Co., Syracuse; the Palmer-Moore Co., Syracuse; and the Brockway Motor Truck Co., Cortland. The Franklin Automobile Co. was represented by Bull & Young, the Syracuse dealers. W. T. Butler, Indianapolis, and E. H. Baker, president of the Cole Motor Car Co. of Buffalo, placed the Cole agency with Nichols, Nichols & Nichols.

Farm Property in Ten Counties of the Syracuse Territory

County	Population	Acreage	Farms No. of	Acreage Average	Value of All Farm Property
St. Lawrence	89,005	1,728,640	8,244	129.1	$49,975,175
Jefferson	80,382	815,360	5,778	126.8	40,095,331
Oswego	71,664	618,240	6,319	77.9	23,804,151
Lewis	24,849	812,800	3,343	142.1	16,288,674
Oneida	154,157	800,000	6,929	99.6	38,437,991
Madison	39,289	416,000	4,042	94.4	20,891,990
Onondaga	200,298	499,840	5,770	75.8	37,291,043
Cayuga	67,106	449,920	4,785	85.9	26,915,448
Cortland	29,249	321,920	2,610	114.8	13,171,013
Tompkins	33,647	304,640	2,988	91.4	14,898,795
Total	789,646	6,767,360	50,808	133	$281,769,611

Farmers of Northern Iowa Will Spend $2,500,000 on Cars in 1915

FORT DODGE, IA., March 1—The fourth annual northern Iowa show which ended here Saturday night surpassed any other similar event in this section of the state, produced more business than any larger shows, and, attracted close to 25,000 people from a radius of 100 miles. Dealers are enthusiastic over the results obtained.

In the heart of the only section in the country where business has been good for the past few months, according to a recent map United States Chamber of Commerce, Fort Dodge is the center of a section where people have money to spend for automobiles. Seventy-five per cent. of sales go to farmers. Local distributors handled $2,000,000 worth of cars in 1914, and expect a 25 per cent. increase this year. Thirty counties in the prosperity belt handled out of this city. Five hundred and fifty subagents working under distributors last year sold 2,500 cars and expect to sell 3,000 this season, and twenty-eight makes of machines are represented here. Fort Dodge now is recognized as logical center for automobile distribution in northern Iowa. Four hundred and sixty-four subagents registered at the show.

From a sales standpoint the show was a success. Few notes were offered and most of the buyers paid cash. Accessory men reported more sales than at the Kansas City or Omaha shows.

The fifty-sixth regiment armory proved entirely too small and the show association was forced to turn down twelve requests for automobile space with a total of fifty cars. As a result dealers are behind the movement to build a coliseum at least three times size of the armory. With the prices of farm produce increasing because of the war, northern Iowa will have big business from the farmers this year. Land is increasing constantly in value and farmers are prosperous.

$4,116,000 Sales Predicted for New Haven Territory in 1915

NEW HAVEN, CONN., March 1—In the territory centering around this city, cars were sold last year to the value of $2,796,000 and for the current year, conservative estimates place the total volume of sales at approximately $4,116,000. Although these amounts may seem small by comparison with the totals that are piled up by such great distributing centers as Kansas City, Omaha and Minneapolis, where the dealers have hundreds of thousands of square miles of territory to draw from, it must be remembered that the territory which is covered by New Haven dealers is almost microscopic by comparison.

A Market of 1,037,000 Persons

The average New Haven dealer calls as his territory an area which does not exceed 1,500 square miles. In this territory, there is a possibility that he may sell to 1,037,000 persons. This is made up of New Haven county, Fairfield county and Middlesex county, the respective population figures being 337,000, 45,637 and 245,352. But not every dealer has these three counties in which to sell cars. Only the larger dealers can place their agents in these counties adjoining New Haven. The smaller dealers must be content with New Haven county including the city of New Haven with a population of 144,500 and perhaps a small part of Fairfield and Middlesex counties. In some few instances, the larger dealers have the whole of the State of Connecticut for territory.

As a matter of fact, most dealers concentrate their selling efforts on New Haven itself, few of them having more than three or four sub-dealers in other cities in their territory. That there is room for considerable expansion in this respect, is generally admitted, and the reason for the lack of expansion is given as being the inherent caution of the New England dealer in making business connections. In the majority of cases, the dealer insists on the most rigid examination of the credentials and business ability of those he appoints as his subdealers.

The Used-Car Problem

As is the case in so many other cities throughout the country, the used car problem looms rather large to the New Haven dealers, though the proximity of New York has relieved matters somewhat by providing an outlet. Latterly, however, the atmosphere has been considerably clarified by the action of the New Haven Automobile Trades Assn. which has subscribed for the Used Car Central Market Report of the Chicago Automobile Trade Assn. for its members. This has operated to stabilize used-car values and the report is quite generally referred to when a used car is offered in trade or for sale. It is the concensus of opinion, however, that the "as is" values as given in the report are slightly too high for New Haven and for this reason the practice of subtracting about $50 from the value given in the book is gaining. This permits the dealer who takes in the used car a margin upon which to work in order to cover overhead and such minor repairs and adjustments that may be necessary.

Electric Cars Gain

Although the demand for electric cars is small in this particular territory, it is steadily increasing. There are at present approximately seventy-five electric passenger and commercial vehicles in the city of New Haven and the two dealers in electrics are optimistic for the future because of the absence of hills in the city, the comparative cheapness of current and the excellent roads in the surrounding territory. Road improvement has made it possible for the electric tourist to make such trips as to Meriden, Bridgeport or Waterbury quite easily and this, it is pointed out, will have a stimulating effect. During the year gone by the Detroit agency distributed about sixty cars, and this it is expected will be increased to seventy-five for the present year.

The annual show, which is held in the armory, and which was brought to a close on Saturday night, is almost exclusively a retail show, the appointment of sub-dealers being the exception rather than the rule. Contrary to the usual practice, members of the dealers' association, with one or two exceptions did not exhibit at the show last week, there being a general feeling that a show at this time of the year was not exactly desirable particularly in view of the fact that the Bridgeport and Hartford shows had just been brought to a close. Nevertheless, the show was well attended, though the crowd was slow to arrive.

Lehigh Valley's First Show Indicates Growing Sales

SOUTH BETHLEHEM, PA., March 1—The Bethlehems and surrounding towns gave enthusiastic endorsement and support to the First Annual Lehigh Valley Automobile Show which opened here in the Coliseum on Monday and closed Saturday. The show, a paying proposition from the start, was open every afternoon and night from 1 to 11 o'clock.

The exhibition was a representative one in every respect, seventy-one cars being on view divided among fifty-seven dealers. Thirty-two different makes of pleasure cars, seven makes of trucks and six firms displaying many new accessories and devices applicable to the occupied space.

The daily attendance averaged between 1,000 and 1,100. Opening day being Washington's Birthday, and a holiday to many in this region, the attendance was doubled, as it was today, the last day; when 2,000 visitors were present.

The AUTOMOBILE

PUBLISHED WEEKLY

Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, March 4, 1915 No. 9

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - - - - - - - - - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - - - - - - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - One Year, 5.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.

Member of the Audit Bureau of Circulations.

The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

10 Per Cent. Motorists

NEARLY 2 per cent. of the population of New England are motorists, or rather, a far larger proportion must use automobiles every day since 2 per cent. of New England's inhabitants are owners of automobiles. Suppose that each of these owners has as few as five people who constantly use his car and we see that 10 per cent. of the people of New England are habitual motorists. Now, we must remember that in taking census returns we include people of all ages, and that if we could figure the very old and the very young we should have a much smaller population who could possibly be habitual motorists, and it results in the surprising thought that something like one-fifth of the adult inhabitants of the six States, Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont, are regular automobile travelers.

Of course, this is guessing, insofar as the number of people who ride in each car is concerned, but to reckon five passengers as an all the year round average is conservative estimation. A man does not always have the same companions, in fact most automobile owners delight in making motoring enthusiasts of as many friends as possible, so one might even hazard the thought that a very great many more than one-fifth of the New Englanders have a practical appreciation of modern road travel.

If we study the rate of increase in the number of cars we see that it is far more rapid than the growth of population, and that the total number of automobiles in New England today is very large indeed, so large in fact, that it could absorb the outputs of more than one good-sized factory. Often hearing of outputs of many thousand cars a year creates a wonder as to what becomes of them all. Figures such as those relating to New England provide the answer that the day is at hand when more of us are motorists than not, and a wonderfully large number of us can find the means to buy and use automobiles

Defined Service

THE 50-hour free service card that is becoming more general with dealers in many cities is doing a good work for the disturbing free-service problem. It is something definite, tangible. You can see it. It is something more than a promise, a promise which may or may not be made good. The buyer has something he can put in his pocket, can look at; something in black and white, something with a few signatures attached, finally something that he has confidence in. It is something more reliable than the promise of commission salesmen, something that has a standard value 6 months hence or a year, if not consumed by that date.

Where in use the 50-hour free-service card is getting away from complaints, of owners, who tell of promises to keep the automobile running in good shape for a year or perhaps longer. This abuse with the floater type of commission salesman has attained alarming proportions in some cities. The card is already having its effect in tending to partially stamp out this evil. Anything that will tend to make the sale of automobiles more of a business proposition, and less of a matter of promise to keep a good car running all its life, should be encouraged by makers, distributors and dealers.

Research

THE preliminary report of the gasoline-electric research committee of the Metroplitan section of the Society of Automobile Engineers covers enough ground to show that these committees can be of great benefit to the industry. A great step forward has been made when a committee of this nature has successfully classified the subject of which it is making a study. That this has been done is amply shown by the manner in which the report has been received by the Metropolitan section.

Sufficient data have been disclosed in the preliminary report of this committee to make certain the fact that in the final report a sufficient store of information will be provided to make it of great value to inventors who are working along similar lines. The broad lesson drawn from this work is that it is possible for small units of the total membership of the S.A.E. sections to accomplish work which will not only be of value to the Society as a whole but to the industry at large.

Two New Fuel Processes Discovered

Dr. Rittman, Chemical Engineer of Bureau of Mines, Has Means of Increasing Independent Gasoline Output 200 Per Cent. and of Making Benzol from Crude Petroleum

NEW YORK CITY, Feb. 28—Two important chemical processes affecting the motor car industry have been discovered by Dr. Walter E. Rittman, chemical engineer of the Bureau of Mines. One is a new method of producing gasoline and the other the manufacture of tuluol and benzol, the latter of which can also be used as a motor fuel.

Dr. Rittman plans to end the Standard Oil Co.'s monopoly by dedicating his patent to the whole American people so that the small refiner as well as the trust can avail himself of a cheap process for manufacturing crude oil into gasoline. Heretofore the Standard Oil Co. has had an advantage because it had the most money, could employ the best chemists and therefore had the best processes for obtaining gasoline from the crude oil.

The first of these processes promises to enable independent refiners in this country to increase their output of gasoline from petroleum 200 per cent. or more. With an estimated production by the independent refiners of 12,000,000 barrels yearly, this will mean an output of 36,000,000 from the independents alone.

The second process enables benzol and tuluol to be made from crude petroleum, two products which heretofore could only be obtained from coal tar residues. Benzol is also a good fuel and is used extensively in Europe. However, it is planned to use these two substances for the production of explosives and dye-stuffs.

These processes are fraught with the utmost importance to the people of this country because for some time the Standard Oil Co., through the large amount of money at its command, has employed expert chemists and has thus had a big advantage over the independents in the production of gasoline. It has a patented process by which it obtains three times the quantity of gasoline from a given quanity of petroleum that the independents now obtain. There are two or three other large corporations that have an efficient process for the manufacture of gasoline, but the independents as a whole have never been able to even aproach the results obtained by the Standard Oil Co. Now the federal government, through the efforts of Dr. Rittman, proposes to make free for the use of all the people of the country a process that yields gasoline from crude petroleum in three times the quantity heretofore obtained.

Simpler, Safer and More Economical

It is claimed by Dr. Rittman that his process is simpler, safer, and is more economical in time than the processes now in use and these economic factors are of great importance.

An interview with a Standard Oil official showed that this company has not taken the announcement of the new fuel seriously, although it is admitted that nothing is known of Dr. Rittman's discoveries. The company took the attitude that if the patents were given to the public it would be able to use them as well as anyone else, but it did not explain that in this case it would only be on an equal footing with the independent companies.

The Standard Oil Co. also pointed out that benzol and tuluol can be produced from very few crude oils; and that millions of pounds of coal tar products are yearly burned under coke ovens, and that these products could be utilized in producing benzol and tuluol if it were not cheaper to buy them from Germanyq. No allowance, however, was made for the fact that Dr. Rittman's new method might reduce the cost of manufacture so low that it would be cheaper to make these products than to import them.

Full details of Dr. Rittman's new chemical process for increasing the supply of gasoline through his new formula will be made public by the Department of the Interior late in March. Dr. Rittman today said that in his process all of the oil is vaporized.

The Rittman process, it is understood, will work on all oil residue. Dr. Rittman made it plain that he had a profound respect for the Burton process, this being recognized as the leading practice today in the production of gasoline.

Warns of Gasoline Famine—To Use Alcohol

MILWAUKEE, WIS., Feb. 27—F. W. Kressman, of the official staff of the United States forest products laboratory at Madison, Wis., sounded a warning with regard to the rapidly dwindling supply of gasoline in an address on Some Chemical Problems of the Forest Products Laboratory before a special meeting of the Milwaukee Engineers' Society under auspices of the Milwaukee section, American Chemical Institute, on February 27. Mr. Kressman related experiences in deriving products suitable for fuel for internal combustion engines and predicted that alcohol will be the future fuel for motors of this type because the gasoline supply is nearing its finish and because alcohol will soon be produced cheaply and in many new ways and from heretofore unheard of sources.

Gasoline Prices Down in Milwaukee

MILWAUKEE, WIS., Feb. 27—Further reductions in gasoline prices were announced in Milwaukee on February 25, and motorists who have formed the habit of running their cars to the numerous downtown filling stations operated by the Standard and independent companies are expecting a season of operation considerably less expensive than a year ago. It is believed that the exceedingly close competition among the filling stations is responsible for this reduction, which is the second since January 1, 1915. Comparative quotations for tank wagon delivery, which prices also govern retail sales at filling stations, are as follows:

Test	Feb. 25, 1915	Jan. 18, 1915	July 1, 1914
60	10½ cents	11 cents	11½ cents
65	13 cents	13 cents	15 cents
70	15 cents	15 cents	17½ cents
72	16 cents	16 cents	19 cents

Garages are charging 2 cents over the above scale but, mainly of their own accord, are doing little business, excepting in emergency cases. Garagemen say they do not care to handle the fuel excepting for their own uses and purposes, because of the inability to make any money out of it. Practically the only business they now get is from owners who store their cars in garages and feel obliged to patronize the garage on such supplies, and from drivers who are nearly dry and want enough gas to get to their usual supply stations.

CHICAGO, ILL., Feb. 26—The Standard Oil Co. of Indiana has reduced the price of gasoline and naphtha ½ cent a gallon, with a discount of 1 cent per gallon on 100-gallon lots to wholesalers, bringing gasoline down to a basis of 10½ cents and 9½ cents, and naphtha to 9½ and 8½ cents per gallon. Kerosene remains unchanged at 5½ cents.

DETROIT, MICH., Feb. 24—A cut of 1-2-cent per gallon of gasoline went into effect at the gasoline stations controlled by the Standard Oil Co., the price now being 10 1-2 cents a gallon. Independent and other concerns supplying gasoline to retailers would not say today if they will reduce their price below the above mark. In several garages it was, however, predicted gasoline at less than 10 cents is only a question of a few weeks patience.

Electrics Increasing in England

NEW YORK CITY, Feb. 26—The West Ham Electric Power Supply Co., England, has made special arrangements for furnishing current for charging the batteries of electric motor trucks. The great dearth of gasoline trucks due to the commandeering of those already in use and the factories in which they were manufactured by the British government for war purposes, has left many concerns without any means of motor transportation and the West Ham company has seized the opportunity by announcing that it will supply current for electric trucks, through the medium of a series of striking posters setting forth the convenience and reliability of operation and the cost of current consumption. Other large electric companies are expected to follow the lead made by the West Ham concern. As there appears to be a great field for the electric in England at the present time, several of the large American electric truck concerns have already opened agencies in England.

935 Trucks Shipped in January

Foreign Nations Take $2,545,527 Worth —1,803 Passenger Cars Valued at $1,313,153

WASHINGTON, D. C., March 2—Government figures made public today show that 935 motor trucks valued at $2,545,527 were exported in January, 1915, as against forty-four trucks valued at $77,491 shipped abroad in the same month last year. Exports of passenger cars dropped from 2,481, valued at $2,174,392 in January, 1914, to 1,803, valued at $1,313,153 in January, 1915. The figures show that truck exports to warring nations in Europe are growing by leaps and bounds. These figures are said to be among the most important issued since the war began.

4,859,200 Pounds of Rubber Imported

NEW YORK CITY, March 1—Imports of crude rubber at this port from January 12 to February 23 amounted to 4,859,200 pounds. The largest shipment was from Para on January 28 by the steamer Stephen which carried 1,540,400 pounds of rubber.

Apropos the probable effect of Germany's blockade of England on the crude rubber supply of the United States, if that should happen, it was stated by Sir Richard Crawford, the special commissioner attached to the British Embassy at Washington and appointed by his government especially to supervise all matters arising under the rubber and other embargos, that the British would undoubtedly sanction the shipment of rubber from the East to American ports either direct or by transshipment at Gibraltar. It was also stated by one of the tire manufacturers that this country, in case of a blockade, could do as it did before, when the Emden was creating havoc with English shipping in the Indian Ocean, get its supplies by way of the Pacific Ocean.

Gramm-Bernstein Refuses Truck Orders

LIMA, O., Feb. 27—Owing to the fact that the capacity of the plant is taxed to capacity, the Gramm-Bernstein Motor Truck Co., Lima, was compelled to refuse orders for motor trucks during the past week. The company is under contract with district agents to deliver a certain number of trucks monthly and these contracts have to be cared for. As a result an offer of a contract for 200 trucks for the domestic business received from the East had to be refused. Plans have been made for increasing the capacity of the plant but if they are carried out it will require about 90 days to complete them.

Republic Gets Order for 300 Trucks

ALMA, MICH., March 1—The largest single order of trucks ever received by the Republic Motor Truck Co., has been given to that concern by the Anglo-American Export Co., London, Eng. The contract calls for 300 trucks to be delivered in 1915.

Morton Gets Second Order—116 Trucks

HARRISBURG, PA., March 2—The second of the large truck orders placed by the allied armies, was received this week by the Morton Truck and Tractor Co., this city, from the British government and includes 116 trucks of 2- and 5-ton capacity. This, in addition to the order for 300 tractors reported in THE AUTOMOBILE last week as received from the Russian government, aggregates $2,000,000. The contract calls for delivery in 60 days, and the cars will be shipped from the Harrisburg plant as rapidly as they are completed. Work has been started on the large tractor order for the Russian government.

The plant is being operated to its fullest capacity and many additional employees have been put on in order to get the cars out on time. Samuel Morton and R. L. Morton, members of the firm, have been in England for some time giving demonstrations and it was through their efforts that the two large contracts were secured for the Morton company.

The type of tractor being built for the Russian government is of the four-wheel type of 120-horsepower and in construction is all that is necessary for the strenuous work in drawing gun carriages, ammunition and provision trains on the battlefield. The hood covering the engine and driver's seat will be of ⅝-inch steel plate and everything about the machine will be of the most substantial construction.

NEW YORK CITY, March 3—Shipments of Jeffery Quad trucks to the French government for use in the European war totaled two trainloads of twenty-six flat cars each last week.

This was the rush delivery of the first trucks to be sent in filling the recent $1,000,000 truck order placed by Commandant Dulauroy of French army, with the Thomas B. Jeffery Co., Kenosha, Wis.

Hub Truck Organization Completed

COLUMBUS, O., Feb. 26—The organization of the Hub Motor Truck Co., Columbus, O., recently incorporated with a capital of $300,000 has been effected by the election of J. L. Herpich, president; T. C. Haney, secretary-treasurer and M. C. Piercy, general manager. The first model of truck which is licensed under the Hub Motor Truck Co., of New York, is now being built at a local garage. It is expected to acquire a plant in Columbus for the manufacture of the trucks.

Blair Truck Co. To Be Developed

NEWARK, O., Feb. 27—Cincinnati interests represented by G. F. Osler, have closed an option for the financing and full development of the Blair Motor Truck Co. The truck which has been perfected by F. M. Blair, is being manufactured in small quantities at the Newark plant, but lack of capital is one of the drawbacks to development. The capital stock of the company has been increased from $100,000 to $225,000. The new truck is electrically driven from gasoline power and has direct transmission through a worm gear. Inquiries have been received from New York and Philadelphia for about 200 of the trucks for motor buses.

Receiving Ball Bearings from Germany

PHILADELPHIA, PA., Feb. 26—The news that an embargo has been declared on ball bearings exported from Germany does not seem to have seriously bothered the big importing interests in this country if the notice sent out by the Hess-Bright Mfg. Co. can be taken as an index. This states that in spite of the reported obstacles to the importation of ball bearings the company continues to receive shipments from the Berlin works. It also states that the total since September 15, 1914, has been 375,000 bearings of assorted sizes with one large shipment now en route. A substantial increase in orders is claimed over the figures of last year in spite of the delays due to the European war.

Germany Cuts Private Cars 50 Per Cent.

BERLIN, GERMANY, Feb. 26—The Bundesrath has adopted a measure by which the number of automobiles in Germany not being used for military purposes will be reduced hy about one-half. The purpose of this is to save in the consumption

120-horsepower Morton tractor ordered in quantity for the allied armies in Europe of gasoline and lubricant oils, and in rubber. The order issued provides that all automobiles, beginning March 15, must have new licenses. These will be issued only on proof of public necessity. The Bundesrath declares in this connection:

"This future limitation has particularly the purpose of eliminating all automobiles serving purposes of pleasure or sport. At the same time it will compel the public to employ other means of transportation, such as railroads, street cars and horse-drawn cabs, in increased measure."

Begin Assembling in Dallas Ford Plant

DALLAS, TEX., March 1—Actual assembling of automobiles was begun Monday at the plant of the Ford Motor Co., in Dallas. More than 150 men were put to work and the force will be increased until the output of sixty cars per day has been reached. Heretofore the new building has been occupied as a salesroom, but the assembling of cars was not begun until Monday.

Employees at the plant will get all the benefits of Henry Ford's unique profit sharing plan. No employee will receive less than $5 per day and in addition all will share in the profits of the company in the form of bonuses in proportion to the year's business and profits. The plant has many unique features and represents the most advanced ideas in factory buildings. A most unusual feature is a "race course" of miniature size on top of the building, where the assembled cars will be tested. During the past few days thousands of people have inspected the plant, as it is the finest in this section of the country.

To Sell Detroit and Tarrytown Maxwell Plants

NEW YORK CITY, Feb. 26—The last of the two Maxwell plants in Tarrytown and the Milwaukee avenue plant in Detroit are being offered for sale by Joseph P. Day of this city. The first Tarrytown plant was sold last June to the Chevrolet Motor Co., which combined the local Fifty-seventh street plant and the Tarrytown plant under the New York City management to build right-hand Chevrolets.

The latest Tarrytown plant to be sold comprises about 150,000 square feet of floor space with a frontage on the Hudson River. The Detroit plant comprises about 215,000 square feet of floor space and is situated on the Grand Trunk Railway. When the Maxwell-Briscoe Motor Co. was in full operation in Tarrytown it occupied two plants, one known as the Kingsland Point plant, the first one to be sold, and the other known as the Beekman avenue plant, now for sale.

In 1913 Walter E. Flanders, president and general manager of the Maxwell Motor Co., made it known to the trade that the Maxwell company did not intend to operate all of the eleven plants which were acquired by the purchase of the United States Motor Co.'s assets. The factories totaled 2,884,648 square feet of floor space. The Providence, R. I., Newark, N. J., Hartford, Conn., Auburn, R. I., and one of the Tarrytown plants, have been sold out of the original eleven. The Providence plant was sold to the Universal Winding Co., Providence, in December, 1913, and the Columbia plant in Hartford was sold to the Billings & Spencer Co.

No Need To Test Army Trucks

Senator Lodge Points Out That Foreign Belligerents Find Our Vehicles Satisfactory, So Why Shouldn't We?

WASHINGTON, D. C., Feb. 28—Debate in the Senate on the house provision in the army appropriation bill for $25,000 for the testing of types of armored motor cars was enlivened by Senator Lodge. It was pointed out that the manufacturers of trucks in this country are shipping them by the hundreds to Europe, where they are reported as giving satisfaction. Therefore, it was considered by the senatorial opponents of the provision that there is no necessity to conduct expensive tests. In this connection, Senator Lodge said:

"In making some examination for a speech I made here on national defense I examined into this question of motor trucks and cars. We have not an armored motor car in the army and I was informed at the war department that they had not been able yet to find a perfect truck; they were still testing them and looking for a perfect truck. Canada has bought a lot of our motor trucks for use in the field and finds them sufficiently good for use in the field. Russia has bought more. They said, in reply to that, that the trucks we sold to Canada did not seem wholly satisfactory; and, on that ground, in this country, with all the motor car manufacturers we have, we are deliberately told that we cannot have a motor truck; we must raise $25,000 and wait a year in testing them. The money is of no consequence, but we must wait a year testing them to find a suitable motor truck. Why, they have thousands of motor trucks in the armies of Europe and we have none. Some motor trucks are better than no motor trucks; and the officers of the war department are sitting here looking around to find a perfect truck, and in the meantime we have none."

NEW YORK CITY, March 2—Princeton students have contributed $1,100 to the American Ambulance Hospital in Paris. The money, which was received by J. P. Morgan & Co., will be used to purchase an ambulance for wounded soldiers in France. It is expected Princeton volunteers will be assigned to drive the car at the front. Contributions for the American Ambulance Hospital now total $346,451.82.

EAST LIVERPOOL, O., March 1—The plant of the Columbiana Rubber Co., East Liverpool, has been sold to a syndicate of capitalists from Mansfield, O., at a price which has not been made public. The appraised value of the plant is $85,000 and has a capacity of 400 automobile tires daily. The announcement is made that the plant will resume operations in a few weeks.

Delion Tire & Rubber Co. Opens Plant

TRENTON, N. J., Feb. 26—The opening of the plant of the Delion Tire & Rubber Co., this city, took place this afternoon with speeches by Senator Leavett of Mercer county, and Major L. N. Clayton. The Delion is the eighth rubber tire plant to locate in Trenton, making that city next to Akron in the matter of numbers and importance in the tire industry, which has already assumed imposing proportions.

The plant is of the latest construction throughout, consisting of brick and concrete, the size of the factory being 238 by 75 feet with two floors. The latest tire making machinery and labor saving devices are used. The company will produce about 400 tires and 600 tubes a day when working on full time and will employ 300 men. No hard rubber tires will be manufactured. Delion tires will carry a guaranteed mileage of 4,000 miles. Active manufacturing will start March 1. The first Delion tire was made at the opening of the plant. It was a 37 by 5 plain tread. The complete steps were shown the visitors.

The officers and directors of the company are: H. H. Colemen of Newark, president; F. J. Wetzel, of Trenton, vice-president; G. H. Graham, Jr., secretary and assistant treasurer; directors, Charles R. Whitehead, of Morristown; L. B. Tompkins, of Morristown; Manusl Llara, F. G. Hasselman and W. T. Rock, of New York City; Warren A. Clapp, of East Orange, and Lionel Emdin, of New York City. Mr. Emdin will also be general sales manager, with headquarters in a new store at 1791 Broadway, New York City. The company was incorporated in 1913 with a capital of $500,000 and recently raised that to $750,000.

New plant of the Delion Tire & Rubber Co., Trenton, N. J., opened last Friday

Studebaker Profits Gain 150.6 Per Cent.

$4,441,966.16 Net Profits for 1914—Surplus is $5,265,819.45—Debts Reduced $4,168,978.98

SOUTH BEND, IND., Feb. 25—The fourth annual report of the directors of the Studebaker Corp. and its subsidiary companies, for the year ending December 31, 1914, shows net profits of $4,441,966.16, as against $1,772,473.65 net profits in 1913, which is an increase of $2,669,492.51, or 150.6 per cent.

After the payment of the regular dividends on the preferred stock and transfer to special surplus account of the amount required to be set aside therein, the balance of the profits, $3,165,893.11 was added to surplus and this account showed a total credit, as of December 31, 1914, of $5,265,819.45 and the special surplus account showed a balance of $1,230,747.54.

The net profits gave the company a return of 12.8 per cent. on the outstanding common stock, after deducting the payment of the 7 per cent. preferred stock dividends, as against a return in 1913 of 3.1 per cent., but rather than use any part of the profits for the payment of dividends on the common stock, the directors believed it the wiser policy during the year to devote the profits to the payment of debts and to the increase of the cash balance, which resulted in a debt reduction of $4,168,978.98 and an increase of $1,581,703.05 in the cash on hand, making a total improvement in this respect of $5,750,682.03 for the year.

Total Net Sales $43,444,223.41.

The total net sales for the year were the largest in the history of the business, amounting to $43,444,223.41, as compared with $41,464,949.82 for 1913, an increase of 4.8 per cent.

Shipments in 1914 were 36,430 cars, compared with 32,504 in 1913. At the close of the year the company had made and sold over 150,000 Studebaker cars.

During the year the corporation purchased the remaining 6 per cent. of the stock of the Studebaker Corp. of Canada, Ltd., Walkerville, Ont., and now owns this company entirely.

The report shows that the corporation's working capital on December 31, 1914, was $14,771,150, an increase of $2,892,132. Of the $8,000,000 of 5 per cent. gold notes sold in March, 1912, $2,450,000 have been retired. Quick assets total $24,665,019, against which stand liabilities of $9,893,869.

The net expenditures for plant and property during 1914 were $551,872.54 and the depreciation credits were $361,794.01, so that only $190,078.53 was added to this account.

The by-laws of the company provide for a fund of $1,000,000 for the redemption of the preferred stock before dividends can be initiated on the common shares. The annual report shows a fund of $1,320,000.

Subsidiary Firms Included

The company has $12,180,000 in preferred stock and $27,931,600 in common stock. The active subsidiary companies of the corporation whose accounts are merged in the report are the Studebaker Corp. of America and the Studebaker Harness Co., of South Bend, Ind.; the Studebaker Corp. of Canada, Ltd., Walkerville; the Studebaker Bros. Co. Northwest, Portland, Ore., and the Studebaker Bros. Co. of Utah, Salt Lake City, Utah.

The report of the Studebaker Corp. for the year ended Dec. 31, 1914, compares as follows:

Profit from	1914	1913	1912	1911
Mfgs.	$5,703,942	$2,767,458	$3,342,560	$2,691,848
Other inc.	133,965	83,465	122,392	113,089
Total inc.	$5,837,907	$2,850,923	$3,464,952	$2,804,937
Sal. and Dep.	492,511	367,788	339,076	270,895
Balance	$5,345,396	$2,483,135	$3,125,876	$2,534,042
Charges	500,732	578,722	528,202	483,981
Surplus	$4,844,664	$1,904,413	$2,597,674	$2,050,061
Pfd. div.	869,050	901,075	930,825	708,750
Balance	*$3,975,614	$1,003,338	$1,666,849	$1,341,311
Extra exp. chgd. off.	402,688	131,939	284,429	396,479
Surplus	$3,572,916	$871,399	$1,382,420	$944,832

* Equal to 14.23 per cent. on $27,931,600 common stock against 3.59 per cent. on same stock previous year (after deducting full 7 per cent. preferred dividend and before charging off $402,697 for extraordinary expenses).

Net sales for the year were $43,444,223 as compared with $41,464,950 the previous year.

The consolidated balance sheet of the Studebaker Corp. as of December 31, 1914, compared as follows:

ASSETS

	1914	1913	1912	1911
Trade name, good will, pat'ts, etc.	$19,807,277	$19,807,277	$19,807,277	$19,807,277
Real estate, bldgs., mach. and equip.	12,058,040	11,867,962	10,589,651	10,297,450
Frgn. trade marks.	....	5,336	5,156	4,892
Inv. in other cos.	247,654	246,509	1,075,692	1,199,640
Inventories	13,470,564	16,622,229	15,730,841	14,391,250
Accts. and notes receivable	6,698,148	5,923,793	4,958,121	5,668,661
Ins. unexpd., int. prepaid, etc.	382,421	376,520	440,445	263,308
Disc't and com on notes	327,068	412,859	506,632	381,829
Susp. acct.	....	402,496	472,270	489,448
Cash	3,539,164	1,957,460	865,795	1,672,434
Total	$56,530,336	$57,622,440	$54,451,881	$54,176,222

LIABILITIES

Pfd. stock	$12,180,000	$12,650,000	$13,095,000	$13,265,479
Com. stock	27,931,600	27,931,600	27,931,600	27,931,600
Min. stkhldrs. int. in cap. stk. sub. cos.	28,300	54,341	28,300	28,300
5% gold nts.	5,550,000	6,800,000	7,600,000	....
Nts. payable	1,850,000	4,550,000	1,400,000	10,050,000
Drafts disc.	....	....	....	318,312
Dep. rec. on con. for sales of autos.	284,325	249,594	327,159	321,296
Accts. pay.	1,853,160	2,098,134	1,182,944	1,044,623
Sundry res.	356,384	365,120	559,625	268,777
Spec. surp. account.	1,230,748	823,724	*417,009	....
Surplus	5,265,819	2,099,926	1,910,243	944,832
Total	$56,530,336	$57,622,440	$54,451,881	$54,451,222

* Applied to purchase of preferred stock for cancellation under provision of charter

YOUNGSTOWN, O., Feb. 26—The issuing of $2,500,000 preferred stock has been approved by stockholders of the Republic Rubber Co. The new issue will have a maturity of 15 years, and will bear the same dividend rate as the stock redeemed under the old issue. Recommendation was also voiced that $1,000,000 additional stock be issued in the near future to take care of expansions.

LOS ANGELES, CAL., Feb. 24—The Master Carbureter Corp. has distributed a 25 per cent. cash dividend to its stockholders. The concern, which was incorporated in 1913, has a capital stock of $150,000, and has been making 800 to 900 carburetors a month. The business outlook is reported to be very satisfactory.

AKRON, O., Feb. 26—The Goodyear Tire & Rubber Co., this city, which previously has paid dividends once each year, announces that hereafter dividends will be declared quarterly. The first quarterly dividend of 3 per cent. was paid March 1, to holders February 20. An annual dividend of 12 per cent. was paid last November.

King Gives Employes 7½ Per Cent. Bonus

DETROIT, MICH., Feb. 22—A bonus equal to 7 1-2 per cent. of their total wages for the year 1914 was given last week to the working men of the King Motor Car Co. There were 25 per cent. more men on the pay roll in 1914 than the previous year.

Weidely Motor Co. Is Organized

INDIANAPOLIS, IND., Feb. 24—The Weidely Motor Co. has been incorporated and taken a factory building at 133-43 South West street in this city, to manufacture the Weidely motor. The organization is: President, W. E. Showers, Bloomington, Ind.; vice-president and general manager, George A. Weidely; treasurer, W. A. Umphrey; secretary, L. A. Poundstone; directors, Edmund Rosenberg and George Hughes.

Gaulois Tire Reduces Prices

NEW YORK CITY, March 1—The Gaulois Tire Corp., importer of the Gaulois tire, made in France, has reduced the prices on all its tires. The 34 by 4 non-skid rubber tread has been reduced from $41.30 to $32.45 and the 37 by 5 non-skid rubber tread has been reduced from $60.40 to $47.95 Other sizes have been reduced in proportion

The company is receiving weekly shipments from the factory in Clermont-Ferrand, France. J. Grenies will soon start from this city to appoint agencies in Detroit, Cleveland, Buffalo, St. Louis, Kansas City, New Orleans, and other centers.

To Bring Out a New Lozier Car

New Company Will Continue Four and Six—To Center All Activities in Detroit Plant

DETROIT, MICH., Feb. 26—Within the next 2 weeks the new owners of the Lozier Motor Co., will place on the market a new Lozier car which will have all the features and characteristics of the former Lozier models. The price will be between $1,800 and $2,000. The big six and the four which were made before the company went into bankruptcy are also to be continued by the new management. At the present time about 175 men are being employed and the force will be gradually increased. W. G. Thomas, formerly with the Pierce-Arrow, E. R. Thomas and Packard companies, has been appointed production manager. H. H. Williams, who has been with the Lozier organization for many years, is in charge of the service and sales department. Many of the former Lozier dealers will continue to handle the Lozier cars. There will be no resumption of operation of the former Lozier plant in Plattsburg, N. Y. This property will be sold. All production and service activities are concentrated in the local plant.

$500 Elco 30 Enters the Field

SIDNEY, O., Feb. 27—A five-passenger touring car called the Elco 30 and selling for $500 with single-unit electric lighting and starting equipment, will shortly be placed on the market by the Bimel Buggy Co., this city, of which A. C. Noble is president and T. M. Miller manager and treasurer.

The power plant will be a Davis unit with block-cast L-head cylinders 3 by 4, multiple disk clutch and three-speed gearset. Ignition will be by Atwater Kent system, lubrication by constant level splash, cooling by thermo-syphon and the carbureter a Zephyr. Regular equipment will include 30 by 3 tires; with 30 by 3 1-2 straight side tires and demountable rims the price will be $50 extra. Wheels will be of wood; wheelbase, 102 inches; tread 56 inches. Lamps, electric horn, tool kit, jack and pump will be regular equipment.

Market Reports for the Week

NEW YORK CITY, March 3—Market reports this week were generally steady. Tin was again excited and higher in sympathy with the violent advances at London, causing increased buying of future positions at a sharp advance. The visible supply of tin in Europe and the United States in February increased 647 tons, the total visible on February 28 being 14,548 tons. Most of the other metal markets were strong and steady with the exception of copper, which experienced small sales during the week. At London there were some few sales of American electrolytic, the market being weaker in tone. The most interesting copper development, however, was the report of further negotiations of copper for export on the part of Russia and Germany. Although no shipments can be made to Germany under present conditions, orders are pending with the sellers willing to pay interest on deferred shipments.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.18½	.18½	.18	.18	.18	.18	—.00½
Beams & Channels, 100 lbs.	1.26	1.26	1.26	1.26	1.26	1.26	......
Bessemer Steel, ton	18.50	18.00	18.00	18.00	18.00	18.00	—.50
Copper, Elec., lb.	.14½	.14½	.14½	.14$\frac{13}{16}$	.14¾	.14¾	+.00$\frac{1}{16}$
Copper, Lake, lb.	.14¾	.14¾	.14¾	.14¾	.14¾	.14¾	......
Cottonseed Oil, bbl.	6.80	6.76	6.84	6.82	6.82	6.73	—.07
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	..	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	.92	......
Lead, 100 lbs.	3.85	3.90	3.90	3.90	3.90	3.92½	+.07½
Linseed Oil	.60	.60	.60	.60	.60	.60	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans. crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.50	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.75	.75	.75	.75	.75	.75	......
Rubber, Fine Up-Para	.59½	.59½	.59½	.59½	.59½	.59½	......
Silk, raw, Ital.	..	3.90	..	3.90	3.90	3.85	—.05
Silk, raw, Japan	..	3.30	..	3.30	3.32½	3.32½	+.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	37.75	38.00	38.75	39.50	40.50	40.50	+2.75
Tire Scrap	.05	.05	.05	.05	.05	.05	......

Automobile Securities Quotations

NEW YORK CITY, March 3—Several of the stocks on the securities market made large gains during the past week while a number of others showed declines which were, however, less marked. Some of the large gains are Aluminum Castings, 3 points; Firestone common, 10 and preferred, 1; Peerless common, 5; Portage Rubber common, 4 and preferred, 5. Kelly-Springfield Tire showed a pronounced reaction the common dropping 8 1-2 points and the first preferred 2 although the second preferred gained 1. Miller Rubber common declined 5 points as did Stewart-Warner common although the preferred of the latter gained 1-2 point. White lost 5 points and Willys-Overland common 1-2.

This week the official quotations of the Detroit Stock Exchange have been added to our regular report based on the New York City market. This will enable our readers to keep track of values in the two cities whose automobile securities markets are most important.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	200	..	250	..	..
Ajax-Grieb Rubber Co. pfd	99	102	100	..	..
Aluminum Castings pfd	97	100	98	100	+3
J. I. Case pfd	..	..	75	80	..
Chalmers Motor Co. com	84	87	..	90	..
Chalmers Motor Co. pfd	92	94	91	93½	..
Electric Storage Battery Co.	..	..	47½	48½	..
Firestone Tire & Rubber Co. com	285	290	380	..	+10
Firestone Tire & Rubber Co. pfd	108½	109½	108	109½	+1
General Motors Co. com	68½	69½	92	93½	—2
General Motors Co. pfd	91	91½	94	95	—1
B. F. Goodrich Co. com	22¾	23¼	31½	32	—1½
B. F. Goodrich Co. pfd	87¼	90	96	97	—½
Goodyear Tire & Rubber Co. com	212	218	188	190	—2
Goodyear Tire & Rubber Co. pfd	96	97½	102	103	+1
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	..	..	..
International Motor Co. pfd	..	15	..	..	..
Kelly-Springfield Tire Co. com	54	56	104	105	—8½
Kelly-Springfield Tire Co. 1st pfd	125	130	82	83	—2
Kelly-Springfield Tire Co. 2d pfd	..	..	122	127	+1
Maxwell Motor Co. com	5¼	5⅜	24	25	+1¼
Maxwell Motor Co. 1st pfd	27½	28	62½	63½	+1
Maxwell Motor Co. 2d pfd	9	9½	25	26	..
Miller Rubber Co. com	..	..	155	160	—3
Miller Rubber Co. pfd	..	..	101	103	
New Departure Mfg. Co. com	..	..	122½	127	..
New Departure Mfg. Co. pfd	..	..	103½	108	..
Packard Motor Car Co. com	..	..	..	99	..
Packard Motor Car Co. pfd	96	98½	95	..	+2
Peerless Motor Car Co. com	..	30	20	21	+5
Peerless Motor Car Co. pfd	..	80	..	55	..
Portage Rubber Co. com	..	40	34	36	+4
Portage Rubber Co. pfd	..	90	85	95	+5
*Reo Motor Truck Co.	7½	8½	10⅜	11¼	—½
*Reo Motor Car Co.	18	18½	26	26¼	+1½
Stewart-Warner Speed. Corp. com	56	57½	48	51	—3
Stewart-Warner Speed. Corp. pfd	98	100	101	103	+½
Studebaker Corporation com	25½	26½	45	45½	—1½
Studebaker Corporation pfd	81	83	93	94	—2
Swinehart Tire & Rubber Co.	69½	70½	73	75	+4
Texas Company	..	..	126½	127½	..
U. S. Rubber Co. com	58⅝	59¼	54	55	—2½
U. S. Rubber Co. pfd	101¼	101¾	101	102	—1
Vacuum Oil Co.	..	..	184	186	..
White Co. pfd	107	110	103	108	—5
Willys-Overland Co. com	67	68	95	96	—½
Willys-Overland Co. pfd	94	97	95½	96	..

*Par value $10; all others $100 par value.

Official Quotations of the Detroit Stock Exchange

	1914		1915	
	Bid	Asked	Bid	Asked
ACTIVE STOCKS				
Chalmers Motor Co. com	82	85	..	85
Chalmers Motor Co. pfd	..	93½	90	..
General Motors Co. com	72½	74½	91	93
General Motors Co. pfd	91½	94	93½	95
Maxwell Motor Co. com	5	5¾	24	25½
Maxwell Motor Co. 1st pfd	27	28	63	65
Maxwell Motor Co. 2d pfd	9	10	25	26
Packard Motor Car Co. com	101	106	..	98
Packard Motor Car Co. pfd	96	98½	95	97½
*Reo Motor Car Co.	18½	19	26	27
*Reo Motor Truck Co.	8	8½	10⅜	11⅜
Studebaker Corporation com	..	..	45	46½
Studebaker Corporation pfd	..	..	91	95
Continental Motor Co. com	..	165	..	190
Continental Motor Co. pfd		75	80	85
INACTIVE STOCKS.				
Atlas Drop Forge Co.	..	21	..	..
Ford Motor Co. of Canada	500	..	500	..
Kelsey Wheel Co.	..	200	195	..
W. K. Pruden Co.	..	21	19	20
Regal Motor Car Co. pfd	..	50	..	22

*Par value $10; all others $100.

Baker Patent Is Void

—

Court Refuses To Grant Injunction in Suit Against Former Chalmers Representative

CLEVELAND, O., March 2—In an opinion just rendered, Judge John H. Clarke, in U. S. district court, upheld the prior art claims of the defense in action of the American Ball Bearing Co. against Edward B. Finch, former Cleveland representative of the Chalmers Motor Co. He refused to grant an injunction or damages for what the complaint alleged as infringement of a patent issued to Walter C. Baker, of the Baker Electric Vehicle Co. and the American Ball Bearing Co.

Judge Clarke reviewed the evidence at length, with the statement that: "The only question I shall consider is: 'Is the combination of the patent such as to have required inventive genius to develop it in a mind informed in the art to which it relates at the time the patent was applied for in February, 1902?' "

The desirability and importance of bringing the steering knuckle as closely as practical to the hub and to the plane of the tread were perfectly understood prior to 1902. Such appears in the testimony of Professor Carpenter, expert witness for the plaintiff, and in that of Mr. Baker and is clearly shown by the Faure patent, 591,595, in 1897; by the Clubbe and Southey patent, 621,017, in 1898, and by the Knudsen reissued patent, 11,721. Thus it is clear that the locating of the steering knuckle was actually practiced prior to 1902.

The Robinson patent, 599,266, in 1898, has for its object the improving and simplifying of the construction of ball bearings for vehicles and the drawings of this patent clearly show the anti-friction balls near the outer and inner ends of the spindle, the larger ones being nearer the inner end.

Professor Carpenter said: "It would be idle for me to take the stand that Mr. Baker was the first to employ anti-friction bearings in the spindle of a steering axle, nor does the Baker patent assert that he was the first to do so."

He said it was the general practice prior to 1902 where a load shaft was supported by bearings at the two ends, to vary the sizes of these bearings according to the location of the load along the length of the shaft.

Artillery wheels, too, the evidence shows, were in general use before even the advent of the automobile.

It seems clear that not only were all of the features of the claimant combination familiar to persons skilled in the art of 1902 or even in 1898, but that the arrangement as provided in the Baker patent and the reason for such adjustment would seem to have been obvious.

It seems clear that the various elements of the Baker patent are not so grouped as to produce any new or useful result. The knuckle close to the plane of the wheel produces the same effect in the Baker construction as it did in the Panhard of 1902, a model of which was offered in evidence. At best it is a slight carrying forward of ideas which the state of prior art shows were common among men skilled in it.

This conclusion involving as it does the finding that the patent suit is void for want of patentable novelty and invention, makes unnecessary the consideration of the many other questions stated upon the record in this case.

—

Orders Re-opening of Kardo Suit

CLEVELAND, O., March 3—*Special Telegram*—Judge John H. Clarke has ordered a re-opening of the suit of the Kardo Co., substituting for the American Ball Bearing Co. in action against Henry J. Adams, former representative for the Reo factory and dealing locally as the Reo Motor Sales Co. This suit charges infringement of Patent 792,690 issued to Alanson P. Brush, of Detroit, and covering a compensating mechanism termed the floating spider in the bevel gear drive. It is stated that the reopening of the case is the first step in a further investigation into the organization and purpose of the Kardo Co.

—

Dividends for Creditors of Four Bankrupts

DETROIT, MICH., Feb. 26—The creditors of four bankrupt automobile manufacturing concerns are receiving or will shortly receive dividends from the Detroit Trust Co., receiver for the concerns. The creditors of the Lozier Motor Co., are to receive a first dividend of 5 per cent. which will total about $160,000; the first dividend to the creditors of the American Voiturette Co., will be 10 per cent. and total about $50,000. A fourth dividend of 5 per cent. has been ordered paid to creditors of the Flanders Mfg. Co., making the total to date 50 per cent. or about $500,000. Application was also made to the court to pay a final dividend to the creditors of the Warren Motor Car Co., making a total of 20 per cent. or about $80,000.

—

DETROIT, MICH., Feb. 27—The Keeton Motor Car Co., this city, has purchased the Keeton business from S. L. Winternitz. It is the intention of the company to reorganize and not only to continue to furnish all repairs for Keeton cars, but to continue their manufacture in a small way. According to announcement from that company, it is able to furnish repairs promptly. Delivery of cars can be made within a week or 10 days from receipt of order.

—

BOSTON, MASS., Feb. 26—The stockholders' committee of the Walpole Tire & Rubber Co. has joined with the reorganization committee, of which J. H. MacAlman is chairman, and hereafter these two committees will act jointly in the interests of stockholders. The proposed plan of reorganization as outlined by the joint committee in a letter just issued, is for a company with $500,000 first mortgage, 6 per cent., 10-year bonds, $1,500,000 non-cumulative 7 per cent. preferred stock of a par value of $100, and $1,000,000 common stock with a par value of $50.

—

CINCINNATI, O., Feb. 26—At a meeting of the creditors of the Crescent Motor Co., Carthage, O., held recently, the proposition of Col. F. B. Enslow, of Huntington, W. Va., to take over the real estate in exchange for his bonds and to pay 75 per cent. of the appraised value of the unmortgaged property, was accepted. The offer also includes the assuming of a mortgage of $22,000 held by an insurance company on the real estate.

—

NEW YORK CITY, March 3—Judge Mayer has appointed Francis Gilbert receiver for the Motokart Co., 1790 Broadway, bond $2,000. It was stated that on October 13 last the company, through an attorney, issued a statement that the assets were $90,000, against which there were mortgage debts of $15,000 and merchandise accounts $21,000, and that the depreciation since then would bring the total assets down to $25,000.

—

Good Samaritan Help League Formed

NEW YORK CITY, Feb. 26—The Good Samaritan Help League of Motorists has been formed in this city with the following officers: Dr. G. A. Englert, president; P. J. Knauss, vice-president; and R. A. Effenberger, secretary and treasurer.

The difficulty experienced by motorists in obtaining help or assistance on the road, when in trouble, prompted the formation of the league, the object of which is to "help others as you yourself would like to be helped." The league is open to all motorists. No dues are charged those joining the league. Only an entrance fee of 50 cents which makes them a life member and entitles them to an official signal banner and membership card. Members will display the signal when in need of assistance of any kind, and passing motorists will see the banner and render what help they can.

—

National Safety First Society Formed

NEW YORK CITY, Feb. 26—The Safety First Federation of America, which has for its objects uniform laws for control of automobile traffic and improvement of street traffic conditions throughout the country by a standard system of supervision, was organized yesterday by delegates who met at 6 East Thirty-ninth street, this city.

The motto of the federation is "Conservation of Life, Limb and Property," and its object is to procure legislation toward this end in all of the states and Canada. Another general meeting of the federation is to be held in Detroit in September, when a number of Canadian organizations will be admitted to membership. Thereafter conventions are to be held annually.

One of the important changes in the present automobile license system discussed at the meeting was that of photographing and licensing owners and chauffeurs on a common basis similar to the methods employed in England, Germany and France. It is planned to establish a compulsory examination for the owners of the cars as to sight, hearing and operative ability. A photograph of the owner will be pasted to the license cards to identify them in the event of an accident. A picture will also be retained by the board of examiners.

At today's meeting officers and directors were elected. The board of directors includes police commissioners, representatives of automobile clubs, and civic organizations from fourteen cities. The officers elected were as follows: Vice-presidents—Police Commissioner H. W. Newman of New Orleans, C. N. Talbert, director of streets, St. Louis; Police Commissioner John Gillespie, Detroit; J. H. Lippincott, New Jersey Traffic commission. Treasurer—C. L. Bernheimer. Executive secretary, F. H. Elliott, New York City.

A committee was appointed to nominate a president for election at the next meeting at Detroit, in September.

—

107 Exhibits at Brooklyn Show

Brooklyn, N. Y., March 2—Brooklyn's fourth automobile show under the management of the Brooklyn Motor Vehicle Dealers' Assn. opened tonight at the Twenty-third Regiment Armory. In all there are 107 different exhibits, of which forty-eight are car displays. There are six makes of trucks.

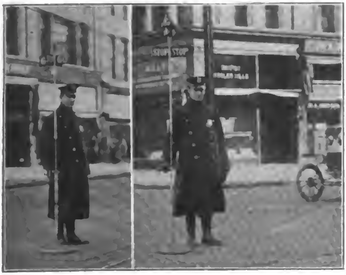
—

$1,000,000 Sales Expected at Des Moines

Des Moines, Ia., March 1—Forty-four makes of automobiles will be on display at the annual Des Moines Auto Show which will open at the Coliseum on Monday, March 8, for the first 1915 showing to the Iowa territory which last year bought 34,370 automobiles for which was paid the sum of $25,771,500, estimating $750 as the average cost per car. Basing their estimates on previous shows, Des Moines dealers predict that the sales at the show alone will approach the million dollar mark.

Iowa led all the states of the Union last year in the value of her farm products, according to the U. S. Department of Agriculture. The aggregate value of the Iowa crops was $351,450,000 as compared with $327,996,000 in 1913 and with $319,656,000 in Illinois, the second state in rank last year. With such figures at hand it is demonstrated that the Iowa field is the best in the nation for the automobile business this year and the Des Moines show is expected to mark the opening of a season which will break even the record of last year.

The Automobile Institute of the Iowa State College at Ames will be in daily session at the Coliseum during the show. Lectures and demonstrations will be given. When it is considered that in Iowa there are now approximately 115,000 pleasure and commercial cars, that the annual expenditure for fuel is $5,500,000 and for tires $12,500,000 with 20 per cent. of this sum wasted on account of the carelessness of owners, the importance of the institute work can be realized. R. A. Leavell, of Chicago, formerly instructor in the Armour Institute of Technology and the Chicago Motoring School, will conduct the institute. It will be free to all those who attend the show.



The illustration shows the device invented by Secretary of Police Walters, of the Detroit, Mich., police department, which is now being tried on Woodward avenue. During the day the post is not surmounted by the oil lamp shown at the right. The word Stop is red, the letters being white. The word Go is white on a green plate. At night a red light is shown over the word Stop and a green light over the word Go.

Hub Show at 2 P.M.

—

Over 400 Cars, Trucks and Chassis To Be Displayed in Grecian Bower

BOSTON, MASS., March 1—Manager Chester I. Campbell of the Boston Automobile Dealers' Assn., took charge of Mechanic's building today with an army of 350 workmen to transform the structure into a Grecian bower for the annual motor show. He has changed his plans this year so that the show is to be opened at 2 next Saturday afternoon instead of at 8 Saturday night as in former years. This will do away with the great crush that marked the opening of the show each year it is expected.

This year it will be a combination passenger car and truck exhibition, the dealers having voted some time ago to discontinue the separate truck show of past years. In order to get the trucks in it was necessary to shorten up a little on some of the spaces upstairs so that more exhibitors could get in. As a result there will be a larger display of vehicles than in the past. There will be some makes new to Boston, for several agencies have been closed the past few months, and as soon as this was done application was made for space. The late comers were willing to take anything that they could get. Some of them will be forced to show in the basement with the trucks, but the greater number will be in the two big halls upstairs.

The decorations this year will be along the lines of Grecian scenes. Last year they were Venetian. In Grand Hall a temple 25 feet high, surmounted by a gilded dome, will rise up at the intersections of the main aisles. The ceiling will be studded with lights and streamers of electrics will run in all directions across the hall.

In Grand Hall the larger number of makes that have occupied the stage and main aisles will be seen again, such as the Pierce-Arrow, Packard, Cadillac, Peerless, Winton, White, Stearns, Locomobile. The Stevens-Duryea space will be occupied by the Maxwell and the Marmon line will have the Knox space. In the balcony above there will be a lot of accessories as usual.

In Exhibition Hall, the triangular section, the space will be transformed into a Grecian grove. There will be a series of large white columns, and at different sections there will be many trees whose branches will form arches across the aisles.

In this hall there will be a great number of exhibitors, for there is more room. They will comprise about all the well-known makes on the market. This year there will be an absence of the cyclecars which were so numerous a year ago. The management states that there will be more than 400 vehicles and chassis on exhibition, and the total exhibitors will be more than ever. Despite the ban on accessories by the Accessory association, there will be all the well-known devices displayed through the medium of the local dealers.

—

Farmers Buy Cars at Tacoma

Tacoma, Wash., Feb. 26—Sixty-five automobile and accessory dealers exhibits completely filled the Glide rink at Tacoma during the second annual automobile show, the week of February 15. Instead of being strictly a Tacoma show this year, it was a great distributing show for the Pacific Northwest; dealers from both Portland and Seattle exhibited with the Tacoma dealers, and worked with each other in entire harmony during a most profitable week.

The show was opened by Governor Lister, President George H. Stone, of the Chamber of Commerce, and President D. A. Outcalt, assisted by many officers of the Tacoma Automobile Club, and many out of town visitors.

A total of forty-two pleasure cars were exhibited by seventeen dealers, and three dealers exhibited trucks.

Among the purchasers of cars were many grain men, as the Northwest has received a large share of the returns from wheat and flour, both Tacoma and Seattle having exported many thousands of tons to Great Britain and the Orient during the past few months. The lumber business has been quiet for some time past, otherwise sales would have undoubtedly been doubled. However, the majority of exhibitors were well pleased with the treatment accorded them and the interest manifested by the large attendance each day, which varied from 500 in the afternoon to 2,000 each evening.

Financially the show was a great success and the dealers were unanimous in declaring for a repetition of the event in 1916, when it will be repeated but will undoubtedly have to be housed in a much larger building more centrally located.

Jitney Movement Reaches Eastern Cities

J. N. Willys Predicts Sensational Transportation Developments

PASADENA, CAL., Feb. 26—"The strong political influences exerted by electric street railway interests may succeed for a short period in retarding the sudden and great development of the jitney bus but it will never be able to suppress that new and popular means of transportation," declared John N. Willys, president of the Willys-Overland Co., in the course of an interview on the jitney situation at his winter home in Pasadena, Cal. Since arriving in California, Mr. Willys has made a study of the jitney bus in the cities where its remarkable rise to popularity started.

Mr. Willys believes that the world is just upon the eve of most startling developments along this line.

"Why," he continued, "in England the jitney business is no longer confined to the cities. There have been dozens of bus services established between smaller towns. Out of London lines run in all directions carrying passengers into the country to points which have never before been available to the rank and file.

"At the beginning of the war a tremendous movement was on foot to nationalize motor bus transportation, and compete more and more with steam railways, which in their suburban passenger traffic already are being hard hit by bus competition. In historic old Oxford the trams have entirely disappeared from the streets."

Mr. Willys is of the opinion that manufacturers of moderate priced cars will soon be turning their attention to the production of a special type of automobile which will serve better than the standard touring car as used today for jitney purposes. At present the jitney service makes a splendid outlet for second-hand cars.

KENOSHA, WIS., Feb. 27—Orders for $75,000 worth of jitney buses were received during the past week by the Thomas B. Jeffery Co. Among these was one order for ten twenty-passenger motor buses for the Universal Bus & Taxi Co., which is the official hotel bus company for the Panama Exposition at San Francisco. These buses are built on the 1 1-2-ton Jeffery standard chassis, and the bodies were all made in the Jeffery shops at Kenosha, just outside of Chicago. They have 7 feet clearance inside.

Jitneys in Dallas Boost Car Sales

DALLAS, TEX., Feb. 25—During the month of February, according to estimates handed out today the street railway company at Dallas lost at least $30,000 from the operation of jitney cars in Dallas. There are now 412 licensed jitney cars in the city and the number is increasing daily. Monday morning a public hearing on a proposed ordinance by the city of Dallas was held before the commissioners of the city. This ordinance will compel all jitney drivers to file a $10,000 bond with the city assessor and collector of taxes.

As a result of this jitney service the sale of automobiles in the city of Dallas last week broke all former records, 136 licenses for numbers being issued. The former record was eighty-one cars in 1 week. The drivers of jitney cars have organized the Dallas Jitney Assn. and indications are that this service has come for good. The cars run cross town and to all parts of the city. Patrons of the street railways are taking to this new service. In this connection Dallas is leading all other cities of Texas, even having a girl jitney operator.

BUFFALO, N. Y., March 3—The Buffalo Jitney Bus Co., this city, has been incorporated for $10,000 to run a jitney bus line in this city. The incorporators are: Ella Ryan, R. E. Rayman, O. S. Kinsley, all of the White Bldg., Buffalo.

Chicago's First Jitney Bus Appears

CHICAGO, ILL., Feb. 27—Chicago's first jitney bus made its appearance on the streets Wednesday and on Friday the number had been increased to four. Three of these are touring cars and one is a limousine. The service was installed on Madison street, a street car line being in operation there. The jitneys run between Halsted street and the loop district, and were installed by James Levy, president of the Chalmers Motor Co., of Illinois, and Nate Jacobs of the Newberry Auto Livery Co.

Limited as the service is in its beginning, it seemed to meet the approval of the public which patronized it to capacity. It is expected that this service with small cars will be extended by private interests. Meanwhile movements are under way by five different concerns toward the establishment of regular bus lines of from eighteen to thirty-passenger cars to operate on the streets and boulevards of the city.

Impetus has been given to this by the decision of the corporation council's office, that no franchises are needed.

The situation is somewhat complicated at the moment by doubt as to whether the boulevards are open to the buses, as these are under the control of the park boards, which are independent of the city authorities.

During the second day of service of the jitneys, the touring cars took in $7 each and the limousine, $7.50.

Jitney Bus Service for Harrisburg

YORK, PA., Feb. 27—Harrisburg, Pa., is to have a jitney bus service. Application will be made to Governor Brumbaugh on March 18 for a charter to operate a "jitney bus" line in the capital city and between that place and Steelton. The capitalization of the new corporation will be $25,000. Included among the incorporators are: O. M. Copelin, C. E. Covert, Augustus Wildman, A. H. Snavely, H. M. Barnes, all of Harrisburg; I. W. Copelin, of Toledo, O.; and Frank Williamson, of Lancaster. A meeting to elect officers will be held shortly.

Fifty vehicles with not less than twelve or more than twenty-five passenger capacity, will be put in operation and Market Square is the proposed terminal point for lines reaching out in all directions. Whether or not the cars will be double-deckers, similar to the kind used in other cities, has not yet been determined.

Arrest Women Conductors in New York Buses

NEW YORK CITY, March 3—The women conductors and the drivers of the two jitney buses operated in this city by the People's Five-Cent Bus Corp., were last night summoned to appear in court.

A test case is to be made to establish the right of the new corporation to operate on the city streets.

PATERSON, N. J., March 2—The first jitneys invasion in the East has commenced in Paterson, N. J. The jitneys are operating in competition with the street car lines of the Public Service Railway Co., one of the operating subsidiaries of the Public Service Corp. of New Jersey and in this way all quarreling is avoided.

WINNIPEG, MAN., Feb. 23—The jitney bus has now invaded Winnipeg, and over sixty touring cars are plying for hire on various routes in the city. The distance traveled by the majority of the jitneys, is within a 2-mile radius of the City Hall, and the fare is 5 cents. Several of the larger taxicab companies are having special bodies fitted to touring car chassis, with a passenger capacity of fourteen, and judging by the results obtained from the use of touring cars with a capacity of only five passengers, the new type should give excellent results.

A license fee of $10 is charged to all operators of the jitney bus, but this is to be reconsidered by the City Council, owing to representations made on behalf of the Winnipeg Electric Railway Co., who are protesting against the service, owing to inroads on its income.

Jitney Developments in Ohio Cities

COLUMBUS, O., Feb. 27—The jitney bus fad is not taking as rapidly in Columbus as has been the case in other cities of the country. The number of buses which are being operated by individuals remains about the same as formerly. Lack of patronage has not compelled the owners to consolidate into a concern for the purpose of operating buses on the regular schedules.

One of the reasons given for the partial failure of the idea in the Buckeye capital is the fact that the local street car service is thoroughly well organised. Outside of a few outlying sections the street car service is good and there are only a few complaints heard. As a result the jitney bus appears to be out of place in Columbus.

In Cleveland the idea is taking root rapidly and organized service on many of the streets is being given. Preparations have been completed for the operation of buses by the Cleveland street car system to compete with the "jitneyites."

In Dayton the jitney buses are also quite popular, and they are having an effect on the earnings of the local street car system. The announcement was made that the traction officials would operate buses in competition with the jitneys.

In Toledo they are also quite popular and the number is gradually increasing. Service has been organized on many of the principal streets of the city, and the people are riding on the buses as a protest against the methods of the traction monopoly.

In Cincinnati quite a few jitney buses have been operated with a measure of success. Service is moved from the center of the city to outlying districts where the street car service was notoriously bad.

WILLIAMSPORT, PA., Feb. 27—The jitney bus, the automobile trolley car, has invaded Williamsport. The first two cars operated by a newly organized company ran on a belt line, covering West Fourth and West Third streets between Market street, the eastern terminus, and Grier street on the west. The line which opened in Williamsport is one of the first in Pennsylvania. The service is known as the Jitney-Cadillac, although the city Cadillac agency management is in no wise interested in the movement.

Agitation for Regulating Jitneys

WASHINGTON, D. C., Feb. 28—Decision to allow jitney buses to operate under either of two sections of the license law has been made by the district commissioners after a conference with the promoters of the proposed bus service. One of the sections provides for a $6 annual fee and the other for a fee of $9. The former charge is made for vehicles carrying passengers for hire "over a route sufficiently definite to enable the public to ascertain the streets and avenues on which vehicles can be found en route. The latter fee is for licenses as public hacks. Licenses for operation over definite routes require the approval of the district commissioners.

Several conferences which may result in the incorporation of the Washington Jitney Bus Assn. were held this week with A. I. Hickey, president, in charge. If the association abandons its present identity and becomes a corporation, it will be because backers fear that as soon as the lines are fairly established under certain provisions of the hack law, the city government, seeing the utility of the jitney lines, will attempt to class them as common carriers and bring them under the direction of the public utilities commission, prescribe schedules and otherwise regulate the operation of the buses.

DENVER, COL., Feb. 24—A mandamus suit to compel Commissioner of Finance C. J. Pitcher to issue 137 permits for automobiles to be used in jitney bus service was filed today in the district court by the Denver Street-Auto Service Corp. The above number of applications filed by this one concern have thus far been refused by Commissioner Pitcher, whose office makes him ex-officio excise commissioner. The city council recently passed a bill declaring a jitney bus line a public utility and requiring any persons or corporations wishing to operate such a service to apply for a regular franchise. But the jitney bus promoters claim they have a right to permits the same as have persons operating taxicab service.

Eighteen five-passenger Ford cars, which the above corporation had purchased and prepared for the service thus far prohibited, were turned over to the Auto Clearing House Co. 2 days ago, and have all been sold.

DES MOINES, IA., March 2—The jitney bus industry is just 4 weeks old in Des Moines and forty-three jitneys already have been licensed to operate. They are expected to multiply with great rapidity when spring opens. According to the most complete statistics available the jitneys now in service are picking up the cream of the transportation business and getting 10 per cent. of the city railway company's gross receipts. The average gross income of each jitney is about $12 a day and some run as high as $15 a day with a minimum of $10 a day. Cutting the estimates down to the minimum, the jitneys now in service would get $430 a day, indicating an annual income of about $150,000 a year. The annual gross income of the city railway is about $1,300,000.

ALBANY, N. Y., Feb. 26—Assemblyman G. F. Thompson has introduced a bill providing that all motor vehicles carrying passengers for hire in cities of the first class, excepting New York City, shall be considered as common carriers. The bill exempts from its provisions stage coach and buses operating on state routes or highways, constructed wholly or partly at the expense of the state.

Consolidated Car Co. Expands—Other Late News

DETROIT, MICH., March 3—The Consolidated Car Co., organized to take over the business of the Abbott Motor Co., has completed plans for financing the business on a more extensive scale than originally was contemplated. New capital has been added and C. L. Lewis, of Toledo, O., and his associates have acquired control. Lewis has been elected president and will go to Detroit in the near future to give all his time to affairs of the company. He is secretary and sales manager of the Edward Ford Plate Glass Co., Toledo, and is also a manufacturer of automobile parts and equipment.

A. C. Knapp and R. A. Palmer, who were members of the temporary organization, are no longer connected with the company. M. J. Hammers, D. E. Perry and F. E. Sangbush, who have been active in the management of the Abbott-Detroit business, will continue in like capacities with the Consolidated.

Practically all of the original Abbott-Detroit dealers and distributors have re-contracted with the Consolidated company.

The company is already producing the two models upon which it will specialize—a seven-passenger, six-cylinder touring car, at $2,290, and an eight-cylinder, seven-passenger touring car, listing at $1,885; the former has a Continental motor and the latter a Herschell-Spillman.

Saxon Makes Record Shipment of 115 Cars

DETROIT, MICH., March 3—The biggest production and shipping day in the history of the Saxon Motor Co., was February 22 when 115 cars were turned over to the railroads. All departments are working full time and although the old Abbott plant, where the Saxon company is now located, is fully one-third larger than the former Saxon home, it is by no means adequate to take care of the increasing business. Further expansion will probably be necessary soon.

SYRACUSE, N. Y., March 3—The Franklin Automobile Co., this city, recently made a large shipment of cars to the Pacific Northwest. It consisted of a trainload bound for the states of Washington and Oregon. Twenty cars alone were destined for Walla Walla. The rest of the trainload was made up of cars for Pendleton, Ore., and Seattle. In value, this shipment represents almost $70,000.

Grossman Offers $1,000 Indianapolis Prize

NEW YORK CITY, March 3—The Emil Grossman Mfg. Co., this city, is offering a cash prize of $1,000 to the winner of the 500-mile race to be held at Indianapolis, May 30. The award is conditional on Red Head spark plugs exclusively.

ELGIN, ILL., March 3—Officers and directors of the Elgin National Road Race Assn. were elected at a meeting held this week as follows: President, James Dorsey; vice-president, John A. Logan; secretary-manager, F. W. Jencks; treasurer, Phillip Freiller; directors, Harry Vissering, W. C. Wilson, Mort Aldridge, E. J. O'Beirne, and W. A. Kerber, Jencks succeeds Wilson as manager and secretary, Wilson, who was secretary, becoming a director. Prospects for successful races this year are bright. Chicago men and officials of the American Automobile Club, which co-operate with the Elgin club in staging the races, declare that the list of entries will contain a longer array of star drivers than ever before. A dividend of 10 per cent. on all stock was declared, payable between March 1 and 10.

DETROIT, MICH., March 3—The regular quarterly dividend of 1 3-4 per cent. upon the preferred stock of the Packard Motor Car Co. will be paid on March 15 to the stockholders of record at the close of business the first day of March, 1915.

KANSAS CITY, KAN., March 1—J. H. McDearmon, who has been with John Deere Plow Co., this city, for 11 years, has resigned to become assistant sales manager with the Oakland Motor Co.

Factory Miscellany

STERNBERG Trucks Arrive Safely—Cablegrams were received in Milwaukee on February 26 from France announcing that the shipment of 100 Sternberg army trucks made some weeks ago from Milwaukee by the Sternberg Motor Truck Co. had safely arrived at a French port. The messages were from Norman Sternberg, son of vice-president E. M. Sternberg, who accompanied the shipment with several other factory experts.

Firestone Output Increase 78 Per Cent—The output of the Firestone Tire & Rubber Co., Akron, O., has increased during the last year 78 per cent., and the number of Firestone dealers has been increased 50 per cent.

Excel Rubber Moving to Wadsworth—The Excel Rubber Co. is preparing to move its plant from Akron to Wadsworth, O., where a factory site has been secured near the Erie Railroad. The capital of the company was recently increased from $10,000 to $50,000.

Canadian Goodyear Prospering—The Goodyear Tire & Rubber Co. of Canada will double the capacity of its plant at Bowmanville, Ont. The increased output will also materially effect the cost of production and the consumer will get the benefit by a reduction in price of about 37 per cent., compared with prices of 2 years ago.

Delco's February Shipments Large—February was a banner month for the Dayton Engineering Laboratories Co., Dayton, O., in the way of shipments of the Delco systems. The first week of that month 3,182 complete systems were shipped, the second week 2,836 and the third week 2,575 were shipped. During the last week of February the average has been 280 a day.

Babcock to Build—The Babcock Automobile Spring Co., which was established in Milwaukee, Wis., at 187 Oneida street about 18 months ago, is about to erect a plant in Milwaukee for the manufacture of its products. A contract has been awarded for the erection of a factory building on Milwaukee street, near Chicago street. It will be of solid brick construction, one-story, 40 by 100 feet in size.

Troy Wagon Enlarges—The Troy Wagon Works Co., Troy, O., has started building a new motor truck trailer works, which will cover 16,800 square feet of ground, being 120 by 140 feet in size. The company will turn out more than sixty trailers a week. The company is now making trailers in three sizes—1½-ton, 2½-ton and 5-ton. The 1½-ton is non-reversible, while the other two may be obtained in either reversible or non-reversible types.

Marion in New Indianapolis Plant—The Marion Motor Co., Indianapolis, has secured the four-story building at 430 North Capitol avenue and removed from former location on Oliver avenue. The new location will house the general offices, engineering and service departments, and the small manufacturing that will be done in Indianapolis. The principal factory of the company, which is allied with the Mutual Motors Co., is located at Jackson, Mich.

Studebaker Adds 70,000 Square Feet—A new steel stamping and a new enameling plant is being erected for the Studebaker Corp., Detroit, Mich., to its plant at West Jefferson and Clark avenues. The structure will be four stories high, 220 by 80 feet and have 70,000 square feet of floor space. It will cost $85,000. The first three floors will be used for stamping fenders, oil pans, splash guards, etc., while the top floor will have the enameling ovens. The building is to be ready in 90 days.

Large Canadian Shipments — The Grand Trunk and Grand Trunk Pacific railways have just handled the largest single shipment of motor cars and carriages ever made by a Canadian vehicle factory. The McLaughlin Carriage Co., Ltd., of Oshawa, Ont., shipped this week forty-five carloads, a solid train of its McLaughlin-Buick automobiles and McLaughlin carriages, for Winnipeg, Regina, Saskatoon, Moose Jaw, Edmonton and Calgary, over the Grand Trunk System lines. The vehicles in this train would make a procession 3 miles long.

Hans Equipment Increasing Force—The Hans Motor Equipment Co., of La Crosse, Wis., which was involved in financial difficulties some time ago, has now been re-established on a sound basis and is operating at the largest capacity yet attained by the plant. During last week about twenty-five additional workmen were employed and if the present rush of orders is maintained, the force will be still further increased. The concern manufactures gasoline and oil gauges, pumps and other small equipment which is used by many of the leading car builders of the country.

Reclamation Work on Overland Land—Reclamation work has been started on the land upon which the two large Overland factories will be built in Toledo, O. The foundation of the larger building to be built will rest partly on what was formerly a river bed and partly on the cut-out where a hill once stood. This building will be 1,000 feet long, 200 feet wide, and will consist of two stories and a basement. The second building will be 200 feet square. Together they will contain 17 acres of floor space. When the additions have been completed the Overland factory will have a total of 79 acres of floor space in the Toledo plant alone. This, together with the affiliated Overland plants operated in other cities, will aggregate over 100 acres.

May Locate in Springfield — The Widam Mfg. Co., of New York, is seeking a location for a plant at Springfield, O. Widam is president.

The Automobile Calendar

Mar. 1-5	Wilkesbarre, Pa., Show. Vehicle Trades Assn.
Mar. 1-6	Fargo, N. D., Show, Armory.
Mar.	Benton Harbor, Mich., Show, St. Joseph and Benton Harbor, St. Joseph Garage, St. Joseph.
Mar.	Charlotte, Mich., Show.
Mar. 2-9	Brooklyn, N. Y., Show, Motor Dealers' Assn., 23rd Regiment Armory.
Mar 3	Albany, N. Y., Associated Garages of America, General Convention.
Mar. 3-4-5-6	St. Joseph, Mich., Show, St. Joseph Auto Co. Bldg.
Mar. 4-6	Springfield, Mass., Show; J. H. Graham.
Mar. 6	San Francisco, Cal., Vanderbilt Race, Panama-Pacific Exposition Grounds.
Mar. 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13	New York City, Made in the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-11	Johnstown, Pa., Show.
Mar. 8-13	Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 8-13	Utica, N. Y., Utica Automobile Trade Assn.
Mar. 13-20	Harrisburg, Pa., Show Arena, Harrisburg Dealers' Assn.
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
Mar. 17-20	Elgin, Ill., Show, W. H. Tidmarsh, Mgr.
Mar. 22-27	Bangor, Me., Show, Bangor Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
April 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
April 20-22	Oklahoma City, Okla., Road Race, S. W. Auto Racing Assn.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4-5	Tacoma, Wash., Road Race.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

LANSDALE Denby Vice-President—Henry Lansdale, until recently general manager of the Krit Motor Car Co., and previously during a period of 6 years with the Cadillac Motor Car Co., Detroit, Mich., has become identified with the Denby Motor Truck Co., having been elected vice-president.

Oscars Indianapolis Goodyear Mgr.—E. B. Oscars has been appointed manager of the Goodyear Tire & Rubber Co., Indianapolis, Ind.

Parker Resigns from Briscoe—B. D. Parker has resigned as advertising manager of the Briscoe Motor Co., Jackson, Mich., and has returned to Detroit to form a connection.

Finney Goodyear Sales Manager—W. E. Finney, who has been connected with the Goodyear Rubber Co. for some years, has been appointed sales manager of the St Louis, Mo., branch.

Lavoie Oxford Motor Mgr.—A. J. Lavoie has been appointed manager of the Oxford Motor Car Foundries, Ltd., Montreal, Que. This firm is now manufacturing the new Maisonneuve motor truck.

Edwards Heinze Mgr.—The Heinze Electric Co. has opened a branch office at 33 South Eleventh street, Minneapolis, Minn., in charge of William Edwards, formerly manager of the branch in Kansas City.

Hasiett Detroit Goodyear Mgr.—W. A. Hasiett has been appointed manager of the Detroit (Mich.) branch of the Goodyear Tire & Rubber Co. He was until recently manager of the company's branch in Pittsburgh, Pa.

Sims Timken Advertising Mgr.—F. S. Sims, who was assistant advertising manager of the Timken-Detroit Axle Co., Detroit, Mich., has been appointed advertising manager. E. A. Walton, who held that position, resigned some time ago.

Changes at Springfield—H. H. Bierman has resigned as manager of the Springfield Buick Co., Springfield, Mass., and he has formed the Springfield Reo Co. with H. P. Gates. G. A. Mevis has been appointed manager of the Buick agency.

Biggers Hyatt Advertising Mgr.—W. E. Biggers, formerly associated with the Packard and the Ford companies, has joined the Hyatt Roller-Bearing Co., Detroit, Mich., in the capacity of advertising manager. His headquarters will be in Detroit.

Caton Makes Change—E. L. Caton, for some time with the Hudson agency in Worcester, Mass., has joined the sales force of the Norcross Automobile Co., in that city, handling the Buick line. He is president of the Worcester Automobile Dealers' Assn.

Burt Assistant General Mgr.—C. R. Burt, for the past year and a half factory manager of the Russell Motor Car Co., Toronto, Ont., has been appointed assistant general manager and elected to the directorship made vacant by the resignation of J. E. Rogers.

Kirby Resigns—T. C. Kirby has resigned from the management of the Montreal Automobile Trade Assn., Montreal, Que., to accept the management of the Canadian Home Markets Assn., an organization formed for the promotion of Made in Canada Goods.

Hexter Republic Sales Manager—P. K. Hexter, formerly president of the Hexter Gas-Electric Vehicle Corp., New York City, has been appointed Eastern district sales manager of the Republic Motor Truck Co., Alma, Mich. He will make his headquarters in New York City and will have charge of all sales made of Republic trucks east of Pittsburgh.

Recent Warner Gear Announcements—The Warner Gear Co., of Muncie, Ind., has recently added about $60,000 worth of new equipment to take care of the heavy increases in production which will be in force at its factory during the next 5 or 6 months. Harry Orr, formerly of the American Locomotive plant at Providence, R. I., comes to the company in the capacity of production manager, taking up his duties March 1.

Dodd and Maddea Get Chase Appointments—W. S. Dodds, formerly district manager with the Maccar, and E. R. Madden, who has been connected with the Chase Motor Truck Co., Syracuse, N. Y., for several years, have been appointed division sales managers of that company. Mr. Dodds will establish headquarters at Buffalo and will cover part of New York State, western Pennsylvania and eastern Ohio, while Mr. Madden will cover a western territory with headquarters at Kansas City.

Garage and Dealers' Field

Moon Closes Big Agency in Seattle—J. C. C. Morris, formerly manager of the Johns-Manville Co., Seattle, Wash., for the entire Northwest, has just closed arrangements with the Moon Motor Car Co., St. Louis, Mo., whereby he handles this entire territory for Moon cars, appointing his own agents, and assuming every detail of the service and management in Washington, Oregon, Idaho, and Western Montana.

Duplex Engine-Governor Moves—The Duplex Engine-Governor Co., New York City, has moved from 80 Maiden Lane to 245 West Fifty-fifth street, that city. This company has taken the front half of the tenth floor of that building and will consolidate into that space its general office, testing and assembling plant. Four companies have already adopted Duplex as standard equipment and that company anticipates that five other companies will so adopt it within the coming 2 months.

Milwaukee Co. Opens Salesroom—The Geuder, Paeschke & Frey Co., Milwaukee, Wis., announces the opening of a sales office at 1308 Majestic Bldg., Detroit Mich., and the appointment of A. B. Walker as direct factory representative. This company has a very large plant in Milwaukee, covering many acres, and specializes in the manufacture of sheet metal stampings, including oil pans, axle housings, gasoline tanks, mufflers, etc.

McNaui Tire Installation Completed—The McNaul Tire Co. has completed the installation of its plant on Miami street, Toledo, O., and is now manufacturing the McNaul tires there, which heretofore were made for its inventor, W. M. McNaul, by one of the tire manufacturing concerns of Akron, O. Ole Hibner, who is the general sales manager of the company, states that the company has now orders on its books which will keep it busy all year.

N. Y. Store for Owen—R. M. Owen & Co. have arranged for a Broadway location in New York City at Fifty-seventh street, at the southwest corner. The agents in that city for the Owen car are E. S. Partridge and C. H. Page. The two stores in the building are to be remodeled for the uses of the Owen agency. The corner was occupied by the Oldsmobile branch store and the Fifty-seventh street side store by the Lancia.

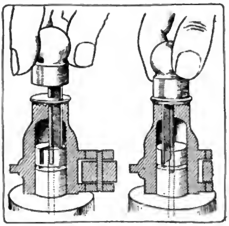
Federal Rubber Employees' Minstrel Show.—Nearly 200 office and shop employees of the Federal Rubber Mfg. Co., of Milwaukee, Wis., appeared in a minstrel show which packed the Pabst theater at Milwaukee on the evening of February 23. A year ago the employees staged a similar show, principally for the entertainment of the entire corps of employees. It was so successful that this year the welfare division arranged a performance for the general public. From now on a pretentious effort will be made each spring to prove the histrionic ability of employees.

Awards Contract for Register—Arthur Fifoot, secretary of the Automobile Club of Hartford, and Albert Simons, a deputy sheriff, have made a contract with the Secretary of State to print and publish the State Automobile Register. This is the first time since the state has conducted a register that it has been issued outside. For some time past this action has been agitated. Mr. Fifoot was formerly registrar of motor vehicles under Secretary of State Max Rogers. The first book will be out shortly. It is estimated that a big saving will be effected by the state allowing the book to be printed by an outside party.

Packard Opens Own Detroit Branch—The Packard Motor Car Co., Detroit, Mich., has decided to open a branch in that city, and beginning March 1 this branch will be located temporarily at the main plant of the company, on East Grand Boulevard. As soon as a suitable location is found in another part of the city a branch salesroom, garage and service station will be erected. The Standard Auto Co., 850 Woodward avenue, which has handled the Packard motor cars for many years, will discontinue that car and instead the company will act as distributor for the state of Michigan and northwestern Ohio for the Detroiter and Scripps-Booth cars.

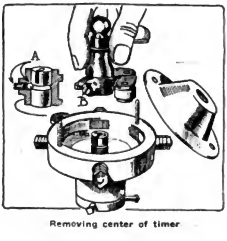
ACCESSORIES

SIMPLE Lighting Outfit—It is often not worth while to spend much on an old car, but it not infrequently happens that owners of old types would like to improve their automobiles by the addition of an electric-lighting outfit. The Eureka outfit consists of a simple little dynamo of the permanent-magnet type complete with a storage battery, lamps and all necessary switches and wiring, the whole selling for an extremely moderate sum. Being supplied with permanent magnets like a magneto the power required to drive the generator is small, and the voltage is kept steady by means of the vee-belt pulley governor. There is a cut-in and cut-out switch located between the magnets, this being operated by the governor through the medium of the pulley. The complete outfit is made in a form that renders its attachment to a Ford car particularly easy, but it can, of course, easily be fitted to any kind of car.—Henricks Magneto & Electric Co., Indianapolis, Ind.



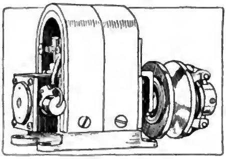
Inserting key in timer lock

Washing Brush—This is an automobile washing brush, which seems to be especially well made and of unusual strength to withstand hard usage. The back plate, which is the essential part of the idea, is aluminum, and it should be observed that the water holes are drilled in the inner edge of the plate. This has the effect of driving the water inward toward the center of the brush and insures a proper spreading of the supply over all the back of the brush, which is less easy to arrange for when water is taken in at the center. Either a brush or a sponge can be clipped in the holder by means of a simple locking device or, if it is desired to cut heavy mud, there is a fine hose nozzle with the equipment that can be used as an extension piece for the handle or by itself to give a strong jet of water.—Peerless Fountain Brush Co., Chicago Ill.



Removing center of timer

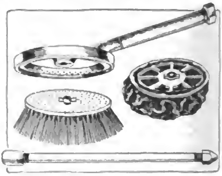
Ignition Automobile Lock—There are many devices intended to render the stealing of an automobile difficult or impossible, and of these one of the latest is called the Atlantic Positive Motor Lock. It is applicable to any car that has timer ignition, and is made so that it is not only of use as a lock, but facilitates the removal of the inner member of the timing distributor for cleaning or examination. The illustrations make clear the operation of the apparatus. Firstly, for locking purposes there is a slot cut in the top of the spindle that projects vertically upwards in the center of the stationary part of the timer, and the revolving member fits snugly over the spindle. It is, however, free to turn on the spindle until the locking key has been inserted. This key can be put in from the top of the cover and slips into the slot cut in the top of the driving spindle, whereupon the timer acts just like any ordinary igniter. The second illustration shows how the center portion of the timer can be removed for cleaning, as the steel ball A has a spring B behind it and this snaps into the groove turned in the spindle. It may be added that turning the motor with the key removed from the timer does not affect the timing when the key is replaced, as it can only slip in its slot when the timer center and the spindle are in the correct relative positions.—Atlantic Machine Co., Brooklyn, N. Y.



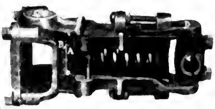
Simple lighting generator

Fan and Horn Combined—The idea of using the motion of the fan to operate a horn diaphragm is ingenious and seems well carried out in the Marvel combination. The diaphragm is located in the center of the fan, and the only attachment is a cable which ends in a push button and can be fixed to any place convenient for the driver. To fit the fan to a Ford it is only necessary to remove the old fan and slip the Marvel into place.—Marvel Auto Supply Co., Cleveland, O.

Steering Steady.—A simple and strong device for attachment to Ford cars is the Savidge apparatus for absorbing shocks on the steering gear and steadying the steering on rough roads or at high speed. Attached to the center of the front axle is the larger of the two clips seen in the illustration, and the smaller is gripped similarly to the middle of the steering tie rod. Each clip has on it a pair of trunions, of which two are shown at C and D and connection between the clips is made by the link containing the heavy coil spring. This spring is adjustable for tension by means of the screws and lock nuts shown and presses upon a sliding block bearing a roller A. On the clip attached to the axle there are two lumps, B, between which the above-mentioned roller normally lies. As the steering is turned the tie rod, of course, moves transversely and carries with it the end of the link which is on the pins D. This swings the link containing the coil spring about the centers of both pins C and D, which causes the roller to mount one of the "lumps" that lie on either side of it. This compresses the spring, which means that the movement is resisted, and there is a natural tendency for the wheels to return to the straight position. It is claimed that the device will eliminate front wheel wobble and makes for safety at all times, while it is obvious that the fitting is simple.—Savidge Steering Device Co., Indianapolis, Ind.



A strong washing brush



Steering Steady for Ford car

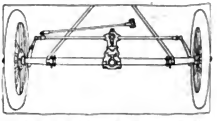


Diagram of mounting of steering steady

SLUSHING IN OIL!

When attending the great

Panama-California Exposition

do not deny yourself the opportunity of seeing the

V-Ray
SPARK-PLUG

being drenched in carbonizing oil—abused and slushed in it—every five seconds, with an electrically driven immerser, continuously—day in and day out.

You will find this *grief-resisting plug* sparking "between drinks" as brilliantly as though it were bone-dry.

Oil and heat will not affect the

V-Ray

NOTE—When the exposition closes next fall, these abused porcelain and "Mika" V-Rays will be driven—untouched and uncleaned—back to the Atlantic seaboard—in a motor that will be exacting as to crucial test.
V-Rays have come out of these withering tests, with a 100% simon-pure record, before. They will do it again.

This is the

V-Ray

the *original* 4-point plug. If you are satisfied with less than V-Ray quality

BUY-AN-IMITATION

The plugs undergoing this Rigorous test at the Varied Industries Building are the identical articles that you can purchase from any *good* dealer or jobber in the United States or Canada.

Porcelain Type—$1.00. **"Mika" Type—$1.25.**

THE V-RAY CO.
Marshalltown, Iowa

Increase Your Sales

The means is now provided to manufacturers of Automobiles and Accessories to reach the entire purchasing power of the industry without spending one dollar on the general public who are not interested.

Apply the old "straight line between two points" axiom to your sales campaign.

Did you know that you can reach every worth-while dealer in this country, every established manufacturer of automobiles, parts and accessories and over 80,000 automobile owners by placing your message in these four papers:

THE AUTOMOBILE
MOTOR AGE
MOTOR WORLD
MOTOR PRINT

Perhaps you don't care to reach them all—the entire 100,000 and over—but prefer to reach only the dealers or the owners.

In that case select the medium which reaches the right audience for you. Each of these papers reaches a distinct class.

Apply the present day principles of efficiency to your merchandizing—it's the proven route to success.

The Class Journal Company
239 West 39th Street, New York

MARCH 11, 1915 Automotive Industries 10 CENTS A COPY

3-15-15
amk

The AUTOMOBILE

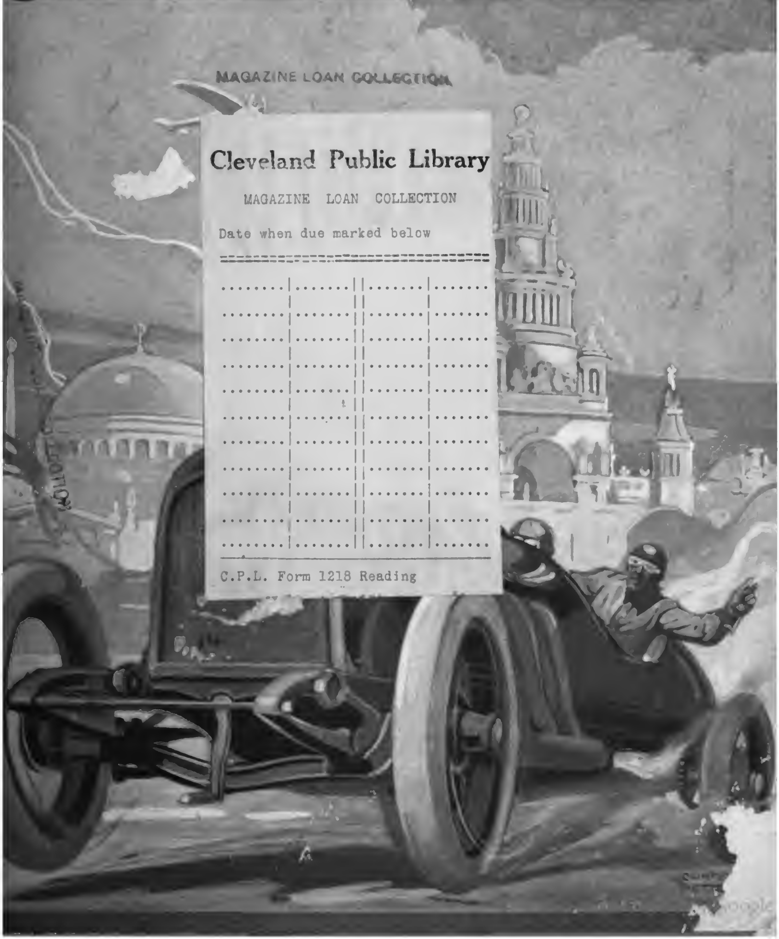
MAGAZINE LOAN COLLECTION

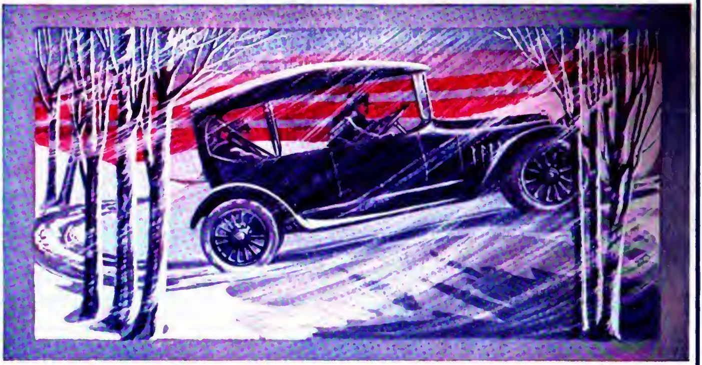
Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading





The Greatest Spark Plug Troubles Are Caused by the Defects That Are Not Suspected

But they mean everything to the efficiency and smooth operation of a motor.

Frequently, when motoring on a good stretch of road with the throttle opened wide a car will run smoothly enough for a mile or so but suddenly a miss is detected which increases as the motor is pushed to its maximum. Then again, while pulling up a long hill, or through a heavy road, an engine knock or miss develops which necessitates shifting to a lower gear.

NINE TIMES OUT OF TEN THE TROUBLE IS CAUSED BY LEAKY PLUGS. The metal parts in a plug expand so much more than porcelain that after a motor attains its normal heat, and is pulling under a fair load, the leakage is so considerable as to overheat the electrodes. Premature ignition develops, causing a miss and engine knock which are very detrimental to the motor.

THIS IS ONE OF THE TROUBLES THAT VERY FEW SUSPECT, and that our extensive tests have enabled us to discover.

The success of our 1915 AC TITAN AND CICO plugs and their adoption by so many of the leading manufacturers is due to the fact that they are the most efficient plugs made.

When the car owners realize what a gas tight plug means—one that is gas tight under all conditions—they will not run their motors another day with leaky plugs.

All responsible dealers and jobbers carry AC TITAN and CICO plugs—the plugs that give results.

We manufacture the AC TITAN and CICO only. Do not be misled by a similarity of names.

Well-known Users of the AC Line

Buick
Cadillac
Chalmers
Chase
Chevrolet
Cole
Commerce
Cartercar
Dodge Bros.
Dort
Federal
Ferro
G M C
Haynes
Harley-Davidson
Hudson
Hupp
Jackson

Well-known Users of the AC Line

Knox
Lambert
Lexington-Howard
Moline Knight
Monroe
Moon
National
Oakland
Olds
Packard
Peerless
Paige
Reo
Saxon
Stearns
Stutz
Touraine
Velie
Wilcox Truck

CHAMPION IGNITION Co

FLINT, MICHIGAN, U.S.A.

Vol. XXXII New York—Thursday, March 11, 1915—Chicago No. 10

The AUTOMOBILE

New England— Will Spend $58,500,000 for Cars and Accessories

$21,000,000 for Tires and Accessories in 1915—Industries in the Six States Total $2,950,000,000

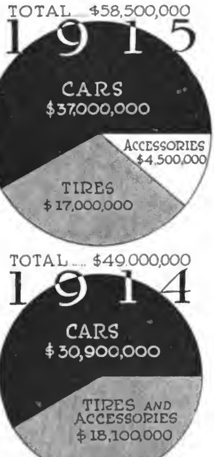
By J. Edward Schipper

BOSTON, MASS., March 6—In the New England territory there is $58,500,000 worth of business awaiting the automobile and accessory trade. Last year through this territory, which has its logical capital at Boston and whose boundaries are the boundaries of the six New England states save that small portion of Connecticut south of Bridgeport, the business amounted to $49,000,000. From a carefully-compiled census taken at the Boston show the amount of business in complete passenger vehicles totaled $30,900,000. If the percentage of increase throughout the year continues at the same rate as it has up to this date, the passenger vehicles sold in the New England territory during the coming year will go well above the $37,000,000 mark.

Big Tire Business

This enormous car business will carry along with it at least $17,000,000 worth of tire business and in addition to this the big accessory houses whose business covers the territory of New England are figuring on a total volume of business that will closely approximate the $4,500,000 figure. This does not even touch the vast industries furnishing parts and fittings such as nuts, bolts, screws, hub caps, etc.

These figures, even when taken roundly, are sufficient to cause the casual observer to wonder where all this money can come from. The cars bought throughout New England are largely used for purposes of recreation and hence to a great percentage are bought with funds that may be considered as surplus and above the ordinary money used in carrying on a business. The principal industry, throughout the major portion of the six states, is manufacturing. On the other hand, vast areas of ground in each of the states are devoted to farming and some of the richest crops in the world come from this country of the machine shop, mill and foundry.



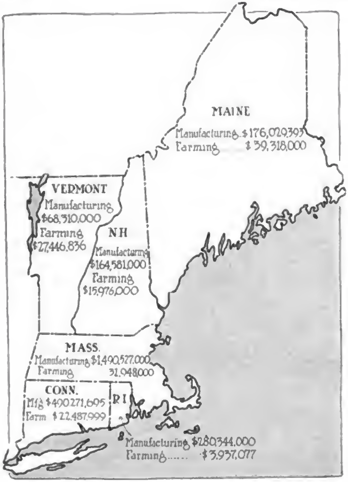
Comparison between automobile and accessory business in New England in 1914 and estimate for 1915. Last year a total of $49,000,000 was spent for cars and accessories; $58,500,000 is the estimate for 1915

Products Worth Billions

Based on the census of 1910, and with due consideration to the normal increase and decrease in business throughout the past 5 years, the manufacturing industries in the six New England states turned out products to the value of $2,950,000,000 during the year 1914. That this figure will be closely equalled, if not surpassed in 1915, is practically a certainty, according to authorities in Boston.

While some of the industries are not as busily engaged as a year ago, the general tone is one of great prosperity. The New England factories are getting the benefit to a large extent of the war in Europe. The wool factories, the cotton mills, the boot and shoe plants, are working night and day to make up for the enormous wasteage of material now going on throughout the countries at war.

Besides these industries throughout these states there are many factories engaged in the manufacture of arms and ammunition. These are located



Map of New England, showing the value of farm and manufactured products of each state as reported in the census of 1910. It is interesting to note the high value of manufacturing as compared to farm products.

in Massachusetts and Connecticut and, needless to say, the demands upon these are larger than ever before. Some of these factories are building great additions and taking on hundreds of laborers in addition to their normal amount of help during peace time.

The value of the farm land scattered throughout the states in the New England group is enormous and this is paying excellent returns. This is especially true in the field of the cereal and dairy products. Taking a total of the value of crops during the past years the estimate can be conservatively made that for 1915 the total figure will closely approximate $150,000,000 even at the normal prices that held in 1914. But with the increase due to the rise on price in many of the farm products the final returns will probably show a higher result. The principal crops are corn, oats, wheat, barley, buckwheat, hay and forage. In addition to these the potato industry of many of these states, such as Maine, Massachusetts and Rhode Island is a vast factor in the buying power.

Foundries and Machine Shops Important

While all of Connecticut may not properly be considered in New England territory there is only a small portion that falls outside. In this state alone the manufacturing industries turn out annually more than $500,000,000 of finished products. The factories engaged in the foundry and machine shop work alone employ approximately 50,000 people and the value of the products reaches close to $70,000,000. These companies are running full blast and a large part of the buying power in the state is centered in this industry.

Brass and bronze work, while furnishing employment to only half the number of people as the foundry and machine shop, results in a product valued at the same amount due to the higher cost of the raw material. The profits in this business are also large factors in the purchasing of automobiles in Connecticut. Besides these two leading industries, the manufacture of wool, silk and firearms are of great importance. The firearm industry in Connecticut during the year 1910 turned out finished products valued at $20,000,000. In 1915 it is estimated that the figure will be close to $60,000,000.

Farming in Connecticut is carried on over an area that embraces practically two-thirds the acreage of the state. The total value of the farm land is $160,000,000 and the total value of the crops is about $24,000,000 annually with prospects bright at present prices to surpass this amount.

Maine Potato Crop Buys Cars

Maine, although one of the great farming states in the group, has manufactures which annually quadruple the value of the farm products. The manufactured products from Maine during the year 1915 will be worth $176,000,000. The value of the farm products will be more than $40,000,000. Yet one dealer states that a good potato crop in the county of Aroostook means thirty-five sales. He sells a $1,000 car. In one county a good potato crop will mean $35,000 worth of cars alone for one dealer. Add to this the tire business and the accessory business that will naturally follow during the year and then consider that this is only one county of the state and only one of the many industries.

The principal manufacturing enterprises of Maine are lumber, paper, cotton, shoes and wool. Every one of these industries are prosperous and many, in fact, better than they have been for years. A dealer selling cars priced at $1,295 states that during the past month he has sold three cars to brokers in wool who have made more money in the last 3 months through bonuses alone than they had in any two years previous. These were salaried men working with profit-sharing bonus agreements.

There are over 60,000 farms in Maine and their total value is over $200,000,000. The principal crops are the cereals—corn, oats, wheat and buckwheat. Potatoes follow closely behind these and the potato farmer, as indicated above, is often a good buyer.

Massachusetts the Leader

Massachusetts is the leading New England state in the value of its industries. Within a 20-mile circuit about Boston is one of the biggest car buying centers in the world. The concentration of the population may be conceived from the fact that 93 per cent. of the population of the state dwell in cities. There are twelve cities in Massachusetts having a population of 50,000 or more. In addition to these there are forty-three between 10,000 and 50,000. In spite of this, Massachusetts is the fifth smallest state in the Union.

The combined manufacturing industries of Massachusetts produce more than $1,500,000,000 worth of goods in a year. Of this gigantic total the boot and shoe industry is the largest factor, the value of its products being $250,000,000 a year. The beneficial effects of the war on this industry have, therefore, served to increase the biggest buying power of the state. Since the opening of hostilities foreign agents have bought up all the available supplies of shoes for the foreign armies, thus giving employment to hundreds of people and forcing the shoe-producing machinery to work to its utmost capacity. The other big industries of Massachusetts are also those which have been benefited by the foreign war. They are the manufacturing of cotton, wool, foundry and machine products and the printing and publishing business. In addition to these there are the meat slaughtering and packing industries, the liquor industry and many others of considerable proportions.

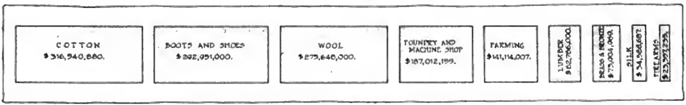


Diagram of value of leading manufactured products in the New England states according to the census of 1910, with detail proportional charts for farming and the various industrial businesses

Car dealers throughout New England have already begun to feel the beneficial effects of the foreign purchases of shoes and wool. These two industries have made New England optimistic and there is a spirit of happy prophecy in the atmosphere of the Boston show.

In spite of the enormous concentration of the population, nearly three-fifths of Massachusetts, insofar as area is concerned, is devoted to farming. There are nearly 2,000,000 acres of improved farm land in the state. This is nearly two-thirds of all the farm land—a remarkable proportion when compared to other states where practically only one-third is improved. The value of the crops anticipated for the 1915 season will run in excess of $35,000,000. The most important farm products are corn, oats, rye, hay and forage, potatoes and tobacco.

In the city of Boston itself are located the commission houses which put this vast market in connection with the channels of trade. The tonnage of the shipments from Boston is second only to that from New York and the internal business created by the enormous population of Greater Boston itself forms a huge potential buying power which an era of prosperity quickly puts into actual touch with the automobile trade. The roads surrounding Boston, and, in fact, throughout all of New England, are good. The population as a whole is interested in good roads and it is impossible to fortell the extent of the actual business if the re-awakening prosperity and the discontinuance of closed mills takes place.

New Hampshire, while largely devoted to farm lands, is still a manufacturing state. The value of its manufactured products as compared with the farm products, is $175,000,000 for the former and $114,000,000 for the latter. The principal industry, as in Massachusetts, is the manufacture of boots and shoes and the prosperous condition of this trade, as reported for Massachusetts, is also true of this state. The value of this industry in New Hampshire is $40,000,000. In order of importance the industries of New Hampshire are the same as in Massachusetts, cotton being second with the valuation of $35,000,000 worth of products a year; wool next, with $17,000,000; then lumber, with $16,000,000; paper and wood pulp, $15,000,000; and foundry and machine shop products, $5,000,000.

27,000 New Hampshire Farms

The New Hampshire farmer is a good car buyer. In the state there are 27,000 farms of all descriptions having a total value of $105,000,000. The big crops, unlike most other New England states, are not the cereals, one-half of the land being devoted to hay and forage. Outside of these the truck farms play an important part.

Rhode Island, the smallest state in the Union, having but 1,250 square miles of territory of which 197 are water surface, has but two cities of over 50,000. These are Providence and Pawtucket. In addition to these there are seven having between 10,000 and 50,000.

Rhode Island is a manufacturing state, the value of its manufacturers compared with its farm products is, respectively, $290,000,000 and $4,000,000. Worsted and wool products valued to the extent of $75,000,000 are manufactured yearly. Cotton follows second with $51,000,000 and next jewelry, $25,000,000. The jewelry trade gives employment to 10,000 people, this being the only New England state in which jewelry manufacturing is of sufficiently large proportion to bring it into the leading industries. Foundry and machine shop products are made to about the same valuation as the jewelry.

$4,000,000 Crops in Rhode Island

While farming in Rhode Island is not of the prominence in proportion to the rest of the industries that it has in the other New England states, still the money-making capacity of Rhode Island farmers is proverbial. The average farm is not extensive and there are a little more than 5,000 farms in the state, most of which are very small, yet the $4,000,000 worth of farm products are produced annually on a total acreage of 178,344. The principal crops are corn, oats, rye, barley, hay and potatoes.

Vermont's biggest industry is in the quarrying of marble and other kinds of stone. Out of a total of $69,000,000 worth of manufactured goods, stone products have a value of $13,000,000. Lumber is next, with $9,000,000, and dairy products just slightly under that figure. The wool industry is also quite important in Vermont, producing over $5,000,000 of business in a year.

Dairy Products a Factor

In Vermont there are 32,709 farms; the total acreage of the state is 5,839,360, of which 4,700,000 is in farm lands, 2,000,000 acres being improved. The value of the annual crops is $28,000,000. Dairy products, which are classed as under the manufactured industries, still occupy the attention and require considerable space of the farmer and his land. There are only three cities in Vermont which have over 10,000 population; these are Burlington, Rutland and Barre.

These are only the big producing industries in each state. In addition the non-producers bring the total up to a bewildering summation that can hardly be estimated.

Value of Products of New England States from 1910 Census

INDUSTRY	CONNECTICUT	MAINE	MASSACHUSETTS	NEW HAMPSHIRE	RHODE ISLAND	VERMONT	TOTAL
All Mfg.	$490,271,695	$176,029,393	$1,490,529,000	$164,581,000	$280,344,000	$68,310,000—	$2,670,065,088
Farming	22,467,999	39,318,000	31,948,095	15,976,000	3,937,077	27,446,836—	141,114,007
Boots and Shoes	1,658,000	15,509,000	236,344,000	39,440,000	None	None	292,951,000
Cotton	24,231,880	21,932,000	186,462,000	33,602,000	50,313,000	None —	316,540,880
Wool	19,363,000	18,490,000	141,967,000	16,731,000	74,600,000	4,497,000—	275,648,000
Fdry. and Mach. Shop	65,535,155	5,237,000	86,926,000	4,947,000	20,612,000	3,755,000—	187,012,155
Brass and Bronze	66,932,969	None	6,042,000	102,000	828 000	None —	73,904,969
Silk	21,062,687	None	8,942,000	None	4,584,000	None	34,588,687
Firearms	19,949 235	None	3,408,000	None	None	None —	23,357,235
Lumber	7,846,000	26,125,000	23,026,000	15,284,000	1 907,000	8,598,000—	82,786,000

329 Cars and Trucks at Boston Show

General view of Grand Hall with the stage in the background and Grecian Temple in the foreground

87 Commercial Vehicles on Display—2,000 Dealers Expected To Visit Show During the Week—Many Chassis

BOSTON, MASS., March 6—Once more the Boston dealers' show, which opened here yesterday, has shown that in some respects even the great National exhibitions of New York and Chicago must yield their premier position to the great New England business gathering. Four hundred and thirty-three names are in the list of exhibitors. Of these 107 are showing cars and the remainder accessories, publications, etc. There are 329 cars on the floor. New York had 208 and Chicago 242. Of the 107 car exhibits, sixty-six are displays of gasoline passenger cars, thirty-six are commercials, four electric passenger vehicles and one steam. Altogether there are 234 gasoline passenger cars, seven electrics, eighty-seven trucks and one steam car.

As in the past the electric side of the exhibit does not show up as strongly as at New York and Chicago, the only representatives here being Detroit, Milburn, Rauch & Lang and Waverley, but of the utmost significance is the great commercial vehicle exhibit which fills the major part of the basement space. Here the area which last year was largely devoted to motorcycles, machinery and accessories is now almost completely filled by the varied exhibits of the truck companies.

While at Chicago and New York the truck companies were forced to confine their efforts merely to desk room, here the dealers of great industrial New England have backed their belief in the value of a commercial vehicle exhibit to the extent of purchasing space in which to display their line of business vehicles. The truck exhibitors who hold forth in Mechanics' Hall basement are not confined to one class of trucks but vary all the way from the little delivery car mounted on the Trumbull small car chassis up to the big 10-ton Knox tractor announced last week. The list of those showing commercial vehicles follows:

Andover
Atterbury
Autocar
Buick
Chase
Federal
Ford
Garford
G. V.
Howard
I. H. C.
Jeffery
Kelly
Kissel
Knox
Koehler
Lippard-Stewart
Locomobile
Mais
Netco
Overland
Packard
Pierce Arrow
Republic
Reo
Robinson
Rowe
Service
Stewart
Studebaker
Trumbull
Vim
White

As in the other shows throughout the country the cyclecar has disappeared and in its place the small four has appeared. Last year there were eight cyclecar exhibitors and of these only one name appears this year. This is the Trumbull which has now entered the small car and light delivery car class although still maintaining the narrow tread of which it is the only example at the exhibition.

The feature of the exhibit is the individuality shown in the color schemes. The polished black that has prevailed up to this year has given away to less somber hues. On all sides there are various grays, blues, reds and greens, with which are mingled other colors which, although more quiet, are still a departure from the stereotyped black of 1912, 1913 and 1914. There is a great tendency towards striping the upper edge of the body and also a noticeable inclination to paint the hood in some dark, serviceable color that will be little harmed by the heat of the motor and to paint the main body and running gear a different, and usually brighter, hue.

The use of the stripped chassis is increasing at the Boston show as well as throughout the circuit. In spite of the claim made by the average salesman that the car buyer is more interested in the upholstery than in the mechanism, the mere fact that the exhibitors feel it necessary to go to the expense of finishing a chassis particularly for exhibition purposes is sufficient indication of the class of inquiries that are made at the exhibition. There are thirty-nine stripped chassis on the floor this year as compared with twenty-seven a year ago. Two companies, Reo and Chalmers, are each showing two of these and the interested groups surrounding them and listening to the lectures upon their merits show that these chassis are amply accomplishing their purpose.

In addition to the stripped chassis there are cut-away motors shown by Paige, Marmon and Chevrolet. These also are always found to be surrounded by groups of interested spectators. They arouse interest and pay an implied compliment to those who are interested in following the development in the automobile industry.

Primarily, it is a great retail show. The manufacturer is only indirectly interested, the basis of the whole exhibit being the New England distributor.

The show is not sanctioned by the Motor and Accessory organization, but in spite of this the accessory exhibit is highly creditable and is in advance of what it was a year ago. A year ago the Motor and Accessory organization took a vote as to the advisability of taking space at the Boston show and the opposition won 263 to fifteen. As a result the accessory exhibit last year was rather meager. This year it has become stronger and the accessory exhibitors are very optimistic as regards the actual business accomplished during the show.

Census of the Boston Show

Number of Exhibitors	433
Car Exhibitors	66
Truck Exhibitors	36
Electric Exhibitors	4
Steam Car Exhibitors	1
Number of Cars	329
Gasoline Passenger	234
Trucks	87
Electrics	7
Steam Passenger Cars	1

The big factor of the show is the New England car distributor. This offers him the opportunity of bringing together his subdealers who are scattered throughout the six New England states and of holding dealers' conferences and showing the new models which in many cases have not been seen by the sub-distributors until this time.

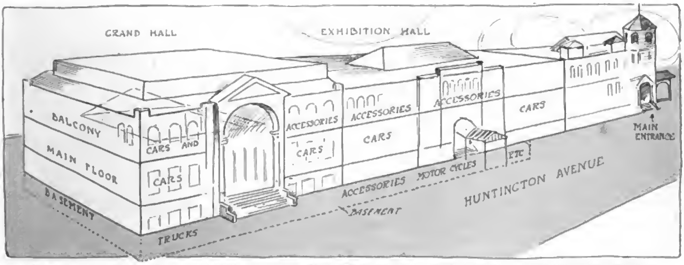
The show is hardly under way and there is as yet no index to the total amount of business that will be done at the show. Over 2,000 dealers are expected to call before the exhibit is over and of these 1,700 are subdealers to those who have their main headquarters in Boston. In addition to these there is sure to be a large number of which no record can be kept because, while the make of car that they represent will not be exhibited at the show, they are anxious to call around to see what the other fellow is doing. There is no way of keeping a record of these because all do not register and the courtesies of season tickets are not offered those who do not represent cars that have taken space.

Show Opens Early

Instead of opening at 8 p. m., the public was admitted at 2 p. m. this year. This was a wise move because, instead of the usual opening rush with the resulting congestion and confusion, the crowd arrived gradually and, while the attendance figures cannot as yet even be estimated, if the opening day is any indication there will be a record number established.

Two foreign cars are at the show. These are the Renault and the Rolls Royce. On these are mounted examples of high-priced body work which attracted general admiration from the show visitors. The Rolls Royce exhibited by the Schuette company has also a stand at the Copley Plaza Hotel.

The individual exhibits are noticeably attractive at this show. Many new bodies are scattered about and while a number of makers are showing the cars that have been shipped from show to show throughout the country others have new jobs that are for the first time on exhibition. There are five eights, Cadillac, Abbott, King, Cole and Detroiter. War has left its imprint on the Packard exhibit which is mounted on the stage of exhibition hall. Here there is an armored car with a turret mounted in Yankee cheese box style on a 2-38 chassis. The chassis itself would be unrecognizable, however, as it is entirely boxed in by an armor plating of 3-16-inch chrome-nickel steel. The radiator is covered by a door that can be closed by the driver who sits



Perspective sketch of Mechanics' Building, in which the Boston Show was held, with positions of the various exhibits indicated

Left—Grand Hall, showing the typical layout of the exhibits. This is looking out from the Grecian Temple towards the stage upon which there is a Grecian view shown through the façade of a Greek Temple. The signs for the various exhibits are in glass on white marble pillars

Below—Looking down the center aisle of Grand Hall beneath the shelter of the Greek Temple. This also discloses a part of the Grecian scene on the stage

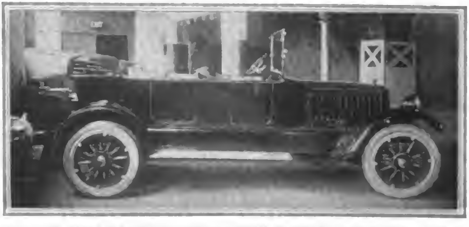
within the housing. In the turret is mounted a quick-firer which is controlled by a man who sits within the turret on a saddle similar to that used on a bicycle. The tires, although similar to pneumatics in appearance and mounted on demountable wire wheels, are solid.

On the same stage is the Cadillac eight-cylinder stripped chassis. As at all other shows on the circuit this year it is a great center of attraction and there is always a crowd to listen to the orator who lectures upon the merits of even torque and few gear changes attendant upon driving an eight.

Stanley is showing the new steam car and to those who are familiar with the round-decked ferry-boat type of Stanley the new job will be a revelation. Unless the hood were lifted the fact that it is a steam car would never be disclosed. The body is a modified streamline foredoor flush-sided job with a cowl dash, the hood is similar to that found on any gasoline car and the rounded nose has been supplanted by a radiator which it has been found possible to employ by the use of a special lubricant containing graphite and kerosene eliminating the deposit of scale on the radiator.

Herff-Brooks has another car which is exhibited at the Boston Show for the first time. This is the new model sell-

(*Concluded on page* 477.)



View of the new Stanley steamer which is changed in appearance due to the adoption of a V radiator and other alterations in design

Bodies Feature of Truck Exhibits

IN the basement are the commercial models of thirty-six manufacturers, three of which are new, the Andover electric, the 1,500-pound Ford and the Howard. All told, eighty-seven commercial vehicles are shown, monopolizing the basement floor except for a few passenger cars which could not find room on the main floor, and a few motorcycle and accessory exhibits.

New things at the show are the three new trucks mentioned, the new Knox, the new worm-driven Packards, the new worm-driven Locomobile, the 3 5-ton Federal and the Netco, all exhibited for the first time, and the Ford delivery car, which after 2 years out of the commercial branch of its business, has returned to the delivery car market.

Bodies are the feature of the truck exhibits as always, although a number of the exhibitors showed chassis, indicating that truck buyers are interested in construction.

The new Andover electric is a radical departure from previous design in that its cab has been set well forward and very low between the front wheels, with the entrance through

New Knox tractor which is exhibited for the first time at the Boston show

a front door. It is worm-driven on the rear axle, and its battery is suspended close under the necked-in frame, and the trays are in swinging arms. The new Howard machine is a standard design of 1,500-pounder with bevel drive.

Atterbury shows its new worm-driven chassis, the new feature of which for 1915 is a cast-case radiator on the larger sizes. The Autocar is shown in a number of chassis with different styles of bodies and one stripped chassis. The most interesting of the bodies is an ambulance intended for Red Cross service. This body is set low on the chassis, the rear wheels being inclosed in wheel housings. It has screened sides and roller curtains, and carries six stretchers. When not in use, the stretchers are arranged to be carried on hooks at the side, crosswise seats accommodating eight passengers sitting inside.

The center of interest at the Jeffery booth is the four-wheel-drive chassis, the standard models being also exhibited. Knox tractors are shown in connection with two novel types of trailers, one of which is unusually long, being a crushed stone wagon, with two hoppers which may be dumped at the bottom separately. The other is a shorter type, arranged to dump at the rear, the elevating gear being carried at the front, and acting by means of worm gears actuating chains and sprockets. It is equipped with steel wheels of the type employed on traction engines.

The feature of the Packard exhibit is the new worm-driven chassis, the 1-tonner being exhibited for the first time. This vehicle is the smallest truck yet put out by this Detroit maker, and while it is identical in layout and general specifications with the larger worm-driven Packards, it is much smaller.

On a 2-ton Reo chassis is shown a simple type of dumping body, actuated by toggle levers, the feature of which is great lifting leverage at the start of the lift, with a quicker movement as the body is raised and more of its weight overbalances the rear pivot. A bus body, with seats that fold up, leaving a clear loading space for baggage or freight is the feature of the Studebaker commercial vehicle line.

At the White exhibit, the largest among the trucks, three novel bodies are shown. The most interesting from the standpoint of current interest is a luxurious bus, mounted on a 1.5-ton chassis. This bus is unlike others of its kind in that it bears no exterior resemblance to a street car, as most bus bodies do, but is constructed more on the order of a limousine. It is of unusual width, with flush sides and drop-sash windows. The interior is upholstered in black leather with cork carpet on the floor. The eaves are somewhat lower than usual, giving the body rakish lines, headroom within being obtained by means of a trunk skylight which merges into the roof at front and back, so as not to be visible from the front or rear.

Entrance and exit has been provided by a door at the front on the right side, the door being of the sliding type and interconnected with a folding step, operated by a lever at the driver's right. The driver's seat is to the left, the bus being arranged for one-man operation.

Another interesting White creation is a special body for the Clearing House Parcel Delivery Co., of Boston. This concern operates a co-operative delivery business and has over 100 vehicles, it is understood. The body is arranged especially for the handling of a large number of packages of

(*Concluded on page* 477)

Accessory department, which includes a large number of up-to-date exhibits

Resta Wins Again—Takes Vanderbilt

Dario Resta in the Peugeot with which he won the Vanderbilt Cup last Saturday. The week before he won the Grand Prize race in the same car

Peugeot Covers 296-Mile Course at 67.5 M.P.H — Wilcox, in Stutz, Again Second— Pullen's Mercer Third

SAN FRANCISCO, CAL., March 6—*Special Telegram*—Handling his Peugeot with all the dash and skill which characterized his Grand Prize victory, Dario Resta today shot across the finish line as winner of the Vanderbilt Cup. Behind him roared the pursuit of the fastest cars and most daring drivers in America, but despite the dangerous and spectacularly treacherous character of the course, the plucky English-Italian led the field with his French car for three-quarters of the race. His average for the 300.3 miles, comprising seventy-seven laps of the 3.8489-mile course, was 67.3 miles per hour, a terrific pace when the condition of the track is considered.

Wilcox Again Second

And the most remarkable thing of the race was that Wilcox, whose Stutz finished second last Saturday in the Grand Prize, was again second in today's contest with an average speed of 65.6 miles per hour. Thus both first and second went to the same men who won these positions in the Grand Prize.

Those who thought that Resta won because of a fluke and the withdrawal of many of the best drivers in the Grand Prize are silent. Nothing but praise is now heard for the unassuming little driver who has captured in his first races on American soil, the most coveted trophies of the automobile racing game.

Pullen Is Third

Pullen, the world's speed record holder, won third place in the Mercer, after having furnished for the spectators the greatest thrills of the day. He and Resta drove side by side down the planks in front of the grandstand time after time. The crowds yelled their approval, both having their supporters, but none of the cheering thousands realized that Pullen, though he was racing, was a full lap behind. His average speed was 65.3 miles per hour.

DePalma, twice winner of the Van-

Tabular Story of the Vanderbilt

Car	Driver	Time	Average	Prize
Peugeot	Resta	4:27:37	67.3	$3,000
Stutz	Wilcox	4:31:36	65.6	2,000
Mercer	Pullen	4:35:37	65.3	1,500
Mercedes	DePalma	4:39:07	64.5	1,000
Maxwell	Carlson	4:44:12	63.3	500
Delage	Newhouse	4:45:38	63.0	
Maxwell	Oldfield	4:52:47	61.5	
Simplex	Disbrow	4:53:37	61.3	
Ono	Young	Flagged lap 77		
King	Klein	Flagged lap 76		
Case	Hearne	Flagged lap 76		
Overland	McKelvy	Flagged lap 75		
Stutz	Anderson	Flagged lap 73		
Edwards Sp	Gandy	Flagged lap 69		
Mercer	Ruckstall	Out lap 72, broken axle		
Deusenberg	O'Donnell	Out lap 54, wrecked		
Stutz	Grant	Out lap 51, water in gas tank		
Tomasini	Tomasini	Out lap 43, burned out bearing		
Case	Burman	Out lap 43, wrecked		
Tahis	Cable	Out lap 43, cracked cylinder		
Gordon Sp	Gordan	Out ... .. engine trouble		
Deusenberg	Alley	Out lap 37, wrecked		
Edwards Sp	Kennedy	Out lap 30, broken wheel		
Californian	Bragg	Out lap 24, broken camshaft		
Parsons Sp	Parsons	Out ... .. engine trouble		
Bugatti	Marquis	Out lap 15, broken spring		
Francis Sp	Francis	Out ... .. engine trouble		
Chevrolet	Durant	Out lap 7, stripped gear		
Chevrolet	Lecain	Out lap 7, broken piston		
Maxwell	Rickenbacher	Out lap 7, engine trouble		
Mercer	Nikrent	Out lap 4, engine trouble		

Howard Wilcox in the Stutz which was second in both Vanderbilt and Grand Prize races at the Panama-Pacific Exposition derbilt Cup, finished fourth, driving a careful, cautious race, never speeding more than was necessary, and taking every turn with a good allowance for safety. The wisdom of this was shown when his competitors began rolling into their pits, either out of the race entirely or out for repairs until all chance at the money was gone.

Billy Carlson, in the Maxwell, drove a similar race, though he did not even appear to be in the winning class until long after the sixtieth lap. Little attention was paid him by the crowds; only the experts in the Maxwell pits saw what he was doing and signalled their approval.

Eddie Pullen, who won third place in the Vanderbilt Cup race, furnishing the greatest thrills of the day

One serious accident marred the day's sport. Bob Burman, a post entry driver who drove the car vacated by Grant when he aligned himself with the Case forces, turned turtle, both Burman and his mechanician being injured. Burman's injuries were slight and after being attended at the emergency hospital on the grounds, he and his wife went back to watch the finish. Joe Cleary, the mechanician, suffered fractures of the thigh and two broken ribs. A spectator was injured when the Edwards Special threw a tire in taking one of the turns at high speed.

Tom Alley lost control of the Duesenberg in the thirty-seventh lap and tore through a fence barricade for a distance of 150 feet. Both Alley and his mechanician saved them selves by crouching in the hood of the car. O'Donnell, driving the other Duesenberg, was also wrecked. His car skidded, jumped a bale of hay and turned over. The two racers picked themselves up, badly bruised, but delighted to find themselves still alive. The car was damaged considerably, but went on its own power back to the pits. Harry Grant, driving Cooper's car, the big Case, was the victim of a peculiar accident. He came to the pit for gasoline, but due to a mistake, the gasoline tank was filled with water. The car lasted half a lap then went out. Minor accidents and trouble of various kinds gradually eliminated the field after the first twenty rounds.

80 M.P.H. on Straightaways

For the first ten laps the speed was excessive. Alley averaged close to 70 miles on hour for five laps, which meant over 80 on the straightaways. But the other drivers were not to be led on by such reckless work and held to a steady gait. Resta especially, refused to be excited by the lead of other cars. He drove a monotonous, steady race varying but a few seconds each lap. He and his car resembled in their humming speed a huge bumblebee intent on reaching home. Nothing could turn them aside, nothing could stop them. The effect on the drivers behind them must have been disheartening. Resta's pace soon told on Alley and the former relinquished his lead in the twentieth lap.

Nerve-Racking Pursuit

Then the race between Resta and Pullen began. It was almost nerve racking, that steady, humming pursuit. Pullen was first across the finish line after Resta and was hailed as second place man, but when the time allowance was estimated, Wilcox, the next finisher, was given second. Just a minute and 1 second separated first and second place. Barney Oldfield, always a favorite, puffed in after a steady race and much engine trouble, in seventh place. Disbrow, fifth in the Grand Prix, came eighth today. In every way the Vanderbilt was what the Grand Prix was not. Fair weather, a large crowd and dry track made the Vanderbilt a race, not a dismal mud fest. In spite of the forebodings expressed last week by drivers and spectators the classic of automobile racing was a success.

Equipment on Cars in Vanderbilt Race in Order of Finish

Car	Driver	Carbureter	Magneto	Plugs	Tires	Oil	Wheels	Motometer
Peugeot	Resta	Master	Bosch	K. L. G.	Nassau	Oilzum	Rudge	Boyce
Stutz	Wilcox	Schebler	Bosch	Bosch	Silvertown	Monogram	Houk	Boyce
Mercer	Pullen	Rayfield	Bosch	Bosch	Silvertown	Oilzum	Rudge	Boyce
Mercedes	DePalma	Rayfield	Bosch	Bosch	Nassau	Monogram	Rudge	Boyce
Maxwell	Carlson	Harroun	Bosch	Rajah	Silvertown	Oilzum	Houk	Boyce

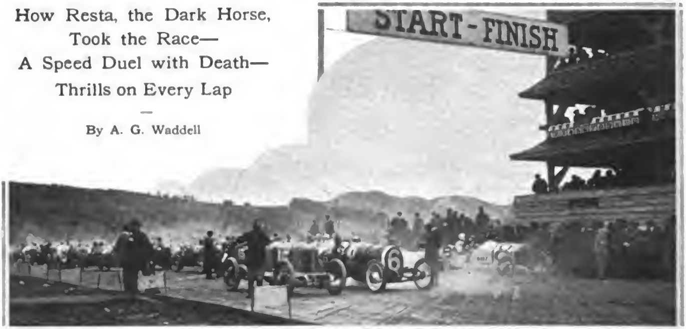
An interesting feature of the race is the fact that Resta used the same Nassau tires with which the machine was equipped in the Grand Prize race the week before.

Barney Oldfield's Maxwell passing the column of progress during the Grand Prize Race at San Francisco, February 27. Barney Oldfield finished seventh in the Vanderbilt

The Winning of the Grand Prize

How Resta, the Dark Horse, Took the Race—A Speed Duel with Death—Thrills on Every Lap

By A. G. Waddell



The high-powered racers lined up just before the start of the Grand Prize race at the Panama-Pacific Exposition, February 27

SAN FRANCISCO, CAL., March 2—The clicking of the telegraph instruments in the press stand stopped for a moment, and in the pause an operator leaned back in his chair and said, "Gee, he was a fifty to one shot before the race! Resta certainly fooled me."

The words of this operator sum up the condition of mind of half of those who saw a comparatively unknown, and at least unheralded driver, carry away one of the most coveted cups of the automobile racing world. But not a soul who saw the nervy, skillful driving of the English-Italian had aught but praise for him. His skill was acknowledged; it was too evident to be otherwise. But the real admiration of the crowd was of a different sort. It was similar to the admiration of a small boy for the man who leaps the gap on a bicycle. It was a mixture of wonder and amazement at the audacity of the driver whose fearlessness carried him at breakneck speed over a course where death continually lurked.

How Resta Felt

Resta very naively says, "In such rotten weather the course was hard to drive." He might have said much more. He might have told of the terrible beating of the rain in his eyes and face, for water coming with a 57-mile head has a sting to it. He might have said something of the sensation of driving through a lake at close to a mile a minute pace and of the regular drenchings which came with each lap. There are many things each driver who stayed fifty laps could tell, but Resta merely says "the course was hard to drive." No wonder Resta is the hero of San Francisco.

True, he had good luck. He came to the pit but twice, once for gasoline and oil, again to change to non-skid tires. He made no mechanical adjustments and the car was running as sweetly at the finish as at the start.

But in this sort of race it is not the machines which interest so much, for they hardly had a chance to warm themselves by speed, but it is the human being who can endure hour after hour and give every vestige of his strength to the gamble between winning speed and lurking death. That is what lends the human touch and that is what makes the remembrance of the race rest not alone with one car or another but with the men who stayed in. It was not so much a race of cars and speed as it was a race of men. The man who was willing to take the most chances and who had the stamina and strength to withstand the cold and beating rain looms far greater in the popular mind than the actual performance of the machines.

The Course

Rain had fallen until 3 days before the race and by the time the course had been put into condition the drivers had

TABLE SHOWING TIMES MADE BY DRIVERS

Car	Driver	5	10	15	20	25	30	35	40	45
9—Peugeot	Resta	18:13	35:44	53:07	1:11:35	1:32:37	1:57:29	2:22:24	2:43:24	3:03:30
26—Stutz	Wilcox	18:46	37:04	55:07	1:13:55	1:35:56	2:03:12	2:24:41	2:45:36	3:05:43
28—Ono	Hughes	18:57	40:03	1:01:54	1:21:10	1:43:45	2:05:38	2:26:14	2:46:31	3:07:30
5—Stutz	Anderson	18:39	36:47	54:56	1:14:36	1:39:53	2:07:34	2:30:47	2:52:45	3:13:21
12—Simplex	Disbrow	20:30	39:48	58:57	1:18:24	1:43:39	2:07:08	2:29:37	2:50:25	3:10:12
10—Mercer	Nikrent	19:06	37:42	56:41	1:17:08	1:42:07	2:07:39	2:33:33	2:56:40	3:16:16
30—Case	Grant	18:30	38:29	58:37	1:18:26	1:46:15	2:10:43	2:33:10	2:54:03	3:17:21
31—Overland	McKelvy	20:16	40:04	1:00:26	1:21:36	1:50:39	2:17:08	2:45:52	3:07:47	3:28:36
32—Maxwell	Carlson	18:36	36:18	53:54	1:12:53	1:35:37	1:59:57	2:22:09	2:43:40	3:04:11
15—Delage	Newhouse	20:01	38:50	58:53	1:28:02	1:54:50	2:20:38	2:44:32	3:07:47	[illegible]
3—Tahis	Gable	20:09	42:48	1:06:08	1:29:49	1:58:54	2:25:43	2:50:34	3:12:49	3:33:35
20—Chevrolet	Durant	19:46	39:03	58:26	1:19:15	1:47:21	2:15:16	2:41:39	3:04:49	[illegible]
2—Duesenberg	Alley	18:22	36:06	53:30	1:12:57	1:36:06	2:02:00	2:26:11	2:49:09	3:09:07
11—Edwards Spl.	Kennedy	22:16	43:02	1:05:36	1:31:53	2:05:53	2:37:29	3:00:26	3:21:23	3:42:05
29—Alco	Taylor	21:21	42:10	1:03:51	1:27:16	1:59:56	2:28:35	2:55:18	3:19:18	3:41:22
18—Chevrolet	Lecain	20:30	43:17	1:03:57	1:26:15	1:57:29	2:26:00	2:51:52	3:13:38	3:34:11
4—Mercer	Pullen	20:47	39:46	58:06	1:17:18	1:42:09	2:06:06	2:29:40	2:53:16	3:12:56
6—Mercer	Ruckstell	17:57	35:53	53:40	1:13:10	1:36:54	2:02:06	2:26:26	2:52:08	[illegible]
22—Mercedes	DePalma	18:47	36:53	54:58	1:14:20	1:40:01	2:06:06	2:30:30	2:53:34	3:14:00
21—Case	Hearne	18:56	40:40	55:33	1:15:58	1:44:33	2:13:10	2:39:20	3:02:36	[illegible]
35—Gordon Spl.	Gordon	20:22	43:57	1:04:24	1:26:34	1:55:02	2:21:49	2:47:26	3:11:38	3:32:53
19—Duesenberg	O'Donnell	19:05	37:57	56:46	1:16:18	1:45:43	2:11:57	2:35:21	2:56:50	3:16:56
16—Kline	Klein	20:26	39:29	59:25	1:19:40	1:49:08	2:15:04	2:39:34	3:00:28	3:20:55
24—Parsons Spl.	Parsons	19:12	41:47	1:12:07	1:39:01	2:09:26	2:36:31	3:02:07	3:24:36	[illegible]
17—Maxwell	Rickenbacher	19:52	36:59	55:53	1:20:17	1:54:10	2:17:37	2:40:48	3:21:16	Out
14—California	Brace	19:01	37:49	56:55	1:17:34	1:46:00	2:16:26	Withdrawn		
1—Maxwell	Oldfield	18:59	37:53	56:25	1:15:30	1:37:20	2:38:43	Out with broken po-		
7—Edwards Spl.	Gandy	19:28	41:51	1:01:29	1:21:33	Wrecked				
27—Bugatti	Marquis	20:13	Out with ignition trouble							
8—Stutz	Cooper	Out with broken crankcase								

just 2 good days in which to practice. The planks which had been hurriedly put down to cover the portion of the track not paved were warped and twisted from the rain and sun. A crew set to work to tear up the most dangerous parts and to place new underpinning in the mire below. When this work was done the planks were hewn and cut until they approximated smoothness, but even this failed to remove the roughness.

Disbrow, in a Simplex, winner of fifth place in the Grand Prize race, held February 27, followed by Barney Oldfield, taking the right angle turn from the straightaway on the Avenue of Palms to the Avenue of Progress

Though the unevenness of the boarded section was bad enough at the start, it was made far worse when the rain began. The partly dried earth underneath took the water readily and pounding cars churned the mud into a thin, greasy liquid. When a car would reach the boarded track each individual plank seemed to take a delight in spitting muddy phlegm at the occupants. The continual poundings soon loosened the planks and in several places they settled slowly into the mud, making dips and dives over which the cars hurdled like runaway roller-coasters. Someone on the grandstand, who was cheerful, though wet, said that it was the first time that he ever saw a 100-horsepower automobile do the tango. And the way the machines slid and hopped down that bumpy track was not unlike some of the gyrations of the modern dance.

Greasy Pavements

Oil and water combined to make the paved stretches desperately dangerous. Jim Parsons found himself and his car whirling wildly around and coming to a stop headed straight for the bay. O'Donnell, in his Duesenberg, seemed to bear a charmed life. He took the greasy right angle turns with a nonchalance that brought him within an inch of destruction. A good dozen times he grazed the straw embankments; twice he whirled completely around. A couple of others shed tires. Cable drove a tire from his Tahis for a full block. An innocent guard attempted to capture the runaway and was promptly bowled over, while the tire continued merrily on its way.

ERY FIVE LAPS IN THE GRAND PRIZE RACE

0	55	60	65	70	75	80	85	90	95	100	104
22 44	3:42:51	4:00:47	4:19:25	4:42:10	5:04:21	5:25:54	5:46:46	6:07:41	6:28:52	6:50:20	7:07:53
25:11	3:44:25	4:03:27	4:28:32	4:50:00	5:10:54	5:31:22	5:54:03	6:14:16	6:35:22	6:56:43	7:14:36
50	3:48:02	4:06:56	4:27:37	4:49:23	5:11:01	5:32:11	5:53:08	6:13:57	6:45:07	7:05:12	7:21:16
15 56	3:54:15	4:12:40	4:34:27	5:01:21	5:24:28	5:46:10	6:07:32	6:28:18	6:19:47	7:12:46	7:30:21
34 19	3:53:04	4:12:14	4:38:54	5:02:26	5:24:45	5:46:24	6:08:11	6:29:36	6:51:16	7:13:43	7:31:38
35 21	3:57:16	4:17:17	4:41:15	5:03:51	5:32:03	5:53:54	6:18:37	6:41:37	7:06:50	7:30:51	Flagged
32 23	3:50:43	4:12:24	4:38:31	5:02:47	5:25:30	5:47:33	6:12:45	6:34:56	6:59:35	7:30:15	Flagged
14 46	4:09:39	4:34:02	4:58:17	5:21:26	5:43:52	6:01:31	6:19:33	6:42:11	7:06:08	Flagged	
21:41	3:42:44	4:01:30	4:22:00	4:53:58	5:24:06	6:08:22	6:31:17	6:56:13	7:23:14	Withdrawn	
51:25	4:13:04	4:40:00	5:00:43	5:32:38	5:58:11	6:24:33	6:51:54	7:20:07	Flagged		
56:14	4:17:33	4:46:18	5:14:04	5:40:39	6:05:47	6:31:09	6:58:48	7:25:47	Flagged		
45:19	4:08:53	4:38:59	5:06:45	5:34:32	6:01:35	6:29:05	6:57:58	7:28:34	Flagged		
27 52	3:50:26	4:08:42	4:51:55	5:16:40	5:44:03	6:10:31	6:36:50	Withdrawn			
39	4:36:40	5:06:17	5:32:02	5:57:30	6:23:10	6:46:15	7:18:36	Flagged			
52	4:32:16	5:08:47	5:46:36	6:14:25	6:42:32	7:10:55	Flagged				
54 13	4:13:59	4:38:52	5:12:13	5:41:12	6:13:16	6:48:07	Withdrawn				
11 53	3:50:18	4:08:56	4:36:35	4:59:13	Withdrawn						
11 08	3:51:19	4:09:16	4:42:01	Withdrawn							
11 00	3:51:41	4:12:37	Withdrawn								
23 54	4:03:52	4:33:19	Withdrawn								
00	4:14:40	4:47:31	Withdrawn								
35 35	3:50:15	Withdrawn									
19 40	Out with broken piston										
00	Withdrawn										
h fouled spark plugs											

In front of the Philippine building on one of the turns of the course spectators were kept in a continual fever of excitement. Disbrow lost control of his Simplex here on one occasion and landed with the front wheels driven into a straw pile. A quick examination of the car showed that no damage was done and the plucky little driver was off again. Nikrent had a narrow escape from a serious accident at this same spot. He literally dived into the pond which had filled the track and before he emerged his car began to skid. Before the Mercer stopped it had ripped out a section of the fence along the track. Nikrent lost no time, however, and before the guards could reach him he had pulled the splintered pieces loose and was on his way.

But one real accident marred the day. Lou Gandy flew from the track on the approach to the Grandstand straightaway and dashed into the bank. Happily, the bank was wet and soft and the damage was confined to a broken steering gear and a bent axle. A black cocker spaniel dog was the most dangerous thing on the course for 15 minutes in the afternoon. The dog was bewildered by the roaring machines and dashed wildly up and down the track. Fearing their own safety more than that of the dog the drivers swerved from side to side to avoid the animal. Barney Oldfield came within an ace of giving the pup his final joyride, but luck was with the dog and he escaped to edge of the track where he was leashed.

Henry Leaves Peugeot to Design Aviation Motors

PARIS, FRANCE, Feb. 18—M. Henry, designer and chief engineer of the racing department of the Peugeot company, has severed his connection with that concern in order to join the Bariquand company, of Paris, for whom he will produce aviation motors to be used on French aeroplanes and hydroaeroplanes. These new motors will be eight-cylinder V-type of the same general design as the Peugeot racing type. Two models are to be built, of respectively 3.9 by 7.08 ins. bore and stroke and 3.6 by 6.4 ins. bore and stroke. These dimensions correspond to the 1913 Grand Prix Peugeot which won at Amiens, and the 1914 Grand Prix cars used at Lyons. The larger motor will develop about 250 horsepower, while the smaller will show 200 horsepower. This is a higher power than usually employed on French aeroplanes, where the tendency has been to use light-weight rotary Gnomes. It is understood, however, that the motors produced by the ex-Peugeot engineer will be fitted only to the new bigger types of armored aeroplanes.

The departure of Henry makes a serious break in the Peugeot racing camp. The extraordinary success of this racing team has been due to the happy combination of the late Paul Zuccarelli, a man of original ideas; Henry, an engineer of great merit, and the skill and daring of the race drivers. Only the race drivers are now left, and they are scattered by reason of the war.

Americans Speed Up French Factories

Experts Increase Results from Machine Tools 50 to 100 Per Cent.—Car Plants Still Making War Supplies—Makers Fear Difficulties in Resuming Car Building After War—Expect Large Demand

By W. F. Bradley
Special Representative of THE AUTOMOBILE *with the Allied Armies in France*

PARIS, Feb. 18.—Trade conditions remain brisk in the French automobile industry by reason of the contracts placed by the army authorities. There is very little similarity, however, between the factories as they exist at the present moment and their condition a year ago. Entire staffs have been changed. When the war broke out about 85 per cent. of the men in the French automobile industry were immediately called into the army. The 15 per cent. remaining represented men beyond the military age or who were excused military service by reason of some physical disability. After about 6 weeks' fighting a complete plan was developed by which the automobile factories should supply war material to the army, this material to comprise guns and ammunition as well as various types of automobiles. In order that this work could be carried out the heads of departments and a certain number of workmen had to be released from active service in the army and returned to their original employment. The men released were not sufficient for the work in hand and labor has been sought in every available quarter. Many of the factories around Paris are employing Belgian soldiers in uniform. These men are sent from the front in order to recuperate. They are employed in the automobile factories for a few weeks, where regular hours, good food and comfortable lodging, together with the satisfaction of drawing a better wage than the soldier's pay, put them again in condition for taking up their place in the fighting line. These men may continue this work after the war.

Banker as Stoker

Skilled Belgian artisans also find ready employment in the French automobile factories. Many of the factory laborers are also Belgians. Some of these men possess an excellent education and held important positions in their own country before the war. They are glad to handle a shovel pending the termination of hostilities. In the Renault factory a former Belgian bank manager was pointed out to me in the role of a stoker; and in the Darracq works a rich Belgian who had lost everything but his six-cylinder automobile was handling shells as they came out of the hardening furnace. The automobile, although nominally his property, was not available for his use or sale, for it was held up at Dunkirk by the army authorities, who refuse to allow any civilians' cars to leave that town on any pretext whatever.

Open air automobile repair workshop behind the French lines

Busy on War Material

All through the winter the French authorities have been making full use of the automobile factories for the production of shells, machine guns, trench mortars, aeroplane darts and bombs. So thoroughly has this work been organized that the Allied forces have as many guns as they can possibly employ and a greater quantity of ammunition than is likely to be exhausted under the most prolonged and severe fighting. The most important item in the automobile factories order is the production of 75 mm. shells and shrapnel. Although the mines and steel and iron works in the north are occupied by the enemy, there has been no holdback in the product. Steel bar has been supplied very largely from England, the supply always being sufficient to keep the factories running at full pressure, and the stock in reserve at present time being sufficient for several weeks ahead. The shells are machined, hardened, tested for hardness and also under hydraulic pressure, and sent away daily to the government powder factories to be charged. The exact nature of the steel employed is a secret not revealed to the factory engineers.

Buy American Machine Tools

The activity of French automobile factories on army contracts has had its influence on American machine tool firms. The head of one of the best equipped automobile factories in France told me that he had spent more money with American machine tool makers during the last 4 months than at any corresponding period of his firm's history. The activity in the American machine tool business is clearly visible at the docks of the leading French ports. America has this business practically in her own hands, for England is barely able to meet her own requirements, the French supply is low and Germany is obviously out of the market.

Above—Entrance to French trenches in the Argonne forests. Albert Guyot's Panhard limousine in the background
Below—Staff officers on a round of inspection of the French trenches in the Argonne district

When getting in new American machinery several of the French factories have at the same time engaged the services of American experts in high-speed production. The works manager of one automobile factory told me that his American expert was getting from 50 to 100 per cent. more out of his machinery than it had ever been possible for them to produce under the best conditions. Formerly it was impossible to get the workmen to run the machines to their full capacity. Objections were made which the factory managers were unable to meet, or if the machines were speeded up the men would change the speeds back again. The expert knows what the machines can do, shows the machine tender how to do it, and insists on it being done all the time. This speeding up has been rendered easier by reason of the uniform nature of the work for the army.

Special Hardening Plants

Special hardening plants have been laid down in the leading automobile factories. The furnaces are specially designed to deal with shells. The furnace, which is heated with crude oil, has an inclined floor, down which the train of shells rolls gradually, the furnace being constantly fed at the upper end, and the 15 minutes necessary to travel from the upper to the lower end being sufficient to heat the shells to the required temperature. In this way the furnaces are constantly fed, day after day and night after night, while the treated shells are being withdrawn at the rate of about one every 2 seconds. The hardening plants used for varied automobile work were not usually suitable for the treatment of shells, thus these special plants have been laid down in record-breaking time.

Truck Plants Rushed

Those automobile factories specializing in trucks, or having facilities for armored cars, motorbuses, automobile searchlights, meat wagons, tractors, and the special types of machines required in army service, have received as many orders as they can execute. Touring car firms have been given big repair contracts for both the British and the French armies. Darracq, for instance, has taken over a big contract for the repair of touring cars and trucks belonging to the British Army. Not being fitted up to handle trucks as a complete unit, motors, gearboxes, axles, etc., are sent separately from the army repair depot, the necessary repairs and tests are carried out in the factory, and the units sent back to the army shops for assembly.

Cars in Good Condition

Touring cars and ambulances are sent complete. Whatever the nature of the car, whether it has a bent steering knuckle or has been lying in the bottom of a ditch for 2 months, the British army authorities insist on cylinders being lifted, pistons scraped, crankcases and gearboxes flushed, all external oil and dirt removed, and all working parts lubricated. This guarantees every car going out of the repair shop in good running condition, and it makes possible the detection of defects which the driver may have overlooked or omitted to report.

Hard to Resume Car Building

While the heads of factories are satisfied with present conditions, they are looking ahead with a little apprehension. The present effort has been made in order to give the Allies a decided advantage in guns, ammunition, and all kinds of motor transport for the huge united effort which will be made to drive the German armies out of France and Belgium into their own country. The material position of the Allies has been so strengthened during the past few months that it is inconceivable that their forward movement should fail. When this movement has been carried out the special work of the automobile factories will have been brought to a close and manufacturers will be faced with the delicate problem of switching over from the making of shells and guns to the production of cars. It was easier to change from cars to shells than it will be to change back from shells to cars. When the first change was made definite orders with the government's backing were in hand. When car production has to be resumed conditions will be interwoven with the general trade conditions of the entire world. There will also be the special problem of getting forgings, castings, special steels and various components from the iron and steel district of northern France so long held by the enemy. Nobody can say exactly what trade and manufacturing conditions will be when the war orders are withdrawn. Hence a certain amount of anxiety on the part of the heads of factories.

Big Demand Expected

Some of the most capable men in the industry are so convinced that there will be a big demand for cars immediately after the war that they are doing everything possible to increase their stocks. The retail price of several makes of cars has been increased from 5 to 10 per cent. and in other cases the usual trade discount has been abolished. Foreseeing a shortage in Europe of raw and partly finished material, some French automobile directors have made or are making arrangements for American supplies, delivery to be made immediately after the war.

Three Broad Classes of Brakes

Diagonal Braking System Is Most Effective But Requires Complicated Mechanism—Transmission Type Powerful with Small Area—Experiments with Hydraulic Brakes—How Wear Is Compensated

By A. Ludlow Clayden

MORE attention has been given to the propelling than to the arresting parts of automobile anatomy. Motors and transmissions have improved out of all recognition while the almost more important brakes have been left severely alone; accelerative powers have increased enormously, but the retarding forces at a driver's disposal are usually no better than they were years ago.

What are the qualities desired in a brake?

1. It should stop the automobile in the minimum distance.
2. It should be durable so as to retain its power.
3. It should be easy to apply so that a woman can have the same power of safety as a man, for she has already the same power for speed.
4. The action should be free from jerks at all times.
5. Rapid stopping should not affect steering.
6. Adjustment for wear should be very easy.
7. There must be ample protection from mud or oil.
8. Minimum attention must be required for maintenance of efficiency.

There are three brake systems:

All brakes on rear wheels.

Pair on rear wheels and one on transmission.

Pair on rear wheels with second pair on front wheels.

The advantage of the first is that no braking stresses are thrown upon the axle gearing, though this is of small importance in these days, whatever it may once have been. The advantage of the second is that small, light drums only are needed on the wheels, and the gearbox brake is easy to protect or to adjust while having greater power in proportion as it is geared up by the bevels. The third has the advantage that great power can be combined with minimum effect upon the course of the car over greasy surfaces.

To take the whole theory of front wheel braking would require a great deal of space and serve no very useful purpose but it is roughly as follows. Putting on a front wheel brake tends to lock the front wheel and, if we suppose that the wheel does not slip along the ground, it is easy to see that there will be an effort made to lift the back of the car off the ground. This means that the effect of front brake application is to increase the pressure between the front wheels and the road by throwing the weight forward. Now the amount of force that can be applied to a brake before wheel lock begins depends upon the pressure of the wheel on the ground, and the front brake is powerful because it has the inertia of the car to help it. There is no such action with a back brake, so a front brake has more stopping power than any kind of rear wheel arrester.

It may be accepted as a fact that the arrangement wherein the brakes are linked diagonally is the best. In this system the left side front brake and right side rear one are interconnected and actuated by, say the pedal; while the other two brakes are operated simultaneously by the hand lever. The reason for this is that one then has always two wheels, one in front and one behind, free to roll, and it is only a rolling wheel that is of use to steer with. This diagonal system is expensive to make and not easy to design so that all the mechanical difficulties attendant upon front wheel brake operation are overcome. It is trouble in getting the connections rigid and reliable that has caused several makers to abandon the front wheel system after using it a short while. Also there is danger in having a pair of front wheel brakes that operate simultaneously because, if the wheels should be locked by too vigorous an application, then all steering power is lost and the car slides straight forward.

If front wheel braking is ever to become popular it is the diagonal system that attracts, but the manufacturing drawbacks are seriously in the way, though the immense success of the front wheel brakes used on the cars in the French

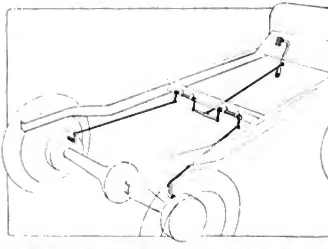


Fig. 2—Ordinary method of compensating brakes by balance beam. Pull is applied at center of beam and is divided between the two brake rods in proportion to the resistance offered, so that if one brake comes on first the other is pulled into action instantly

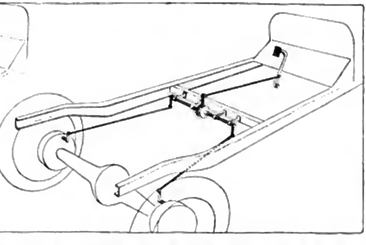


Fig. 3—A small differential gear can be substituted for the balance beam and gives smoother action, but it is, of course, more expensive, and, as a result, is found only on comparatively few high-priced cars. The illustration shows this arrangement

Grand Prix last year would certainly have had an effect in Europe had the 1915 designs come out in the ordinary way.

Figure 1 shows the mechanism of the Argyll front wheel brake and it is easy to see that there are a good many parts, and the manufacturing difficulty can be appreciated.

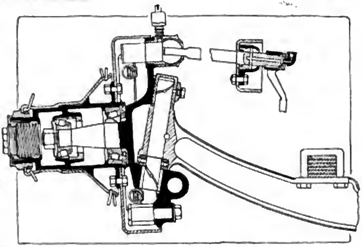


Fig. 1—Argyll front wheel brake operated through short universal shaft from bracket on frame sill. Universal at brake is located on same center line as steering swivel so expanding cam is unaffected by steering

Compensation

When a single brake is used on the propeller shaft the differential takes care of the distribution of force to the two wheels equally, but this kind of compensation has a disadvantage, in that if the adhesion of the two wheels is greatly different, that with the lightest grip on the road may actually be caused to revolve backwards. This is shown by jacking up the rear axle and then turning one wheel while the brake is holding the drive shaft from turning. Still it is only on very rare occasions that this reverse motion happens and it is not therefore a cause of much added tire wear.

When there are a pair of brakes one in each rear wheel they may be compensated by applying the pull of the pedal or lever to the middle of a short beam, the brake operating rods being attached to the ends of the beam, as shown in Fig. 2. If this is not done the task of adjusting the brakes is rendered a good deal more delicate than it needs to be. On a few high priced cars the beam arrangement is replaced by a diminutive differential gear because the action is smoother and a much larger range of equalization is given; this device is shown in Fig. 3.

It is hardly necessary to remark that brake-operating rods are made straight on all well designed cars, because a bend in a rod means that it will be springy and spring means loss of power.

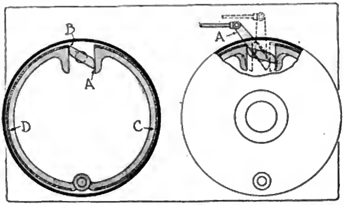


Fig. 4—Left—At beginning of motion, shoe C of brake tends to make contact with drum before shoe D, because the inner end A of spreading cam is nearer to brake center than the other end B. As cam approaches horizontal this effect vanishes

Fig. 9—Right—As the shoes wear away the lever operating the spreading cam sets further forward when the brake is applied, so that leverage is lost and more power is required in order to get the same stopping effect. The lever ought to be upright when the brake is on

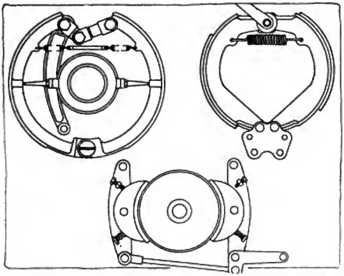


Fig. 5—Left—A device to overcome the trouble illustrated in Fig. 4. Instead of a spreading cam the toggle link is used and this balances one shoe against the other on the same principle as the balance beam compensates pull on rods. Fig. 6—Right—Method used on French car to compensate for unequal cam action by offsetting the lining pads on the brake shoes

Fig. 7—Below—Diagram showing the elements of the "locomotive" type brake in which the shoes approach the drum squarely and make contact over their whole faces simultaneously. This is, of course, only applicable to transmission location

Brake-Shoe Patterns

In order that the surfaces of the brake shoes may wear evenly the mechanism ought to be such that the shoe presses with equal intensity upon the drum and does not bear harder at one end than the other. This cannot be done completely with the ordinary expanding brake, since the spreading cam opens the shoes on a hinge and, obviously, the ends of the shoes next to the hinge will be the first parts to make contact with the drum. Another trouble with the expanding brake, shown in Fig. 4, is that the action of the cam brings one shoe into action faster than the other since the top of the cam, in pressing the shoe, moves along a larger circle than does the bottom part. This action lessens as the cam approaches the middle position, but the tendency is to throw all the work of gentle braking on the one shoe. In Fig. 5 there is shown a way of overcoming unequal cam action by connecting the free ends of the brake shoes through a toggle arm. This distributes the pressure equally between the two shoes at all times and completely does away with any inequality in pressure. Of course, it is slightly more costly than the usual construction and it may perhaps be questioned whether the extra parts are really worth while. A clever attempt to overcome this is used on a small De Dion car wherein the brake lining is applied closer to the hinge pin on one side than on the other; this tending to balance the hastening action of the hinge against the retarding action of the cam as is made clear by Fig. 6. These little points are of most importance when the brake surfaces are all metal and do not matter very much if a woven fabric is employed, since the comparative softness and compressibility of the material evens up the action. With an external transmission brake it is possible to use balanced shoes like those of a railroad brake and this has been found the best type for London taxicabs, because it permits extremely quick and facile renewal

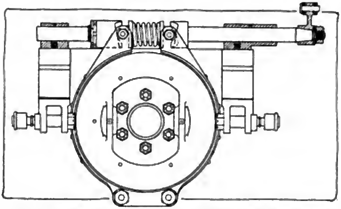


Fig. 8—Transmission brake with two fulcrum pins, contracted by the face cams seen on the top shaft. This is simpler than the type shown in Fig. 7 and practically just as good. It makes a most satisfactory and smooth acting brake

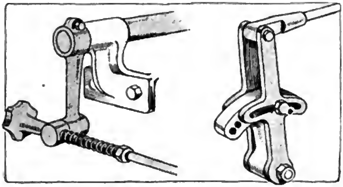


Fig. 10—Left—Hand nut for enabling the length of the brake rod to be altered without the use of tools. Fig. 11—Right—Setting for lever on the shaft of the spreading cam to allow the lever to be returned to the upright position of greatest effectiveness, when the shoes are let down by wear

of the shoes. Figure 7 is a diagram of such a brake and Fig. 8 shows a way of obtaining almost as equal an engagement by using two fulcrum pins instead of swinging both shoes from the same pin.

Most manufacturers find that the outside type of transmission brake is too costly and it cannot be inclosed, which is always a disadvantage. They therefore prefer to use a pair of expanding shoes of the same pattern as those in the rear wheel drums, and if these are of good width the action is practically as smooth. When such a design is employed, however, care should be taken to arrange the drum so that it can be detached without taking down the universal, for otherwise access to the shoes for renewing their linings will be difficult and costly in the repair shop.

The most satisfactory transmission brakes are not very large in diameter, but are very wide.

Good Points of Transmission Brake

The chief advantage of the transmission brake is that it is powerful by comparison with the pedal pressure needed to apply it and is therefore in accordance with requirement No. 3. It is also easy to supply a very handy and quick adjusting handle, so filling requirement No. 6. It is also possible to give complete protection in accordance with No. 7. By making it comparatively small in diameter and of considerable width, it fulfils all the other requirements except No. 5, for in this respect it is a little inferior to brakes on the wheels themselves.

Rear Wheel Brakes

The rear wheel brakes need to be as large as possible, the limiting factors being weight and the amount of space available. Roughly speaking power is determined by diameter and durability by width, but the diameter must be small enough to keep the drum off the road when the tire is running in a rut. Still it should not be forgotten that every inch added to the diameter means less effort is needed to provide a given retardation. Another point in design that is too often neglected is that the spreading cams should be large enough to allow the bulk of the lining to be used up. In very many brakes the adjustment is at the end of its travel long before the linings are worn out, and this means that the owner of the automobile is put to unnecessary expense for relining.

Adjustment of brakes should be possible at two points in the linkage, the first being at the extremities of the pull rods where they connect to the cam levers, and the second at the point where the levers are pinned to the shafts of the cams This is because the lever ought to be upright and in the position of greatest mechanical advantage when the brake is hard on, and if wear allows the lever to come more forward, leverage, and so power, is lost; this is explained by Fig. 9. Methods of providing easy hand adjustment without the need for tools are shown in Figs. 10 and 11.

A detail of brakework that sometimes gives trouble is the pull-off spring between the shoes, since this is liable to lose power through rusting. On one European car the usual helical spring is replaced with a flat leaf of spring steel that is more durable and rather more easy to put in place.

Another point that gives opportunity to the clever designer is the bearing of the short shaft that carries the spreading cam, because this has a tendency to clog with mud and water. Where money permits it is a very real advantage to bush this bearing with bronze as is done with the shackle pins on the springs of the more expensive automobiles, because a little rusting will not cause as much binding as it does where both the surfaces of the bearing are steel. It is necessary to allow for the fact that any greasers fitted to parts of brakework are difficult of access and therefore generally neglected by the user of the vehicle.

An Hydraulic Brake System

In the last illustration, Fig. 13, is shown an interesting form of brake that has been used experimentally only, but seems to possess possibilities worth investigation on a larger scale. Instead of using metallic connecting links between the hand lever or pedal and the brake shoes, there are pipes containing oil that can be put under pressure by a piston working in a cylinder and located centrally upon the chassis. In the experimental apparatus there were four similar brakes, one on each wheel, and there were two pressure pistons working in separate cylinders as is shown in the illustration. These oil cylinders were connected to the brakes by copper pipes with flexible ends and could be linked up so that one piston controlled either pair of brakes. Usually one cylinder supplied the front pair and the other the rear, but it was equally easy to link up diagonally and so obtain the advantage of this form of connection, which has already been ex-

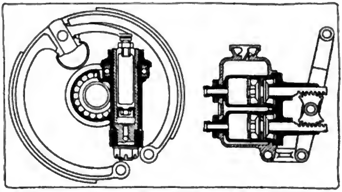


Fig. 13—Interesting arrangement for operating brakes hydraulically so that all four can be applied at once on front and rear wheels

plained. To overcome any leakage of oil the pressure cylinders were contained in an outer casing which could be filled through a plug in the top, and there was a ring of holes in each cylinder uncovered by the pistons when in the normal position. Should any oil have been squeezed out in applying the brakes more would flow through the holes to take its place, as soon as the pressure was released and the pistons allowed to return to the normal place. Of course the idea of using two pistons was to make one set of brakes independent of the other set, so that the accidental fracture of a pipe should not put all brakes out of action together.

The Band Brake

The still exceedingly common type of rear wheel brake consisting of an external band is not easy to praise on any score. It fails to comply with any of the fundamental requirements and has the additional disadvantage that it nearly always drags slightly upon the drum when supposed to be off. Also, since brakes operate as such by changing work into heat, it is scarcely a defensible practice to put two brakes on the same part of the same drum. Woven lining is not a good conductor of heat, so all that is generated has to escape by the drum, and this cannot dissipate its heat so readily if it is encircled by a non-conducting band as if it is free to the air; the effect is that double braking on the same part of the drum greatly decreases the life of the latter and also tends to roughen it, which gives jerky action.

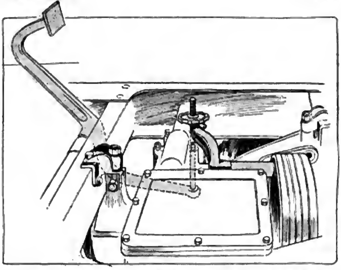


Fig. 12—Example of easy hand adjustment for transmission brake

Signs were not wanting at the Shows that the band brake is losing the hold it has had so long, and just as soon as the users of the new cars with two sets of expanding brakes find out how much less trouble they are, and how much more satisfactory, they will never again accept an automobile with the inferior stopping mechanism.

Recent Court Decisions—Bicyclist Sues

By George F. Kaiser

WHEN a bicyclist and a motorist collide, it is a question for the jury to decide who is actually at fault, was held by a Missouri court in a recent case.

A bicyclist sued for damages for personal injuries, which he contended were caused by the negligence of the motorist. The bicycle was going east and the automobile was going west. The motorist contended that the bicycle swerved into the car, while the latter claimed that the former suddenly turned south and hit the wheel.

The court decided that the matter was for the jury to say who was at fault.—*Harris vs. Pew*, 170 *S. W.* (*Missouri*), 344.

Collision with Freight

A railroad company is only required to provide flagmen, gates, signal lights, etc., at crossings where they may be reasonably necessary.

A motorist sued a railroad company for damages resulting from a collision between his car and a freight train which was standing motionless on a spur track across a public highway. The company had provided no flagman. The motor car was proceeding at a speed of 20-25 miles per hour; its head lights reaching 100 feet ahead. The night was dark and hazy and the motorist's vision was affected by an arc light which he had just passed and he did not see the cars until a few feet away.

Despite the fact that there was no flagman, signal lights or electric signals, the court held that the railroad company was not negligent under the circumstances, and the motorist could not recover the amount of damages he suffered in the collision.—*Frank vs. Boston & Maine R.R.*, 106 *N. E.* (*Massachusetts*), 1022.

Motor Vs. Motor

In Minnesota the rule of the road that a motorist must keep to the right, was explained in a recent case.

An action was started for damages caused by a collision between two automobiles on the theory that one of the motorists was at fault because he had not kept to the right. An electric automobile was being driven south on a street about 3 feet from the right curb in a careful and lawful manner. The gasoline car was being driven north on the same street about 6 feet from the right curb at a speed of about 10-15 miles per hour. A third car was being backed out of an alleyway, having no lights and without giving any warning. The operator in charge of the second car applied his brakes and attempted to turn to the left to get around the car which was backing out. The pavement was wet and slippery and the car skidded, the front of the car striking and damaging the machine which was coming in the opposite direction. Its owner sued for damages to the car but the court held that the rule as regards keeping to the right had no application under the particular facts in the case and refused judgment for the damages.—*Chase vs. Tingdale Brothers, Inc.*, 149 *N. W.* (*Minnesota*) 654.

Must Look and Listen

Suit was started against a trolley company by an automobilist whose motor truck had been damaged in a collision with a trolley car.

The motorist contended that the car had been run at a speed of 30 miles per hour and that no gong had been sounded, which was a violation of a city ordinance. Trees and shrubbery obstructed the motorist's view of the crossing, so the speed of the truck which had been reduced to 12 miles per hour was reduced to about 6 miles per hour. While 35 and 25 feet away from the crossing the operator looked to see if a car was approaching but saw none until the motor truck was struck.

The court held that the railroad company was not responsible in damages for the accident as the motorist should have made another observation, as cars coming at high speed were to be expected at that place and further that it was his duty to look and listen continuously until the crossing was reached.—*Voelker Products Co. vs. United Railways of St. Louis*, 120 *S. W.* (*Missouri*) 332.

The Rostrum

Reliners Not for New Tires

EDITOR THE AUTOMOBILE:—Would a new tire casing be injured by putting in a reliner? Personally I should think a reliner put in a new tire would give it added strength and also prevent blow-outs and most punctures for it would make a thicker casing for nails, etc., to go through to reach the tube. However, a pamphlet I read recently on the care of tires claimed that reliners are injurious to new casings, but gave no reasons.

Greenville, Pa. PAUL R. MOYER.

—It is a general opinion that a new tire casing would be injured by putting in a reliner unless the tire was quite worn out. On the other hand, the use of liners in old casings is a great factor in increasing the mileage. To use the words of one manufacturer of liners:

"We do not recommend the use of reliners in new tires. The use of reliners is advisable only to prolong the life of worn casings and is a sort of reinforcement in the case of worn and broken fabric where the automobilist does not feel that he has sufficient mileage from his tire to warrant the expenditure of the price of new tires. Used in new tires the friction necessarily resulting is only harmful to the carcass of the tire and a decreased mileage is bound to result. No matter how carefully reliners may be applied or how skilfuly they may be cemented to the inside of new casings the union between the reliner and the fabric of the casing is such that heat is bound to generate and damage result. While it is difficult to determine just what effect the use of reliners has on new casings, we believe that the experience of all tire manufacturers is the same and that if the tire manufacturer felt that the additional plies of fabric in the casing were beneficial to the general result he would adopt a tire built with extra plies of fabric to take the place of the reliner in all casings.

"We make no claims for increased mileage in the use of our reliners. The condition of the casing at the time the reliner is applied will have much to do with the mileage resulting from the use of reliners. As a matter of fact, any attempt to make definite claims regarding mileage resulting from the use of reliners is out of the question and statements regarding mileage results obtained are usually visionary rather than real."

Constant Mixture Not Always Best

Editor THE AUTOMOBILE:—I read with interest the article on carbureters in a recent issue of THE AUTOMOBILE and would like to ask the following questions:

1—Do you mean in your first sentence by a suitable mixture, a constant mixture?

2—Is it a constant mixture that is most efficient for a carbureter to supply at all the varying speeds of a given motor?

3—If not, why not?

4—If so what is the approximate volumetric proportion of gasoline to air that gives the most efficient mixture under the ordinary atmospheric condition in a few of the common types of automobile engines?

5—Does the proportion of gasoline to air seem to have, for the most efficient mixture, any particular relation to the size of the cylinder, amount of compression, etc.?

6—If not, why not?

7—Why will not the proportion of gasoline to air remain a constant for the most efficient explosive mixture when the gasoline is of a definite specific gravity and the air constant in regard to moisture and density?

Hopkinston, Mass. FRANK A. REECE.

—1—By suitable mixture is not necessarily meant a constant mixture but that which meets the condition under which the motor is operating at the time.

2—While theoretically there would naturally be a mixture that would possess the property of greatest explosive power under practical conditions it is probable that higher efficiency is secured when a richer mixture is supplied at low speeds and a leaner mixture at high speeds.

3—This is answered under 2.

4—It has often been stated that under average conditions, a mixture by volume of 16 to 1 gives good results. It must be remembered that the range of explosive mixtures is quite broad and, while a perfect mixture theoretically is one in which there is just sufficient oxygen present to unite with the fuel in the proportion to form the most stable compound, or, in other words, a minimum of CO and a maximum of CO_2, in practice the best mixture would contain more than the theoretically required amount of oxygen. How much more than the amount theoretically required depends upon the variable features of manifold design intake manifold jacketing, whether or not the air entering the carbureter is preheated, and many other features which vary for each motor. For this reason it is always necessary to have a needle valve adjustment or something corresponding to it in order to set the primary adjustment of the carbureter to the proper proportion for the particular motor to which the carbureter is fitted. After this it is the function of the carbureter to retain this proportion for all motor speed with the variations necessary to create the best conditions.

5—The proportion of air to gasoline does not seem to bear any definite relation to the size of the cylinder although it may to the amount of compression and other factors.

6—The size of the cylinder would not alter the proportion necessary because the carbureter and manifold size is designed to meet the requirements of the cylinder size, but the amount of compression may have an influence in affecting the homogeneity of the mixture and hence its combustibility under conditions of different proportions of air to gas.

7—There are two methods of judging the efficiency of fuel combustion in a gasoline motor; one is by economy and the second is by power. The correct power adjustment in a carbureter is never the one which is the most economical. The reason for this is that after a car has been brought up to a certain speed, the power required to keep it running at that speed on a level road is relatively very slight. Hence, the number of heat units in the shape of fuel which it is necessary to consume in the cylinder is not the maximum which could be consumed at the motor speed required to keep the car running at the rate in question. On the other hand where the maximum power of a motor is to be required such as for running at high speeds, or through continually varying conditions of grade, etc., it may be necessary to set the carbureter to produce maximum power and to sacrifice accordingly a certain amount of economy. Following this through, the reason for a varying condition of mixture for low speed and high speed work may be, without going too deeply into the theoretical end of the question, that at low speeds a heavy sustained torque is required, while at high speeds a quick-firing, snappy mixture is sufficient.

Again, the rate of combustion depends to a large extent on the compression. Compression is higher at high speeds that it is at low speeds and hence the conditions of combustion are different.

Reasons for the Steam Car

Editor THE AUTOMOBILE:—1—What are the relative merits and demerits of steam propelled automobiles in their present form?

2—Could a steam condenser of some kind be made for this style machine, thus making possible long runs without the addition of water as is now necessary? If so, how?

3—What is the reason for the abandoning of the two-speed axle on the Cadillac and of the electric gear shift on the Haynes?

4—If possible, kindly give a diagram of the new Entz magnetic transmission as used on the Owen magnetic car.

5—How does the percentage of power actually delivered to the wheels with this type, compare with that transmitted by the usual sliding gears?

Lexington, Va. J. H. FORBES.

1—Two reasons have generally been advanced for the small relative popularity of the steam car as compared to the straight gasoline vehicle. These are first the limited distance which they can go upon a definite quantity of water and secondly, the complicated method of starting and controlling them by means of the pilot flame and various valves and other devices. It is stated that one of the large manufacturers is shortly to introduce a much improved type of steam vehicle which is intended to overcome these specific objections together with those of appearance.

2—Steam vehicles have been operated with a condenser. The Doble steam car used a honeycomb radiator for a condenser and avoided the deposits on the surface of the radiator due to introducing the lubricant with the steam by using a special form of oil which would not so deposit.

3—The reason generally assumed for the abandonment of the two-speed axle on the Cadillac is that in the introduction of the eight-cylinder car it was not felt necessary to employ the two-speed axle. The electric gearshift was discontinued on the Haynes car because certain improvements which have since been made were lacking and trouble was had with the apparatus. It is stated, by the Haynes company, however, that the electric gearshift as now made has overcome these difficulties.

4—A diagram of the Entz magnetic transmission was published in THE AUTOMOBILE for July 2, 1914, on page 8.

5—As yet we have not had the opportunity of examining any figures on the transmission efficiency of the Entz drive.

Charging Battery from 125-Volt Dynamo

Editor THE AUTOMOBILE:—Will you kindly advise me whether it would be possible to charge a 6-volt 60-ampere storage battery from a 125-volt 3-ampere (kilowatt .375) shunt wound direct current generator. If so, I would thank you to advise me how to make the connections.

The repairmen and storage battery people here do not seem to know how to connect up a regular charging outfit, and the opinions regarding storing as I mentioned are varied. Some tell me that the voltage makes no difference and just to connect it up anyway, while others state a certain amount of resistance is necessary, but it can be seen that with a machine of this size the resistance would probably cut down the charging capacity.

Montgomery, Ala. F. A. BIVINS.

—The best way to accomplish this would be to place in series with a battery a bank of carbon lamps, Fig. 1. This in turn would be connected to the 125-volt circuit, at the same time taking care that the positive terminal of the battery is connected to the positive side of the generator. The lamps of this bank should be in multiple and the number used would depend upon the charging current and the candlepower. The normal charging rate is probably given on the name plate, and from this the number of lamps can be calculated. For instance, if the current is to be 10 amperes, it would require ten 32-candlepower carbon lamps in multiple or twenty 16-candlepower carbon lamps. The lamps as stated are in multiple and the bank is in series.

The voltage required for charging a 6-volt battery is approximately 6 volts at the start of the charge and 8.1 volts at the finish. This being true, it is necessary to either reduce the voltage of the 125-volt generator which may, however, be impracticable, owing to sparking and other troubles, or to insert a resistance as for instance the bank of lamps between the dynamo and the battery, thus absorbing the excess voltage.

The calculation required in determining the resistance is as follows: Resistance R equals

$$\frac{125 \text{ volts} - 6 \text{ volts}}{3 \text{ amperes}} =$$

39 2-3 ohms. The regular charging rate of a battery of this size is 8 amperes, but a rate of 3 amperes may be used for charging if necessary; at this rate it will not be necessary to taper the charge.

Replacing Brush Balance Gear

Editor THE AUTOMOBILE:—I have taken down an engine from a Brush car in which the gears were all broken. In replacing these gears, could you kindly tell me how the counter-

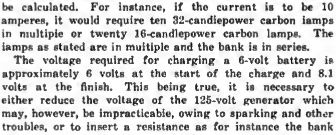


Fig. 1—Wiring diagram showing arrangement of lamps to provide resistance in charging a 6-volt battery from a 125-volt generator

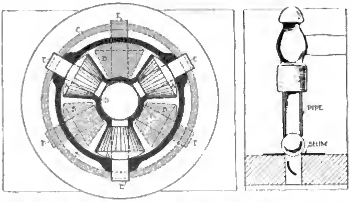


Fig. 2—Left—Use of six pinions in differential. Right—Cutting a round hole in a shim

balanced gear should be set; also publish the valve timing?

2—I have heard that this heavy counterbalance gear is not necessary in these engines, and that I can get along without it; is this so?

Gowanda, N. Y. **L. C. Boller.**

—The counterbalance gear was placed in the latest model of Brush cars to overcome the vibration of the one-cylinder motor. However, the car will run satisfactorily without the use of this gear, but the vibration will be more noticeable and more attention will have to be given to loose bolts and nuts.

To place the counterbalance gear in the motor, the gear is first assembled upon the stud and the motor is then placed upon top or firing center and the gear placed in position with the weight upon same being directly down the same as the weights upon the crankshaft.

The timing of the Brush runabout is as follows: The inlet valve opens after the piston has moved down 1-16 inch past dead center and closes when the piston has moved up 3-16 inch on the second stroke. The exhaust valve opens 7-16 inch before the end of the third stroke and closes 1-16 inch after the end of the fourth stroke, or just before the inlet valve again opens. The spark should occur a little before or after the end of the second stroke and depending upon the speed of the motor and regulated by the speed of the motor and the position of the spark lever.

2—This was answered above.

Wants Auxiliary Spring on 1908 Pierce

Editor The Automobile:—Will you advise me how to equip a 1908 Pierce Arrow 6-40 which has straight frame and semi-elliptic rear springs? Can I put on a three-quarter spring or auxiliary coils, or what?

Kennebunk Beach, Me. **A. J. Smith.**

—It would be very expensive to put three-quarter elliptic springs on a Pierce Arrow 1908 40-horsepower six-cylinder car. If you added a good make of auxiliary spring, these could easily be attached to this model car and should give additional comfort, especially as regards small inequalities in the road surface.

Suggest Method of Adjusting Bearings

Editor The Automobile:—In adjusting conecting-rod and crankshaft bearings, the removal of one or more shims often makes the bearing too tight and I find it necessary to make a thinner shim to get the right adjustment. Also, in bearings without shims I prefer to file off a little too much from caps so as to make the bearing too tight to run. In this way I am absolutely sure the bearing has been taken up enough. Then by using a very thin shim on one or both sides of cap, as required, the bearing is just right. The next time the bearing needs adjustment the removal of shims is enough.

In making shims of very thin brass or steel, I found it difficult to cut the bolt holes satisfactorily till I hit on this way of doing it.

Place the shim on a piece of metal having a hole of the size desired drilled in it; hold a steel ball, larger than the hole, with a short piece of pipe or bushing—as illustrated in Fig. 2, directly over the hole with the shim between and give the pipe a sharp stroke with a hammer.

It will cut a perfectly round, clean hole, if the edge of the hole in the metal used is free from nicks.

The steel ball can be held better if soldered to the end of a pipe or rod.

This method can also be used on gaskets.

Worcester, Mass. **Constant Reader.**

Singing Noise on Down Grade

Editor The Automobile:—I have a 1914 model T Ford touring car. When running on the level or down grades at a fair rate of speed there is a singing noise that seems to be on the left side of the gearbox, but going up grade I can run as fast as I desire and the noise is not there. I can give the car a good start down grade and free the engine and you do not hear it any more until you engage the clutch again. It does not seem to injure the pulling at all, but it seems as if there were some parts rubbing. This has been in the car for a long time.

Jemison, Ala. **C. M. Thomas.**

—From the description which you give it would seem that the noise is produced by the driveshaft pinion and the differential gear not meshing properly. In order to overcome this it will be necessary for you to install special heat treated parts which can be secured from any of the Ford service stations. The fact that the pinion and gear are not meshing properly causes a misalignment which sets up vibration, producing the humming or singing noise.

Repairing 1911 Reo Differential

Editor The Automobile:—Here is a sketch, Fig. 2, illustrating the way I overcame differential trouble which may interest your readers.

The car is a four-cylinder 1911 Reo. The differential pinions tripped repeatedly, as they were designed too light for hard mountain work in Oregon, an error corrected in the model of the following year.

The remedy consisted in installing six pinions in place of the three originally furnished. This was accomplished by shrinking a band, marked C, of strap iron 1.25 by .375 welded and turned, around the differential gearcase K to furnish sufficient outboard bearing for the three new studs F, carrying the three additional pinions B. The original studs are shown at E, and the original pinions A. The inner ends of all the studs are held by the floating brass spider D.

Five pinions would have doubtless sufficed to do the work, but six were used on account of the convenience of locating and drilling accurately the holes for the new studs. This was done by the use of a drill with an extra long shank, drilling each new hole through the old hole directly opposite across the gear case.

The expedient has proved entirely successful, and might be applied to other cars experiencing similar trouble.

New York City. **Ralph Root.**

Engine Indicator Impossible on Automobile

Editor The Automobile:—Will you give me the rule for finding the thickness of the sides and top of pistons to be made of aluminum? Also for cast iron?

2—Can an indicator be applied to an automobile engine, and if so how?

3—In case it can, will the regular steam engine indicator do?

4—If two engines of the same make and model were set in the same frame, one ahead of the other, would the rear crankshaft be strong enough to stand the strain?

5—How are the valve settings for high speed engines determined?

Clay Center, Kan. G. L.

—The thickness of the piston is generally a function of the bore, to which is added a small amount to take care of inaccuracies in casting and also for a factor of safety in strength. It is a general rule that, with cast iron pistons, the thickness can be somewhere close to .03 times the bore plus 1-16 inch. This is for a flat-topped piston with an interior boss for the piston pin and of conventional design throughout. Thus for a motor of 3 inches bore, the piston thickness would be .09 plus .06 inch or .15 inch. To get this to our customary forms of measurement, it would be close to 5-32 inch in thickness.

A definite rule for aluminum cannot as yet be laid down as the matter is still in an experimental stage and hence not settled enough for the formulation of empirical formulas.

2—The manograph can be applied by special attachments which are supplied with the instruments.

3—The regular steam engine, or Richardson, type of indicator will not do because it is not capable of operating at the speed customary with gasoline motors.

4—The rear crankshaft would have to be strong enough to transmit the horsepower of both motors. This would be especially true if the timing was so arranged that the power strokes of the two motors were synchronized so that the maximum stress from both motors fell upon the shaft at the same time. In such a case as you mention, a heavier crankshaft should be installed in the rear motor.

5—These are nearly all determined by experiments. What is regarded as a good average timing is first given the motor and then variations are tried until finally the best results are obtained. The design of the manifolds and various features exercise influences which cannot be determined accurately by mathematical calculation.

Use Series Plug for Two Sparks

Editor THE AUTOMOBILE:—The February 18 issue of THE AUTOMOBILE prints a letter from Roy Corbett, page 324, regarding a scheme for operating two spark plugs simultaneously in the same cylinder, from a single-spark magneto. Although, as you point out, the proposed scheme is impracticable, still it is by no means impossible to get the desired results by means of a method, as shown by the sketch, Fig. 3, in which an ordinary spark plug is used in connection with a special type of series plug. There are several makes of these plugs on the market, and I know of a number of instances where they are being used with very satisfactory results.

Again, referring to a letter from J. N. Liolios, page 326, same issue, I am surprised that no one remembers the original Pierce automobile; a single-cylinder machine built on the order of the De Dion-Bouton voiturette, with engine mounted directly on the rear axle. The Pierce motor was very similar to the De Dion motor, having inclosed flywheels, automatic inlet valve, single-piece cylinder and head water-jacketed, etc. It will make a very satisfactory stationary motor for the purpose suggested, if throttled down to run about 800 r.p.m.

Brooklyn, N. Y. JOHN T. MCGUCKEN.

Differential Gears for Front Drive

Editor THE AUTOMOBILE:—Is it necessary to use differential gears on a front drive? According to theory they should be used, but I remember reading an article stating it is not necessary to use them. If they are not needed please give a cross section of the axle used.

Marion, O. D. G. TROWBRIDGE.

—Regardless of whether the drive is taken at the front or rear of the car, there should be some differential mechanism to compensate for the difference in speed between the two opposite wheels. These differences in speed occur not only in rounding curves but in passing over obstructions where one wheel is required to travel over more ground than the other in going the same relative distance. There is practically as much difference between the speeds of the different front wheels as there is between those in the rear under the conditions mentioned. In very light vehicles having narrow tread and where the idea has been to keep the cost of construction down to the lowest limit, the differential has been eliminated, but this could not be accepted as universal or good practice where vehicles are loaded to any extent. When there is no differential it means that one tire is allowed to slip or drag over the ground, putting strains on the construction and wearing the tires.

Chevrolet Cars Geared 4 to 1

Editor THE AUTOMOBILE:—What is the gear ratio of the Chevrolet for 1915?

2—The gear ratio for the Ford?

3—What does S. A. E. rating mean?

4—Is there any difference in the foreign rating and the United States rating?

Lamberton, Minn. A FRIEND.

—The gear ratio of the Chevrolet cars is 4 to 1 for both the Baby Grand and Royal Mail models.

2—The gear ratio of the Ford is 3.63 to 1.

3—S. A. E. rating means the horsepower that is determined by using the S. A. E. formula $\frac{D^2N}{2.5}$ where D equals the bore and N the number of cylinders.

4—The same formula is used quite commonly abroad, although there are other formulas which have standings about as high.

Magneto Cannot Change Storage Battery

Editor THE AUTOMOBILE:—Will you tell me if it is practical to use a storage battery in connection with the magneto on a 1912 Ford? In other words, will the magneto charge the battery?

I want to put on a storage battery so I can use electric side and tail lights. There is no place here where I can get the battery recharged; so I cannot use storage unless I can float it on the magneto.

If this is practical, will you give me a rough pencil diagram showing proper wiring?

2—Can you advise me what I will need in the line of switches, cut-out, etc.?

Sidney, N. Y. J. H. RUSHTON.

—A Ford magneto will not charge your storage battery because it produces an alternating current, whereas, without a rectifying apparatus, a direct current is necessary.

2—This is answered under number 1.

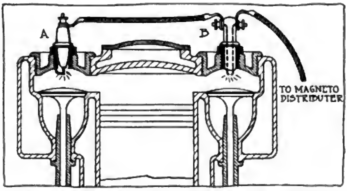
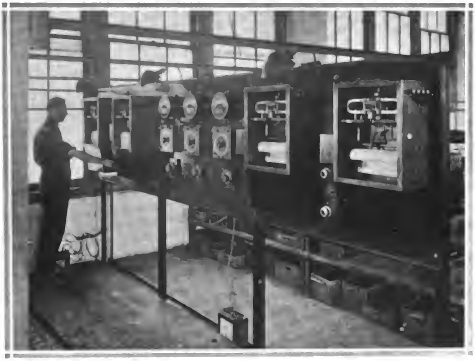


Fig. 3—Method of using a series plug to secure two sparks from a single distributer

Recording Instruments for Heat-Treating

Packard Uses Central Control Station and Colored Lights and Bells Indicate Furnace Temperature—Special Device Keeps Permanent Record of Variations



Control board of heat-treating department. Instruments register the degrees of temperature of the furnaces, and the proper signals to each furnace, whether the heat is high, low or of proper temperature to quench

CONTROL of the heat-treating department in the Packard Motor Car Co.'s plant in Detroit, Mich., is effected by the use of recording instruments which give a permanent record of the rise and fall of the temperatures within the heat-treating furnaces. One of these instruments is connected to each furnace thereby affording the man in control an exact knowledge of the work performed by each of his units.

A Central Switchboard

All the instruments are directly connected to a central switchboard or control station which in the Packard company's plant, is located close to the door entering the office of the governing head of the department. The location of the board in this position has been chosen because it is considered of sufficient importance to be frequently examined by the department head. In installing the switchboard, however, it is of great importance that the location be so selected that the recording instrument itself will be free from any variations caused by excessive external temperature changes.

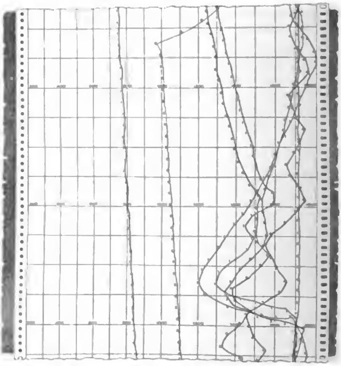
System of Signals

A system of colored lights and bells is used as a signal by the switchboard operator whenever the temperature within one of the furnaces becomes higher or lower than that desired for the particular work being carried on. Besides the signals given in this manner the operator also has the permanent record which is given him in the form of a chart illustrated herewith. This records in degrees Fahrenheit the temperature of the furnace at frequent intervals, thus establishing a continuous curve of temperatures in each of the furnaces. The purpose of the signals is to notify the furnace attendant whether the heat is too high or too low and whether or not it is time to remove the contents of any of the furnaces.

Detail Information

Beside the permanent record of temperatures in each of the furnaces there is also a record of the kind and number of pieces in each. This is kept in tabular form by the same operator who keeps the records of temperature, thus giving a complete permanent notation of exactly the work that each furnace is doing as regards number of pieces taken care of, kind of pieces, temperature at which the heating was carried out and length of time exposed to that temperature.

The recording instrument is of a type which has recently been put out by the Leeds & Northrup Co., Philadelphia, Pa. It is of a type which does not need calibration for resistance, although it is a form which utilizes the resistance at different temperatures to an electric current for the measurement of temperature.



A section of the permanent record of the temperature of a heat-treating furnace in the Packard factory. This records the temperature of the furnace at frequent intervals, thus forming a continuous temperature curve for each furnace

In this style of recording device the lead can be as long as is necessary to carry the information from the interior of the furnace to the simple control board. Another feature is the location of the cold end junction which is situated at the switchboard instead of in the head of the fire end. This is said to do away with the cold end troubles that have bothered users of electrical pyrometers in the past. The variations in temperature of the cold ends are compensated for by a device on the recorder itself which makes it simply a matter of adjustment by the operator, thus making the instrument read direct regardless of any variation of the temperatures of the cold end of the apparatus between 40 and 140 degrees. The same compensation is used on both the indicating potentiometer and the automatic recorder.

Periodical Inspection

In order to keep the instruments at their best effectiveness at all times they are periodically inspected by a man who has been trained by the Packard company to be a specialist in this work. Thus the charts furnished by the recording device are dependable records. In order to distinguish the curve furnished by one furnace from those of the others different color inks are used for each furnace. By the use of contrasting hues a clear record is kept regardless of how closely the temperatures approach each other.

It is only within the last few years that the need for heat-treating equipments of this high degree of accuracy has been appreciated. Not long ago it was thought quite good enough if the error on a theoretical correct temperature was not more than 30 or 40 degrees, but modern alloy steels require much closer working than this if the best is to be got out of them. Practical accuracy within 10 degrees Fahrenheit is possible with the best types of furnace and a reliable pyrometric system. Another advantage of these elaborate heat treating plants is that better work can be done for actually less money, in many instances; for the skill of long trained operators, their appreciation of delicate shades of color and so on, we have substituted registering and recording apparatus.

The possibilities of heat treatment are not yet fully developed since things can be done in metallurgical laboratories that are as yet impossible in a factory, but as knowledge advances we can reasonably expect greater economy in production, because we shall be able to get greater strength from steels of no more complex structure than those in use today. It is in connection with drop forging that accurate heating is likely to make the greatest difference for automobile manufacturers since the greatest variations in strength are now to be found in such parts.

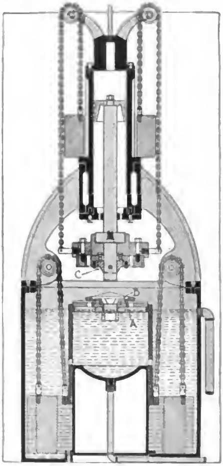
Hardening Bevel Wheels by Special Machine

Elimination of Warping Obtained by Holding Gear Against Die During Quenching

THE principal causes of noise in the operation of bevel gearing are irregularities, due to warping in hardening, either of the teeth as individual units or of the large member of the pair. Of these two causes the second is by far the more important and the machine described here has been designed by the Gleason Works, Rochester, N. Y., in order to prevent any distortion of the crown bevel. The popular system for dealing with bevels has been to copper plate the blank so that the coat of deposited metal is only removed from the actual teeth themselves by the cutting process. This copper sheathing prevents the steel from taking up carbon in the case hardening furnace, so that plunging in the oil bath or in water only hardens the teeth and leaves the body of the gear fairly soft. In this condition the gear can be pressed straight again when it has cooled down, but the operation needs skill and it is not easy to get absolute truth once warping has occurred.

In the Gleason machine the red hot gear is dropped on a die made to suit its shape, and another die is then forced down on top of the gear by air pressure. The two dies with the gear between them are then plunged into the liquid together and the gear is gripped sufficiently to prevent distortion. The process does not really take place in two stages, since it is the weight of the upper die forced down by the air pressure behind it that plunges the whole beneath the liquid, so that it is only a matter of some fraction of a second from the time the hot gear is dropped on the lower die to the time when it is immersed.

In developing the machine it was found necessary to try several different kinds of die, so as to give enough grip and yet allow sufficient piercing of the die plates to give free access of the oil to the gear. In the photograph a gear is shown in place with the upper die just about to descend upon it, and it will be seen that there is a spigot to register with the lower die. This spigot also carries a conical collar shown at C in the drawing, and this expands a split bushing B which rests on the lower die plate A. The expansion of this bushing holds the gear true to center and so squares it up to the dies; which is necessary in order that the conical faces of the dies may grip the toothed part of the gear accurately. The lower die rests upon the head of a cylinder which fits over a stationary head seen at the bottom of the tank, and the dies and gear are carried down till the lower die rests and is pressed upon the top of the head. Oil enters the cylinder by the two holes shown and these are closed directly the cylinder has begun to move, with the effect that all the oil contained in the cylinder is forced to bubble through the dies as the latter descend; so insuring the rapidity and completeness with which the gear is quenched.



Section of Gleason bevel gear hardening machine

Die about to descend upon hot gear

Axle and Frame Movements Plotted for Sharp Single Shock

(The Improvement of Spring Systems—IX)

By M. C. K.

HAVING finished for the present (see sections VI, VII and VIII) with the horizontal shocks, which are the most insidious enemy of those motor vehicles that cannot be equipped with air tires and constitute the principal reason justifying automobile owners and drivers in refusing to have air tires inflated as strongly as their makers recommend, the subject is in the following restricted to the tracing of the effects of the vertical component of a single shock for a vehicle with hard tires.

It will be noticed from Fig. 23 that the movements of the axle and the frame are in themselves unobjectionable, and in fact much less pronounced than those charted for vehicles with air tires, Figs. 9, 10, 11 and 12. To reconcile this observation with the established fact that the air tires nevertheless have a certain indispensable effect for comfort, it is necessary to keep in mind that the chart cannot show the short and disagreeable vibrations which reach the frame as a result of the hard knocks which a running-gear receives if it is not separately cushioned by means of elastic or soft tires —especially when the vehicle springs do not happen to be in the best position for softening such vibrations. But also other inferences are irresistibly drawn, to stand until disproved. One is that it is not so much an active elasticity that is required in the running gears and their tires as the property of deadening vibrations, and another that the vehicle springs could be arranged to take proper care of all vertical shock effects more easily if the active resilient movements within the running-gear were suppressed, and still another, being the one mentioned in the first lines above, namely that the horizontal shocks are the main obstacle to the elimination of resilient movements within the running-gear and must remain so until they are cushioned by resilient movements of the running-gear as a whole. These horizontal shocks are both longitudinal and lateral.

In these provisional inferences there is drawn an outline, in all generality, of the most fundamental improvements of the present spring suspension system which are likely to be worked into practical form in the next ten years. The numerous important refinements for which there is also room, and which at present engage the attention of builders almost exclusively, are in a different class, and with regard to them all mere reasoning, even if it is fortified by a general experience and the study of tests, must remain in the background till experience has been established in each instance—as they deal with highly complicated factors.

The inferences mentioned, almost sweeping as they are in their intended scope, can of course not be even provisionally established by mentioning them or by a single chart, such as Fig. 23, which in all probability could be greatly improved if the subject were taken up by scientists thoroughly versed in kinetics, and which could certainly be made much more convincing by tests with automatic recording apparatus, but they are referred to in advance in this place to indicate the drift of the whole inquiry. The possibility remains that a chart showing the effects of a rapid or peculiar succession of shocks, instead of only a single one, or another chart showing the effects of a different kind of obstacle, may modify or entirely upset the inferences and throw all hope of improvements in the direction of the refinements and accessories—cantilever springs, progressive-resistance springs, spring dampers, regulators and auxiliaries—in which improvements are mostly sought at present.

Two such charts are therefore under preparation and, according to present figuring, should indeed show that the refinements are necessary, though not inconsistent with simplification or the introduction of the more fundamental improvements, especially for commercial vehicles.

Data for Fig. 23

The assumed data according to which the axle and frame movements of Fig. 23 are figured were given in section VI, February 11, as follows: Wheel diameter 40 inches, road obstacle 3 inches high and of triangular cross-section as shown, axle load 800 pounds, unsprung weight 200 pounds, free spring oscillations 90 per minute, flexibility giving 1 inch deflection for 300 pounds pressure, 10 per cent. of friction in spring action, vehicle speed 50 feet per second (35 miles per hour). It is found in course of the figuring that an assumption of a period of oscillation remaining strictly the same for any kind and severity of shock cannot be reconciled with the flexibility and load figures unless much more than 10 per cent. of friction is also assumed, but this error in the assumptions is carried along for the ideas which it suggests and because it does not materially affect the nature of the curves of movement.

The wheels and springs are considered as units instead of pairs.

Figures and Reasoning

For the unsprung weight of 200 pounds there is an unmitigated shock which must amount to one-fifth of the corresponding shock in the case of the 1,000-pound front-end weight of the springless vehicle previously considered. The figure in that case was 3,180 footpounds and therefore becomes in the present instance 636 footpounds, which is spent destructively in wheel, axle and bearings (apart from the much heavier horizontal shock in which we are not for the moment concerned, but which was responsible, for example, for the abandonment of sheet steel front axles). The work of raising the unsprung weight 3 inches, so as to clear the obstacle, is only 50 footpounds.

Next comes the work of compressing the spring. For a 3-inch compression this work should amount to 900 pounds × 3 inches : 2 = 112.5 footpounds, according to the formula for spring work, $W = Pd/2$, where P is the pressure and d the deflection caused by it. This formula is not experimental but fundamental, being based on reasoning, but on the other hand it does not recognize spring friction or vehicle conditions which imply that some other incidental and additional work is always done when a vehicle spring is compressed. But, apart from this, the conditions are not quite so simple that a 3-inch compression can be accepted as the right one. The spring is compressed in advance 2 2-3 inches by its load and while being compressed by the shock it can extend upwardly with the load. Another doubt arises, because Kent says (eighth edition, page 260): "Under a load applied suddenly the momentary elastic distortion is equal to twice that caused by the same load applied gradually." This old rule is unsatisfactory for figuring, as the term "suddenly" is indefinite and might make it appear as if the work of a spring for a given deflection were likewise. The reason for the rule is of course that the work transmitted to the spring by the shock varies with the speed of the shock, and not that the work of the spring for a given deflection varies. The question here is of the amount of kinetic energy or work that must be transmitted to the spring, with its load, when the unsprung weight of 200 pounds is thrown against it in the peculiar manner in which the axle is caused to move, namely in a curve around the road obstacle. It is first of all clear that the amount of the unsprung weight makes no difference so long as it is reinforced by the infinite mass of the rigid obstacle integral with the earth. If it were only 25 pounds it would force the spring upward just as irresistibly.

It is known that the compression movement starts with the vehicle moving at speed of 50 feet per second, which makes the time occupied in scaling the obstacle 0.01755 second, this being the time in which the vehicle passes over 10.53 inches of road, from the moment when the impact is first felt till the top of the obstacle is directly under the axle. A little addition can be made to this time by reason of the retardation caused by the shock. The retardation is less than in the case of the springless vehicle, and the period in question may be taken as 0.018 second. During this time the spring extends with the load while being compressed.

As the natural spring oscillation period is involved with the acceleration of the masses which the spring supports, this extension can be figured without gross error on the following basis: It would be of the same amplitude as the extension which would follow a 3-inch compression, if there were time for it. Such an extension would take the time of one-half of an oscillation period. There are 1 1-2 free oscillations per second, giving 1-3 second to a one-half oscillation. But there is available during the forced compression of 3-inch amplitude only 0.018 second. Instead of extending all the 3 inches with the load, as it would do if the spring were absent, the extension is in about the same proportion to 3 inches as 0.018 holds to 0.33—considering that the spring has a certain inertia against movement offsetting the inertia of the mass of the load. This makes the extension $9 \times 0.018 = 0.162$ inch. The slower the driving, the greater the load lift would be, as period 0.018 would be longer.

On account of this simultaneous extension, the spring requires only to be compressed 3 minus 0.162 inch = 2.838 inches to make the wheel slip over the obstacle. The axle lift remains unchanged. But a load lift of 0.162 is added to the work of compressing the spring 2.838 inches. With the data used, there is little difference between the sum of these two items of work and that required for simply compressing the spring 3 inches, but if the load were smaller, the spring less flexible and the speed smaller the body movement taking place during the compression would evidently become very pronounced, as well understood in practice. As this may be expressed, comparing equal speeds: The greater the load and the greater the flexibility of the springs, the less load lift simultaneously with the impact.

On the chart the load lift of 0.162 inch is indicated. The energy required for it is $800 \times 0.162 = 129.6$ foot-inches = 10.8 footpounds.

Blow of the Wheel

To compress the spring 2.838 inches requires an additional static load of $300 \times 2.838 = 851.4$ pounds. The equivalent in shock of this additional load must be found. As the compression can be effected by gradually increasing the extra load from 0 to 851.4 pounds, making the average weight 851.4 : 2, the work of the shock must be equal to half of that stored in a load of 851.4 pounds that has been raised 2.838 inches, or 0.2365 foot, and this is $851.4 \times 0.2365 = 201.356$ footpounds, half of which is 100.68 footpounds.

The pressure applied to the spring is found by considering the speed of the action. One has $ks = 100.68 = 1/2\ mv^2$. In this case v has an average value determined by the movement of 0.2365 foot in 0.018 second, making it 13.13 feet per second. Hence $100.68 = 1/2\ m \times 13.13^2 = 1/2\ m \times 172.40$, from which m is found to be 1.15.

As the pressure corresponding to a mass, m, of 1.15 is $m \times 32$ or $1.15 \times 32 = 36.8$ pounds, the blow received by the spring is like that of 36.8 pounds pressure operated at a speed of 13.13 feet per second for 0.018 second, and with an obstacle of the nature here considered, the blow as well as the effect on the spring is sharpest at the beginning of this short period; and this probably makes the load lift greater than figured. That such an average pressure can be applied so suddenly and cease so quickly is due to the peculiarity of the movement of the axle.

If the work were looked upon as the pressure of the 800 pounds of load through a space of 2.838 inches at an average speed of 13.13 feet per second—which is the reverse of the true action, since the load does not come down, but might appear as practically the same at a casual glance—one would have: $ks = 1/2\ mv^2 = \frac{400}{32} \times 172.4 = 2{,}155$, and, with $s = 0.2365$ foot, k would be found to equal 8,500 pounds. But it is just such exaggerated pressures that are avoided by the use of springs, through the fact that the mass, 800 : 32, is not moved much or rapidly, the spring being moved instead.

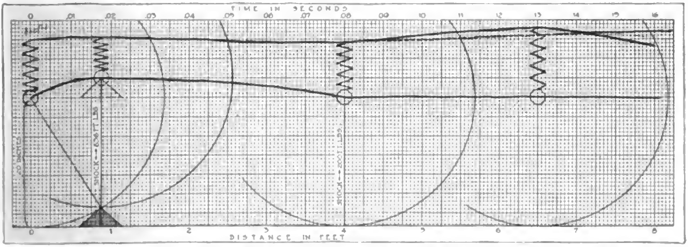


Fig. 23—Curves showing first movements of axle and frame of vehicle with hard tires after one typical kind of shock—plotted in approximate accordence with physical laws

The spring is now compressed 2.838 inches and has accumulated a working capacity of 100.68 footpounds in addition to that of the original load tension, which is now released and capable of producing movement of the running-gear while the latter is off the ground. The vehicle body is raised 0.162 inch above its static level. The axle is 3 inches above its level. The next movement evidently depends considerably upon the shape of the obstacle on the far side—whether it supports the wheel or allows it to drop. The speed of the vehicle has not been much reduced, as the loss in kinetic energy it has suffered from the spring action amounts only to $636 + 50 + 10.8 + 100.68$ footpounds, while the original energy was 117,187.5 footpounds. In comparison with that of the springless vehicle the retardation would be quite insignificant if it were not for the horizontal component of the shock which is not cushioned. As it is, the slight change may be ignored, so as not to interfere with the horizontal scale of the chart. It will be seen that the continuance of a speed close to 50 feet per second precludes the possibility of the wheel hitting the far side of the obstacle when the latter is of triangular section or any similar section.

The spring is under tension between the load above it, 800 pounds, and the axle below it, with its 200 pounds of weight. It will spend the same kinetic energy in the two opposite directions until the wheel strikes the ground. The tension is $800 + 851.4 = 1{,}651.4$ pounds. Out of this tension 10 per cent. is supposed to be lost in friction, leaving 1,486 pounds for work, to operate against the 800-pound load at the rate of 1/2 oscillation in 1/3 second. The deflection from equilibrium is $2.67 + 2.838$ inches $= 5.50$ inches. The energy available, apart from gravitation, is $(1{,}486 : 2) \times (5.50 : 12) = 340.55$ footpounds.

(A variant of the formula $W = Pd : 2$ for the work consumed by or stored in a spring by deflection may be suggested, being more convenient in connection with the majority of the questions which arise. It is $W = Fd^2 : 24$, where F is the number of pounds giving a 1-inch deflection and d the deflection in inches. The result is in footpounds. Allowance for friction loss is to be made additionally according to circumstances).

When in the Air

Any exact construction of the interactions of the spring, extending in both directions at different velocities, with gravitation and forward vehicle speed becomes very lengthy, but a somewhat close approximation can be made as follows:

The axle and the vehicle as a whole would drop 3 inches by gravity in 0.125 second (see table, Fig. 2), and the spring pressure must shorten this period considerably. Now, the first object is to know just when the wheel will strike the ground and with what force, as knowledge on this point discloses the force available for raising the vehicle body to and beyond the height at which the spring is in its initial position.

The whole spring pressure of 1,486 pounds acts in both directions and, unlike gravity, decreases as it is used. If the mean of 1,486 and 0, or 743, is taken as the initial pressure for depressing the axle and this is rounded down to 600 pounds on account of the rapid loss of tension in both directions, the 200-pound weight of the axle may be considered as being practically under the influence of a force 4 times stronger than gravity, and to determine the time in which it reaches the ground, 3 inches below, the gravitation formula $h = 1/2\ gt^2$ can be used, provided the acceleration g is multiplied by four, making the formula $h = 2gt^2$ and $t = \sqrt{\frac{h}{2g}}$ In this case where h is 1/4 foot this means that $t = 1/16$ second. During this period gravitation alone causes a drop of a little less than 1 inch, say 1 inch.

When the wheel strikes the ground, the spring has thus extended 2 inches downward and the whole vehicle has dropped 1 inch. The impact with the ground is, according to $v = gt$ (with $g = 4 \times 32$) that of 200 pounds striking with a velocity of $4 \times 32 \times 1/16 = 8$ feet per second. By formula $h = c^2 : 2g$ (see table, Fig. 2) this is equal to lifting 200 pounds a height $h = 8^2 : 64 = 1$ foot; that is, to 200 footpounds. This is lost in thumping the ground with the hard tire, and the shock is transmitted back to the load without much toning down by the spring, as this is "busy" extending in the same direction as the vibrations travel. The two different molecular actions seem hard to reconcile, though this is purely an unexplained fact.

In the upward direction the spring has meanwhile—during the 1/16 second—extended with the load, raising it one-fourth as much as it moved the 200 pounds of axle weight, or 1/2 inch, and, as the load at the same time has dropped 1 inch by gravity, the frame now stands 1/2 inch lower than at the beginning of the spring extension. At the end of the 1/16 second the spring has altogether extended 2 inches + 1/2 inch and has left only 2.838 inch minus 2.5 inch, in all 0.338 inch to extend before it gets back to its initial tension of 800 pounds, corresponding to the load at rest. The tension is reduced to $300 \times (2.67 + 0.338) = 900$ pounds.

Frame Rebound

To the 900 pounds pressure, in which there is an energy of $Fd^2 : 24 = 300 \times 3^2 : 24 = 112.5$ footpounds comes the energy of the load already moving. It has been raised 1/2 inch in 1/16 second, making the final speed 16 inches per second, giving it an energy of $1/2 \times (800 : 32) \times (4/3)^2 = 100 \times 16 : 72 = 22$ footpounds. The total available is thus $112.5 + 22 = 134.5$ footpounds.

How high will 800 pounds have to be raised to consume this amount of work? Evidently $134.5 : 800 = 0.168$ foot $=$ 2.016 inches. In this figuring the simultaneous gravitation of the load is implied.

The velocity with which the frame is raised 2.016 inches, and the spring extended the same distance, is of course decreasing, but an approximate value may be had from the pressure of 900 pounds equalling 134.5 footpounds. One has $134.5 = 1/2 \times (800 : 32) \times v^2$ or $v = \sqrt{\frac{134.5 \times 8}{100}} = \sqrt{\frac{1076}{100}} = 3.27$ feet per second $=$ 39.24 inches per second.

In the same proportion it should take only 0.051 second for the spring to extend the 2.016 inches with the load, whereafter the load begins again to descend, as it is 2.016 minus $0.338 = 1.678$ inch beyond its original height. The subsequent oscillations to bring about equilibrium between the load and the spring are of subordinate interest when tires are nearly rigid and no complications with fresh shocks arise.

Fig. 23 shows the wheel, spring and load movements in accordance with the foregoing figuring and with the horizontal scale as well as the vertical one in true proportions and in agreement with time and dimensions. The movements therefore appear much less abrupt than those shown in charts, such as Figs. 9, 10, 11 and 12, where the horizontal scale is greatly reduced. Fig. 23 shows altogether an elapsed time of 0.13 second in three periods, the first being 0.018 second for forced compression, the second 0.0625 second for the beginning of the spring rebound until the wheel touches the ground, and the third 0.051 second for the last portion of the first spring extension.

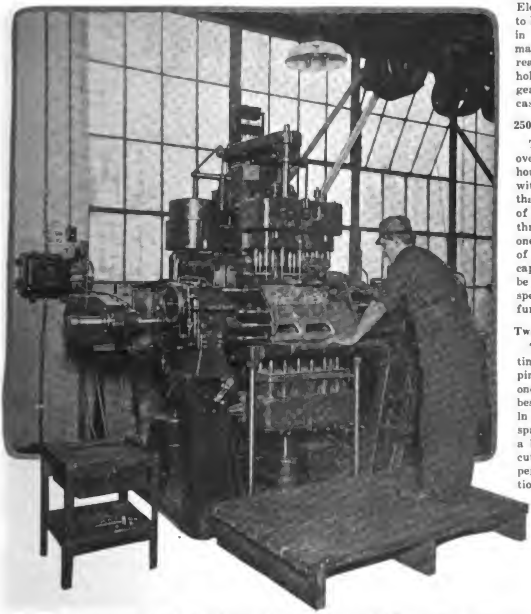
If the last period had been figured by deducting the first portion of the extension period, 0.0625 second, from the assumed duration of a half period of oscillation, which is 1/3 second and allotting the remainder to the third period, this would have become much longer than 0.051 second, and this is indicated in the chart by the dotted line representing an alternative termination of the frame movement curve. The clash of the two curves is left to indicate a doubt with regard to the period of oscillation, which requires further explanation in the next article.

Double Economy in Power Feed Drill

Time, Labor and Space-Saving Device in Dodge Plant Bores 50 Holes in Cylinder Casting in One Operation—Drills 250 Castings a Day

A MACHINE which has the ability to bore fifty-four holes in a cylinder casting at the same time is now in use in the factory of Dodge Bros., Detroit. This new machine, which is an excellent example of how labor-saving devices have been applied to the manufacture of automobiles, is known as a four-way semi-automatic power feed drill. It is illustrated herewith.

This ingenious machine, which bores more than half a hundred holes in a cylinder casting in one operation, works from four sides of the casting simultaneously. It almost dispenses with the operator as all he has to do is to put the casting in position and remove it when the work has been completed. Fourteen holes are drilled in the top of the casting to take the studs that hold the cylinder head in its place upon the main body of the cylinder. Twenty more are drilled in the base of the main cylinder casting to take the cap-screws that hold the oilpan in position. Eleven holes are bored in the front to hold the timing gearbox housing in position and finally the remaining ten are bored in the rear to take the cap screws that hold the gear cover case and the gearset housing to the cylinder casting.



Four-way semi-automatic power feed drill used in the factory of Dodge Bros., Detroit, Mich. This machine works from four sides of the casting simultaneously and almost dispenses with the operator in that the only care required is placing the casting in position and removing it when the work has been completed. In conjunction with this machine is a twin outfit provided with taps instead of drills. This machine cuts the threads in 55 holes in one operation

250 Castings a Day

The machine has a capacity of over 250 cylinder castings in a 10-hour day. Working in conjunction with the machine is a twin outfit that is provided with taps instead of drills. This machine cuts the threads in all the fifty-five holes in one operation. After being cleaned of the chips due to the drilling and capping the cylinder castings can be passed on their way to final inspection and assembly without further delay.

Twofold Economy

This machine not only cuts the time necessary in drilling and capping the cylinder castings to about one-half that needed by even the best machines formerly in use but in addition saves the factory floor-space that would be necessary with a larger number of machines and cuts to a minimum the labor cost in performing this work. The operation of drills or other machines upon all four sides of a piece of material is exceptional and is not only a time-saving element inasmuch as the time used in cutting is just one-fourth that where it is necessary to work on each side separately, but the time necessary in turning over the fixtures or in placing in another machine is saved. Their efficiency renders such machines well worth the additional cost.

View of the Brooklyn automobile show held last week in the Twenty-third Regiment Armory. This was the first Brooklyn show in 2 years

9,000 Cars for Long Island in 1915

Sales of $9,000,000 Predicted—6,000 Cars Sold in This Territory in 1914—Revived Show a Success

AN increase in business on Long Island of 50 per cent. for the present year as compared with 1914 is a conservative estimate if the opinions of the exhibitors at the Brooklyn show can be taken as a barometer. These opinions were, however, based on figures for January and February of this year and last year, and should not be far wrong.

9,000 Cars This Year

This year probably 9,000 cars, valued at $9,000,000, will be called for; last year more than 6,000 cars were sold in this territory, which has an area of 40,000 square miles and a population of over 2,000,000. Some of this new business is due to new cars, such as the Briscoe, Dodge Bros., Remington and Westcott; and also to the increasing popularity of cars introduced last year, as for example, the Chevrolet. Lower prices and more attractive products are also responsible for their share in the increase.

The territory represented by the Brooklyn show is one of the largest and richest in the United States; there are 29,000 cars registered in the four counties on Long Island, or almost as many as New York county, with 31,384 cars. The area of the island is 1,373 square miles and the population is 2,098,460, as against 2,762,522 for Manhattan Island.

The show is considered a success—all the exhibitors are agreed on this point. More cars have been sold, more live prospects obtained, and the crowd on the whole was more alive, more intelligent, and more interested than ever before. No show was held last year, but the great success of this one makes it a certainty that there will be another next year. The attendance was double what it was 2 years ago—largely on account of the reduction of the admission fee to 25 cents and the distribution of invitations, admitting two, to every owner on Long Island.

The Brooklyn show is a retail show and a local show. It is just for the inhabitants of Long Island and is a show at which there are very few sightseers but many prospective buyers. The population is largely urban; approximately 1,900,000 of the population is found in the counties of Kings and Queens which comprises Brooklyn, Long Island City and a few suburbs. The other two counties, Nassau and Suffolk, have a mixed population. Nassau county especially is noted for its fine estates, and many wealthy people live in this section. Therefore this county is a very fertile field for the dealer with high-priced cars, although the tendency is for these people to come straight to New York when they want a car instead of stopping off in Brooklyn.

In addition to this class there is a considerable number of farmers and truck gardeners, who demand cheap and moderate-priced machines. Also there are the townspeople throughout these counties who have grown well-to-do. These people also buy a considerable number of cars. There are only 83,930 people in Nassau county and 96,138 in Suffolk, so that after all the largest automobile trade is found right in the city of Brooklyn itself.

Few Subdealers

This fact and also the comparatively small area of Long Island has resulted in very few subdealers being appointed. All the high-priced cars are sold directly through agents in New York or Brooklyn without the use of subagents in the smaller towns. The medium and low-priced cars are handled by subdealers to a limited extent, the proportion of dealers for any particular car depending to a large extent on the price, the very cheap cars having comparatively many dealers and the medium-priced cars few or perhaps none at all.

While the small size of Long Island and the fact that all but 150,000 of the people live in Brooklyn or its immediate suburbs renders a great number of subdealers unnecessary, many of the exhibitors at the show expressed the opinion that it would be better to have more representatives throughout Long Island, but that it was difficult to place agencies with live men and that no representation was better than poor representation.

Very few contracts for territory were made at the show; most of this work is done later. Just how many new dealers will be appointed this year is problematical, but from a canvass of the show probably the number will be not more than twenty-five.

At present there are forty-five dealers in Brooklyn, which is Kings county, and the population is 1,634,351; ten in Queens county, with a population of 284,041; thirty-six in Nassau, with a population of 83,930, and forty in Suffolk, with 96,138 inhabitants. The dealers in Brooklyn are the main representatives for the whole island, while in the other counties there are subdealers.

Long Island is ideal from the automobilist's standpoint; the country is practically level; the south shore is absolutely so; although there are some short hills along the north shore, the roads are excellent. Besides, there is the Long Island Motor Parkway, which is a private speedway 45 miles in length and on which there is no speed limit.

The attractiveness of Long Island because of its good roads and also its many summer resorts, makes it almost a summer paradise for the motorist, with the result that there is a large transient trade done by the dealers in the small towns throughout the island; most of these motorists come from Brooklyn and New York City.

Good Electric Field

Electric dealers expect a large increase in business in the near future. Brooklyn is an ideal electric city. Its streets are well paved, all the principal ones being asphalted, and it is almost as level as a billiard table. The electric affords the most convenient means of reaching New York.

The country surrounding Brooklyn is also very level and the roads are in exceptionally good condition, so that a more ideal district for the operation of these machines could hardly be imagined. To further the popularity of these cars one garage for electrics exclusively has recently been opened and two more are contemplated.

One distributor of high-priced six-cylinder cars looks for a large increase in his business during the coming season, for in addition to the regular business which he has a right to expect he believes that many of the people that had about made up their minds to buy cars last fall or early in the winter will do so some time during the coming year.

He argues that there are a certain number of people that want new cars every 2 or 3 years and that many of these were ready to purchase new ones when the war made them decide to use the old cars for another year. Many of these people, he believes, will be ready to invest in new cars during the coming season.

Eisemann Brings Out Magneto for Sixes

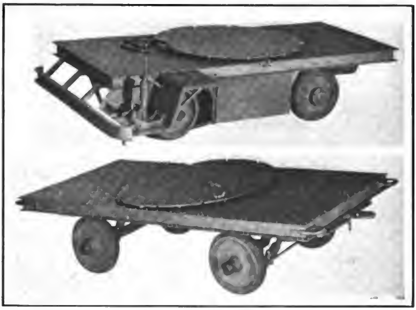
Waverley Electric Truck for Industrial Work

NEW YORK CITY, March 9—In addition to the Type G four-cylinder magneto announced in September by the Eisemann Magneto Co., Bush Terminal, a six-cylinder instrument has been put out. In general appearance the new magneto is similar to the four-cylinder design except that the large driving gear wheel is at the rear end instead of at the forward end, thus giving a slightly different appearance to the exterior.

The magnets are covered by sheet steel housing which are pressed into place providing a tongue and groove joint which is absolutely watertight. The distinctive tapered pole piece has been retained, but the winding of the armature has been considerably increased in efficiency. A new feature is the use of oxidized laminations for the core. This prevents eddy currents due to the insulating film of oxide.

One of the features of the new instrument is the simple installation.

Above—New Eisemann magneto for six-cylinder cars. It is similar in appearance to the Type G four-cylinder instrument recently brought out except that the large driving gear is at the rear instead of at the forward end. On the distributer gear there are two marks: L for left and R for right hand rotation. It is merely necessary to place number 1 piston in firing position and align the mark R or L with a screw in the distributer housing



Right—The newly constructed Waverley electric shop truck which has recently been adopted by the U. S. Government for the Bremerton, Puget Sound, navy yard, is illustrated herewith. It is of structural steel construction, designed entirely for purely industrial purposes. The outfit comprises a tractor and trailer operating on an electric motor which is supplied with current from a thirty-cell, twenty-one-plate lead battery. The turntables are of great use in controlling heavy weights, rendering the tractor and trailer of use in rolling mills and other structural steel work.

Splash Oiling for Eights

A New System to Avoid Use of Drilled Crankshaft

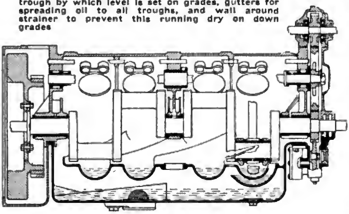


Fig. 1—This shows the overflow beneath the front trough by which level is set on grades, gutters for spreading oil to all troughs, and wall around strainer to prevent this running dry on down grades

ALL the eight-cylinder motors that have so far appeared have been provided with some form of force-feed oiling, the lubricant being directed under pressure through the crankshaft and its throws to the crankpins, and sometimes through the camshaft as well. Naturally such a construction is very expensive, owing to the drilling of the shaft. The splash oiling system, whereby the lower ends of the connecting rods dip into troughs of oil as they revolve, thereby throwing the oil to all the surfaces to be lubricated, is much more simple, but designers of eights have fought shy of it because of the difficulties of splashing the oil into cylinders placed at an angle.

Ernest M. White, automobile engineer of Detroit and specialist on motor car lubrication has come forward with a method of employing splash oiling in eights of the V-type, which makes use of baffles to direct the oil into the cylinders. In combination with these the White eight-cylinder splash systems incorporate the special forms of splash troughs on which Mr. White holds patents and which cause more oil to be splashed on grades than on the level, at the same time having provision for the cutting down of the oil supply when the car is descending a grade: for when going down hill, less work is done by the motor, and consequently less oil is needed. These special forms of splash troughs were described in THE AUTOMOBILE, issue of May 7, 1914.

Though the principle is the same, the White splash system for V eights admits of several modifications it is stated to meet the requirements of any type of engine. The diagrams herewith illustrate the two most important forms which Mr. White has developed.

Method of System

Fig. 1 is a horizontal section of an eight-cylinder fitted with the White troughs, and Fig. 2, the end sections of the same crankcase, showing the corrugated baffle or deflector which is so curved as to throw the oil striking it toward the opposite or right-hand cylinder and placed so as to divide the oil splashed from the troughs into two portions, one for lubricating each set of cylinders. There is, of course, a separate baffle opposite each of the four cylinders of one side.

From the reservoir oil is taken by the pump and discharged into the timing gear case whence it is splashed to the other gears in the timing case by the rapidly-revolving wheel which drives the pump.

From the timing gear case the oil runs to the front or master splash trough and is divided here, part returning directly through a level-maintaining trap to the reservoir. This trap is so designed that when the motor is inclined, as in ascending a grade, a greater quantity is retained, raising the level and causing more oil to be splashed from the trough by the dipper on the connecting-rod. The level is raised about 1-4 inch and lowered about 1-2 inch when the motor is either ascending or descending a 20 per cent. grade.

Effect of Baffles

The baffle plate scheme is readily understood. It is the same idea as if you took a hose and directed its stream of water on a sidewalk, for instance. The water would be thrown upward again at a certain angle to the horizontal. The dipper on the end of the rod splashes or lifts oil from the trough and primarily throws it into left-hand cylinder, Fig. 2, and also against deflector or baffle by which it is redirected into the opposite cylinder. The design of the deflector and dipper is such that practically equal parts of the splashed oil go to each cylinder.

The oil gets to succeeding troughs from the master trough by being directed along passages on the inside of the crankcase. Flowing down the side of the case, it is caught by the inclined gutter and empties into No. 2 trough. By the same means Nos. 3 and 4 are supplied, the oil finally returning to the oil base ready for straining and recirculation.

Special provision is made for supplying the pump with oil when there is little in the reservoir and when the motor is descending a grade as there is a wall around the screen, through which the oil is strained on going back to the pump. This prevents the oil from uncovering this screen and stopping the supply.

A modification of the eight-cylinder splash system just described is shown in detail in Fig. 2. It differs from the other in that the oil is pumped directly into each of the splash troughs, placed one under each of the cranks. Another difference is in the baffles, which are in two sets in this case.

Referring to the diagrams, the oil is taken from the reser-

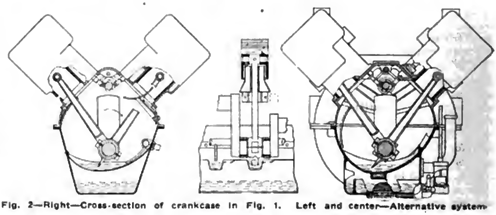


Fig. 2—Right—Cross-section of crankcase in Fig. 1. Left and center—Alternative system

voir by a suitable pump, not shown, and by it fed into a main passage having openings leading to each of the splash troughs. From these, a portion of the oil is thrown by the dippers, part of it going directly into the cylinders, and a portion striking against a baffle from which it is deflected to another baffle and then shot into the cylinder.

At the forward side of each of the splash troughs is an overflow placed below the upper edge, this controlling the depth of oil in the troughs and the quantity of oil splashed therefrom, just as in the other case. When the motor is inclined as in ascending a grade, this overflow point rises, causing a greater quantity of oil to be retained in the troughs so that the dippers will dip deeper and splash more oil to the parts to be lubricated. When descending, the overflows obviously fall, and there is less oil retained, as less is required. In the design shown, the maximum depth of oil would occur when the engine was inclined to a 12 per cent. grade, and on a 25 per cent. grade the depth would be the same as when the motor was in a level position.

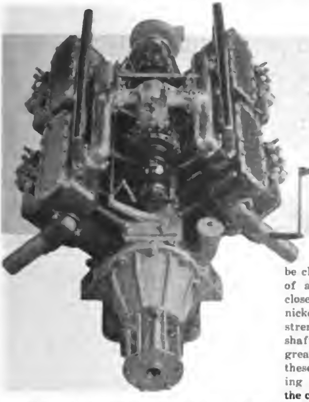
In this system, the size and form of the deflectors or baffles, like the sizes of the connecting-rod dippers and the pump, is largely a matter of experiment, controlled by the size and form of the crankcase. It is understood that the oil thrown from the troughs does not reach the cylinders and bearings in the form of a liquid, but rather as a mist or spray which is beaten into this state by the cranks, connecting-rods and other moving parts within the crankcase.

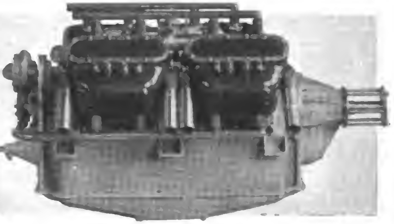
As in all splash systems, there are oil pockets above the main bearings and oil holes in the lower ends of the connecting-rods so that these parts may receive oil. The special form of compensating troughs which White uses, may also be fitted in combination with the pressure oiling method, that is, in those cases where the oil is fed under pressure to the bearings. So far as the trough design is concerned, these systems are also applicable to vertical fours or sixes.

This system seems to care for every eventuality but, of course, it must not be forgotten that force fed oil is an advantage to any kind of motor when it can be afforded. The higher the pressure at which the oil enters the bearings the greater the durability thereof is a law of mechanics, so that on high-grade cars a forced lubrication system is becoming the rule, however many cylinders the motor may have.

Big Eight for Aeroplanes

New Model Sturtevant Aero Motor Follows Automobile Trend





RATED at 140 horsepower the Sturtevant motor is not really so very large as its cylinder dimensions are only 4-inch bore and 5 1-2-inch stroke, but it is designed to run at the high normal speed of 2,000 revolutions per minute. This is, of course, too fast a speed for a propeller so there is a special geared head for the latter and the reducing gears bring down the rate of revolution to from 1,000 to 1,500.

The cylinders are cast, but the jackets have big openings to allow the cores to be cleaned out, and cover plates of aluminum are employed to close the water spaces. Chrome-nickel steel of very high tensile strength is used for the crankshaft and connecting-rods and a great deal of work is done on these parts, the crankshaft being bored out all through and the connecting-rods machined all over. The big ends are not of forked type but are located side by side on common crankpins and white metal bushings are used at this point. Aluminum is used for the crankcase and within it are cast oil passages to conduct the lubricant to various points. For the main bearings of the crankshaft the supply comes from the cast passages and oil then gets to the big ends through the crankshaft. For cam lubrication the camshaft is drilled out and oil led to its interior just as to the crankshaft, while besides the gear type of pressure circulating pump, there is a secondary pump driven by eccentric from the camshaft that sucks from an outside tank and keeps the crankcase level constant.

The photographs give a good idea of the general layout of the motor and it is interesting to observe the way in which the exhaust pipes are brought out between the blocks of pair-cast cylinders. Generally the suggestion is that the pair casting rather aids accessibility and the motor as a whole is particularly clean.

A quite interesting point in the design, especially in the light of the difficulty automobile engineers have been having with a four-cylinder magneto driven at double normal speed, is the use of two separate Bosch or Mea machines. The branched intake manifold and its enlarged center section at the point of carbureter attachment should also be observed.

The Automobile

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, March 11, 1915 No. 10

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Osberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

The Boston Show

HAVING more cars, more dealers and practically as great an attendance as any other show in the circuit, the Boston Show must not be underestimated. Here the hundreds of dealers congregate each year to map out a business which totals more than half a hundred million dollars. Here the New England distributor gathers together his cohorts of sub-dealers to make fresh onslaughts against the huge potential buying power of New England industry.

Rich as the New England territory is it has not as yet been tapped to anything like the extent that the future holds out. Millions of dollars are spent every month on automobiles and accessories through the New England territory and the Boston Show is the headquarters of the general staff which organizes the big selling army for this huge campaign. This is a dealers' show organized by dealers, for dealers and patronized not only by the dealers themselves but by an exceptional number of live dealers' prospects.

Men from all parts of the country are here, buying, selling and observing, all fully appreciating the magnitude of the New England market and zealous to still further develop its possibilities. Nor have they been content to take their opportunities at their face value only; in many cases they have analyzed financial and industrial conditions and are able to go after the business systematically.

Markets in Both Hemispheres

SO far the principal customer of the American automobile manufacturer has been his own countryman, and outside North America Europe has taken most of the surplus. At present, with the chief markets of the Old World practically closed there is a strong natural tendency to look to the republics of the South American continent as a field that has not yet been exploited properly. There has been an inclination to leave Argentina and Brazil to the foreign makers who already have a strong hold there in the automobile field, but with Germany prohibited from exportation almost, and great reductions in the quantities of cars that can be exported from France or England, the opportunity for America to seize the market that should be hers by natural right is very tempting.

Recent research by responsible departments of the Government and by representatives of financial interests who are well qualified to judge, shows that business conditions, so far as the ethics of buying and selling are concerned, are improving greatly, in Argentina particularly. It is now quite possible to do business there in a businesslike way, using methods of appreciated value in the parts of the world with which the American manufacturer is already acquainted. To develop the potentialities of South America should not be any more difficult when the job is taken properly in hand than it has been to expand our automobile trade with Australia.

The thing that is not known fully is the type of car which Argentina and the other republics is likely to prefer, for the case is not equivalent to that of Europe, who can take care of herself so far as high-priced chassis go and needs little more from us than the inexpensive vehicles, in the production of which America has stood utterly alone. The thing which really counts is the amount of money the average purchaser desires to spend; for, if a car is sound and well advertised, the details of its design are not of so much importance as the suitability of its price to the market.

In Europe American manufacturers have largely set the fashion in inexpensive cars, and there seems no good reason why they should not do likewise with more costly machines in another continent. All that is needed is really earnest endeavor and persistency of effort, so that a sound trade may be built up in three or four years' time. It is useless to hope to create a big business in a few months, for it is necessary that the public be educated to appreciate the value of American cars of all classes, and it is probable that time and money given to such education will be better spent than it would be on an endeavor to alter our chassis or bodywork radically to suit whatever may happen to be the supposed ideas of the South American buyer at the moment. Fashions in automobile make-up change from time to time and in our sister continent there seems no reason why the direction of change should not be influenced and directed by a little intelligent and patient pioneering which should result in ultimate advantages for both makers and buyers.

London Buses Carry 734,000,000 in 1913

1913 Haulage Nearly Twice as Much as 1910—Of 3,644 Omnibuses Licensed, Only 142 Were Horse-Drawn—28 Motor Buses in 1903—Routes Increased from 195 to 528 Miles

LONDON, ENGLAND, March 6—London omnibuses carried nearly 734,000,000 passengers during the year 1913. This is nearly twice as many as were carried in 1910 and is 90 per cent. as many as were carried by the street cars. It is also nearly 60 per cent. more than were hauled by the local steam railroads. The exact figures for 1910 and 1913, as given in the report of the London traffic branch of the Board of Trade for 1914, recently issued, are:

	1910	1913
Street Cars	763,797,856	811,397,317
Omnibuses	377,207,555	733,931,201
Steam Roads	425,271,861	462,019,537

Of the 3,644 omnibuses licensed in 1913, only 142 were horse-drawn. There were only twenty-eight more buses licensed in 1913 than in 1903, when there were but thirteen motor buses, yet they carried more than two and one-half times as many passengers. At the same time the motor buses serve a much greater mileage than the old horse buses, the length of road traversed having increased from 195 miles in 1912 to 528 miles in June, 1914.

From these figures it will be seen that motor buses have had a tremendous effect in relieving the traffic congestion that would have made the streets impassable if horse-drawn buses had been depended upon to take care of the increased number of passengers. Many bus routes are now from 15 to 20 miles in length.

Although more than 50,000,000 passengers were carried by cabs in 1913, the number of these vehicles was reduced from 11,000 horse-cabs in 1903 to 10,320 cabs in 1913, of which 8,387 were motor driven.

With regard to accidents caused by motor buses, the report says: "In proportion to the work done by these vehicles, their fatal effect has largely decreased. It is not sufficient merely to take the actual number of accidents caused; consideration must also be given to the number of vehicles in each class and the amount of mileage run."

Motor Buses Stopped in Berlin

AMSTERDAM, HOLLAND, March 6—All motor bus traffic on the streets of Berlin, and other German cities has been stopped by order of the Imperial authorities, to conserve the supply of gasoline, according to a message from the German capital.

Since the early days of the war most of the big motor buses have been in service at the two fronts but a few smaller ones and many taxicabs remained and did a good business. Most of them were driven by women chauffeurs.

Last week the Bundesrath adopted a measure by which the number of automobiles in that country not being used for military purposes would be reduced by about one-half. The order issued provided for the licensing of all automobiles, beginning March 15, licenses to be issued only on proof of public necessity. The purpose of this was to save in the consumption of gasoline, lubricant oils and rubber.

To Form Co. for Rittman Process

WASHINGTON, D. C., March 10—A plan is being considered by officials of the United States Bureau of Mines to form a company which will operate under the supervision of the Secretary of the Treasury in connection with the new Rittman processes of manufacturing gasoline and chemicals used in the making of ammunition and dyestuffs. The plan is for oil manufacturers to co-operate in building a plant. Another arrangement discussed is for the Secretary of the Treasury to have sole control of the patents and to license any financially responsible manufacturing company applying to use them.

This method of manufacture which was announced in THE AUTOMOBILE for March 4 consists in vaporizing the residue under heavy pressure and at a temperature of 450 degrees centigrade; the idea being to break up the oil and free the gasoline molecules. The residue that is left by the liquid distilling process becomes available by Dr. Rittman's method and it has been stated that double the amount of gasoline is produced from a given supply of crude. It is stated that full details of the process will be announced by the Department of the Interior, towards the end of March.

LACKAWANNA, N. Y., March 5—The Lackawanna Steel Co., this city, has undertaken the building of a benzol plant, which is now nearing completion. The company has made contracts for the sale of this product for the entire year and expects large sales. The Dominion Steel Co., Sydney, B. C., is also planning to add to its plant and produce benzol.

N. A. C. C. Selects Show and Truck Convention Dates

11,064 Carloads of Automobiles Shipped in February

NEW YORK CITY, March 5—At its quarterly meeting, held yesterday, the National Automobile Chamber of Commerce decided on December 31 as the opening day of the next automobile show at Grand Central Palace. The Chicago exhibition will open January 22, 1916.

Following the report of the Commercial Vehicle Committee, the manufacturers in the chamber selected May 5 and 6 as the dates and Detroit as the place for a convention of commercial vehicle interests, following the regular monthly meeting of the directors, which will also be held at Detroit. To this gathering will be invited all the leading commercial vehicle manufacturers, including those not members of the N. A. C. C.

Evidence that the recent shows at the Grand Central Palace this city and the Coliseum at Chicago broke all records for attendance, and the amount of business done was shown by the report of S. A. Miles, the show manager. There will be a 97 per cent. return of the amount paid for space at the New York show and 83 per cent. on the Chicago exhibition space.

Reports by W. E. Metzger, chairman of the Traffic Committee, show that February shipments of automobiles were 11,064 carloads, a substantial increase over the figures of February, 1914, which were 10,572 carloads.

H. H. Rice, chairman of the Legislative Committee, in his report, stated that forty-eight bills affecting the use of motor cars had been introduced into four state legislatures during the past 3 months. He reported further that there was a general disposition on the part of the lawmakers to recognize the rights of automobilists, and they apparently were disinclined to vote for any measures that would entail a hardship on them.

There were also discussions on reports from the committees on patents, good roads and standard form of warranty.

President Clifton presided at the meeting with more than sixty-five companies repreeented.

Fred Estey, a Pioneer, Dies in Detroit

CHICAGO, ILL., March 8—Fred L. Estey, known throughout the industry as Pete Estey, automobile editor of the Chicago *Examiner*, died Saturday night in Detroit from pneumonia. At one time Mr. Estey was publicity man for Studebaker and in addition has been identified with motoring for the last 10 years. He was a prominent figure in nearly all the Glidden tours.

SAVANNAH, GA., March 6—The price of gasoline in Savannah has fallen from 14 cents to 11 cents.

U. S. Rubber's Net Profits $9,776,873

$6,945,388 Dividends for Year Upon Preferred and Common Stocks—$10,000,000 Cash on Hand

NEW YORK CITY, March 5—The annual report of the United States Rubber Co., the first since the company changed its fiscal year to correspond with the calendar year, shows net sales of $83,678,812, a reduction of about $10,000,000 from the previous 12 months. This was occasioned, acording to President Colt, by the prevailing low selling price of manufactured goods, the volume of merchandise sold having been somewhat greater than in 1913.

Net profits of the company, before deducting interest charges, amounted to $9,776,873. After deducting interest charges the profits were $7,868,223. Dividends to the minority stockholders in certain subsidiaries amounted to $200,884. Dividends for the year upon the preferred and common stock amounted to $6,945,388, leaving a surplus of profits of $721,950, equivalent to about 2 per cent. upon the common stock additional to the 6 per cent. paid

President Colt in his report to the stockholders stated that the company's policy has been to keep strong in cash, the item of about $10,000,000 cash on hand representing over 50 per cent. of the company's current liabilities outside of such as would of necessity exist in the transaction of its business.

The company has made an increase of about $4,850,000 over last year, in plants and properties, expending about $2,100,000 in 1914 on the company's rubber plantations in Sumatra, about $870,000 on enlargements of Morgan & Wright tire plant at Detroit, about $355,000 additions to tire and other mechanical plants, about $360,000 additions to footwear plants and about $170,000 additions to reclaiming plants

Garford Motor Truck Co. Starts Work

LIMA, O., March 10—The manufacture of Garford and Garford-Utility trucks has been started by the Garford Motor Truck Co., whose factory is in this city. As announced a few weeks ago, the Geiger-Jones Co., Canton, O., has purchased the motor truck interests of the Willys-Overland Co., which consisted of the manufacture and sale of both the Garford and the Willys-Utility trucks. This entire line henceforth will be manufactured under the Garford name, the Willys-Utility becoming the Garford Utility. The Utility truck has a carrying capacity of 1,500 pounds while the Garford will be built in 1 1-2, 2, 3, 5 and 6-ton sizes.

E. A. Williams, Jr., heads the new company, which has taken over the Lima factory together with all vehicles on hand and the service stations in the eastern states. Mr. Williams was in New York City last week supervising the final arrangements of his New York distributor, the R. E. Taylor Corp., for consolidating under one roof all the Garford company's interests in that territory, now distributed in three places. This consolidation will be in the garage at 427 West 42d street, occupied by the old Gramm company. This company is also in charge of the Boston branch. H. C. Whitney is in charge at Philadelphia.

Other officials in the new company are J. B. Immler of Canton, associated with the Geiger-Jones Co., vice-president and secretary, and A. Stull of Lima, treasurer.

The engineering department of the company has been transferred from Elyria to Lima. Special machinery for building Garford trucks has been installed. The operating force of the Lima plant will be materially increased within the next 2 months. The Elyria plant will henceforth be employed in the manufacture of Overland parts.

Overland Ships 302 Cars in 1 Day

TOLEDO, O., March 5—As a strong indication of the upward trend of business conditions in this country, the Willys-Overland Co. points to the shipments which recently have been made at the Toledo factory.

On Monday, March 1, the first day following the biggest month so far experienced by the Overland company, 302 cars, valued at $330,185, were shipped to actual purchasers. This is the largest number of cars that ever left the Overland factory in a single day. Of the total number of cars, eighty-seven, valued at $125,325, were of the Overland six-cylinder model. To carry the one day's shipment of cars, 102 freight cars were required, making a solid train measuring 4,742 feet, or almost a full mile in length.

Although February contained only 24 actual shipping days, the Overland Company's records show a total business exceeding that of last October, which had 27 shipping days and which was previously the company's record month. The increase in average daily shipments was 29 per cent. Shipments for the month were 31 per cent. greater than those of February, 1914, and double those of the same month 2 years ago.

Buick Ships 1,952 Cars in Week

DETROIT, MICH., March 9—*Special Telegram*—The week ending February 27 was the biggest in the history of the Buick Motor Co. Shipments totaled 1,952 cars, of which 1,720 were shipped from the factory and the remainder from branches. The total number of Buicks shipped from the beginning of the fiscal year, August 1 to February 27, this year was 30,922, as compared with 21,013 cars for the same period last year.

100% Increase in Atwater Kent Business

PHILADELPHIA, PA., March 6—February proved a banner month for the Atwater Kent Mfg. Works, the number of ignition systems shipped being more than 100 per cent. greater than during the same month last year and fourteen times greater than the output of February, 1913.

The present schedule for 1915 deliveries on Atwater Kent ignition equipment calls for 60,000 systems, with a probability of a very heavy further increase.

Goodrich Reduces Preferred $2,000,000

NEW YORK CITY, March 10—At the annual meeting of the B. F. Goodrich Co. held in this city today, the stockholders voted to reduce the capital stock of the company from $90,000,000 to $88,000,000, by reducing the 7 per cent. preferred capital stock from $30,000,00, consisting of 300,000 shares at $100 each, to $28,000,000, consisting of 280,000 shares of $100 each. The by-laws of the company call for the retirement of 3 per cent. of the original issue of $30,000,000 each year. This retirement of $2,000,000 to cover a 2-year period means the calling in of $200,000 more than requirements.

The old officers were re-elected as follows: B. G. Work, president; C. B. Raymond, secretary; W. A. Means, treasurer; A. H. Lehman, chief engineer; W. O. Rutherford, sales manager; E. C. Tibbitts, advertising manager; E. C. Shaw, factory superintendent; and Chas. Wolf, purchasing agent.

The number of the directors has been reduced from sixteen to fourteen. Last year's list of directors remains intact with the exception of O. C. Barber and A. H. Lehman, who resigned.

YOUNGSTOWN, O., March 5—Stockholders of the Youngstown Sheet & Tube Co. at a special meeting, April 6, will be asked to approve a $5,000,000 increase in the corporation's capital stock, raising the present total of $25,000,000 to $30,000,000. The board of directors has approved this action. Sanction of the stockholders is declared to be already assured.

The stock about to be issued will be preferred, making for the company a total of $10,000,000 of this kind and $20,000,000 of common. Of the latter $18,000,000 is outstanding.

NEW YORK CITY, March 10—The Kelly-Springfield Tire Co. has declared the regular quarterly dividends of 1 1-2 per cent. on its first preferred, 1 3-4 per cent. on its second preferred and 1 1-2 per cent. on its common stocks. The preferred dividends are payable April 1 to holders of record March 15 and the common dividend is payable May 1 to holders of record April 15.

Firestone Reduces Solid Tires 10 Per Cent.

NEW YORK CITY, March 8—Consumers' discounts are eliminated from a new schedule of Firestone solid truck tire prices which went into effect today. A net price is quoted which is 10 to 15 per cent. lower than any net prices given in previous Firestone lists after deducting discounts.

An advantage in making prices universal and fixed is gained by the abandonment of the old consumers' discount method.

Lower cost of crude rubber, lower production cost, a better distribution system and a larger volume of sales are the reasons given by E. S. Babcox, advertising manager, for the cut in prices. The new list follows:

Size	Price	Size	Price
36 by 2	$12.60	34 by 5	$40.65
42 by 2 I.H.C. S.W.	14.75	36 by 5	42.95
46 by 2 I.H.C. S.W.	16.00	38 by 5	45.30
32 by 2½	17.05	40 by 5	47.60
36 by 2½	18.95	42 by 5	49.95
38 by 2½ I.H.C. Flange	20.95	34 by 6	49.80
42 by 2½ I.H.C. S.W.	22.95	36 by 6	52.70
32 by 3	20.95	38 by 6	55.60
34 by 3	22.10	40 by 6	58.50
36 by 3	23.30	42 by 6	61.45
38 by 3 I.H.C. Flange	25.65	36 by 7	64.65
32 by 3½	24.55	38 by 7	68.25
34 by 3½	25.95	40 by 7	71.90
36 by 3½	27.35	42 by 7	75.60
38 by 3½	28.80	36 by 8	83.60
40 by 3½	30.20	40 by 8	93.45
34 by 4	33.20	36 by 10	102.15
36 by 4	35.10	40 by 10	114.35
38 by 4	36.95	42 by 10	120.55
40 by 4	38.85	36 by 12	128.90
42 by 4	40.70	40 by 12	144.45
		42 by 12	152.40

United Garage Assn. Formed—Haradon President

ALBANY, N. Y., March 4—The organization of the United Garage Assn., of New York State, Inc., which was tentatively formed in New York City, January 6, was completed March 3 in this city. W. M. Haradon of the Royal Garage, New York City, was again chosen president; the officers are: first vice-president, John Van Benschoten, Poughkeepsie; second vice-president, A. H. Dudley, Rochester; third vice-president, W. D. Whipple, Binghamton; secretary, Harry Waring; treasurer, E. W. Leahy, Albany. Besides these there are twenty directors.

Attorney Melvin Bender, who has been retained by the organization, reported on legislative work in prospect; the measures include a law making it legal to sell gasoline, tires and supplies on Sunday, something not now permitted under the Sunday closing law; a lien law which will give the garageman a lien on a car which has left the garage with a bill unpaid, and a law permitting the arrest of a man who attempts to defraud a taxicab or livery driver.

An emergency $50 credit card will be issued by member garagemen to reputable customers for a small sum, entitling them to a credit of $50 in case of trouble on the road.

Market Reports for the Week

NEW YORK CITY, March 10—Market prices were generally steady this week. Prices in the metal markets were in a few cases irregular. Tin, for instance, rose from $41.50 to $49.50 per 100 pounds, and then dropped to $48.00, with a gain of $6.50. Though copper was steady in prices, there was much irregularity with a stronger tone. Antimony saw gradual rise from $0.18 to $0.19 1-2 while lead rose to $0.02 1-2. Lead is steady but quiet. There were no changes in the oils and lubricants market. The market for crude rubber lacked new features of importance last week. Fine Up-River Para remained at $0.58 throughout the week. The demand for tires and some other lines of rubber goods is reported to have expanded to some extent of late, but manufacturers do not seem disposed to purchase beyond their current needs.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.18	.18	.19	.19½	.19½	.19½	+.01½
Beams & Channels, 100 lbs.	1.26	1.26	1.26	1.26	1.26	1.26	......
Bessemer Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	......
Copper, Elec., lb.	.14¾	.14¾	.14½	.14⅝	.14⅝	.14⅝	......
Copper, Lake, lb.	.14¾	.14¾	.14¾	.14⅝	.14⅝	.14⅝	—.00⅛
Cottonseed Oil, bbl.	6.65	6.65	6.80	6.82	6.93	6.75	+.10
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	.92	......
Lead, 100 lbs.	3.92½	3.92½	3.95	3.95	3.95	3.95	+.02½
Linseed Oil	.60	.60	.60	.60	.60	.60	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.30	18.50	......
Petroleum, bbl., Kans. crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.50	1.50	1.50	1.50	1.50	1.50	......
Rapeseed Oil, refined	.75	.75	.75	.75	.75	.75	......
Rubber, Fine Up-River, Para	.58	.58	.58	.58	.58	.58	......
Silk, raw, Ital	..	3.90	.	3.90	3.90	3.85	—.05
Silk, raw, Japan	..	3.40	..	3.30	3.42½	3.35½	—.04½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	41.50	44.50	49.00	49.00	49.50	48.00	+6.50
Tire Scrap	.05	.05	.05	.05	.05	.05	......

Automobile Securities Quotations

NEW YORK CITY, March 10—A number of important changes were made in this week's securities market. Some of the changes showed marked gains while others made declines, less marked. Maxwell Motor shares continue to advance, the common 3 1-2 points and the second preferred 1 1-2 points; Firestone Tire common rose 15 points; Goodyear Tire common rose 3 points; Kelly-Springfield common rose 7, its first preferred 1 and its second preferred 2 points; Texas rose 7 1-2 points; U. S. Rubber common rose 2 1-4 and its preferred 2 points and Willys-Overland common rose 3 1-2 and its preferred 1 point. Vacuum Oil dropped 4 points.

In the Detroit Stock Exchange quotations there were few important changes. The Chalmers Motor common dropped 6 1-2 points; Maxwell common rose 4 points, while its first preferred rose 5 1-2 points. In the inactive stocks, the Canadian Ford stock rose 25 points.

	Bid	Asked	Bid	Asked	Net Ch'ges
	1914		1915		
Ajax-Grieb Rubber Co. com.	200	..	250	..	..
Ajax-Grieb Rubber Co. pfd.	90	..	100	..	..
Aluminum Castings pfd.	91	101	98	100	..
J. I. Case pfd.	..	..	76	85	+1
Chalmers Motor Co. com.	82	87	..	87	..
Chalmers Motor Co. pfd.	92	93½	90	..	—1
Electric Storage Battery Co.	..	..	..	..	..
Firestone Tire & Rubber Co. com.	288	295	395	400	+15
Firestone Tire & Rubber Co. pfd.	108½	109½	108	109½	..
General Motors Co. com.	74	75	91½	93	— ½
General Motors Co. pfd.	93	93½	94	95½	..
B. F. Goodrich Co. com.	22	23	30½	31	—1
B. F. Goodrich Co. pfd.	87	90	96	98½	..
Goodyear Tire & Rubber Co. com.	230	250	191	193	+3
Goodyear Tire & Rubber Co. pfd.	96	97½	103	104½	+1
Gray & Davis, Inc., pfd.	90	97	..	..	..
International Motor Co. com.	..	5	..	..	..
International Motor Co. pfd.	..	15	..	..	..
Kelly-Springfield Tire Co. com.		..	111	113	+7
Kelly-Springfield Tire Co. 1st pfd.	.	..	83	84	+1
Kelly-Springfield Tire Co. 2d pfd.		..	120	125	+2
Maxwell Motor Co. com.	5¼	5¾	27½	29	+3½
Maxwell Motor Co. 1st pfd.	27	28	67½	69	..
Maxwell Motor Co. 2d pfd.	9	9½	26½	28	+1½
Miller Rubber Co. com.	..	..	163	170	+8
Miller Rubber Co. pfd.	..	..	101	103	..
New Departure Mfg. Co. com.	..	..	124	125	—1½
New Departure Mfg. Co. pfd.	..	.	105	107	— ½
Packard Motor Car Co. com.	101	116	..	100	..
Packard Motor Car Co. pfd.	96	98½	95	97	..
Peerless Motor Car Co. com.	..	30	20	21	..
Peerless Motor Car Co. pfd.	..	80	..	55	..
Portage Rubber Co. com.	..	40	34	36	..
Portage Rubber Co. pfd.	..	90	85	95	..
*Reo Motor Truck Co.	8	8½	11½	12	+ ½
*Reo Motor Car Co.	18	19	27	29	+1
Splitdorf Electric Co. pfd.	..	..	..	.	..
Stewart-Warner Speed. Corp. com.	56	57	50	52	+2
Stewart-Warner Speed. Corp. pfd.	98½	100	101½	..	+ ½
Studebaker Corporation com.	23	24	47⅝	48	+2⅛
Studebaker Corporation pfd.	79½	81	93	94	..
Swinehart Tire & Rubber Co.	70	71	73	75	..
Texas Company	..	..	134	136	+7½
U. S. Rubber Co. com.	60	60½	56¼	57	+2¼
U. S. Rubber Co. pfd.	101½	102	103	103½	+2
Vacuum Oil Co.	..	..	180	183	—4
White Co. pfd.	107	110	103	105	..
Willys-Overland Co. com.	65	68	98½	100½	+3½
Willys-Overland Co. pfd.	92	96	96½	97	+1

*Par value $10; all others $100 par value.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Bid	Asked	Net Ch'ges
	1914		1915		
Chalmers Motor Co. com.	82	85	..	83½	—6½
Chalmers Motor Co. pfd.	92½	94½	91½	93	— ½
General Motors Co. com.	75½	77½	90	93	— ½
General Motors Co. pfd.	92½	93½	93	96	+1
Maxwell Motor Co. com.	5½	6½	27	29	+4
Maxwell Motor Co. 1st pfd.	27	28	67½	69	+5½
Maxwell Motor Co. 2d pfd.	9	10	26	27	+1
Packard Motor Car Co. com.	101	116	..	97½	—1½
Packard Motor Car Co. pfd.	95	98	93½	..	—1½
*Reo Motor Car Co.	18¼	19	27½	..	+1½
*Reo Motor Truck Co.	8	8½	11½	12	+ ½
Studebaker Corporation com.	..	..	46½	47½	+2
Studebaker Corporation pfd.	..	..	92	94½	+ ½
Continental Motor Co. com.	..	165	..	190	..
Continental Motor Co. pfd.	..	75	80	85	..

INACTIVE STOCKS

	Bid	Asked	Bid	Asked	Net Ch'ges
Atlas Drop Forge Co.	..	21	25	..	..
Ford Motor Co. of Canada	540	560	525	..	+25
Kelsey Wheel Co.	190	200	195	..	..
W. K. Pruden Co.	..	21	19	20	..
Regal Motor Car Co. pfd.	..	50	..	22	..

*Par value $10; all others $100 par value.

NEW YORK CITY, March 5—The Rubber Goods Mfg. Co. has declared the usual quarterly dividends of 1 3-4 per cent. on its preferred stock and 1 per cent. on its common, payable March 15 to stock of record March 10.

The annual meeting of the stockholders of the company will be held in Jersey City on April 8.

Confirm Hess-Bright Ball Bearing Victory

U. S. Circuit Court of Appeals Affirms Decision Holding Conrad Patents Valid and Refuses Petition of F. & S. for Rehearing on an Accounting

PHILADELPHIA, PA., March 8—Affirming the decision of the Philadelphia circuit court of appeals in favor of the Hess-Bright Mfg. Co. handed down last October in its suit against Fichtel & Sachs, and refusing the motion for a rehearing as to the right of an accounting made by the latter, the U. S. circuit court of appeals for the third circuit has issued an order as follows:

"The motion for rehearing has had our joint consideration. The defendant firm was formed but a short time before this suit was brought and is only liable to account for the period subsequent to its formation. Bearing in mind the several prior cases against others in which the rights of the patent here involved were rigorously prosecuted and the not undue time that elapsed between the successful termination of such litigation and the commencement of this suit, we do not find any such delay as should preclude the plaintiff from the customary accounting. The defendant firm volunteered to enter the field of infringement and accounting is a necessary consequence of its act. As to the other matters involved, we see no reason to depart from the conclusion reached and stated in the opinion heretofore filed. The motions are therefore refused."

The suit was brought in 1913 by the Hess-Bright Mfg. Co. of Philadelphia and the Deutsche Waffen und Munitions Fabriken of Germany against Hedwig Fitchel and Ernst Sachs, doing business under the firm name of Fichtel & Sachs, charging infringement of the Conrad patents Nos. 822,723 and 838,303 covering the use of a continuous race in a ball bearing. The patent is owned by the Deutsche Waffen und Munitions Fabriken, the Hess-Bright company being exclusive licensee in America. Judge McPherson in the U. S. district court of Philadelphia handed down a decision in favor of the defendants in December, 1913, but on the appeal the Philadelphia circuit court of appeals reversed this decision and gave the verdict to the Hess-Bright company, holding the Conrad patent covering a continuous race in a ball bearing to be valid and infringed by the F. & S. bearing. Then the F. & S. interests petitioned for a rehearing as to the right of an accounting which has now been denied by the circuit court of appeals for the third circuit.

Assault May Be Committed with Automobile

JERSEY CITY, N. J., March 8—According to an opinion handed down recently in this city by the New Jersey Supreme Court, a motorist who runs down a person may be indicted for assault and battery. The decision sustains the conviction of Walter Schutte, this city, who was indicted for assault and battery for running into and injuring Thomas Mitchell while driving his car at excessive speed. Justice Garrison, who wrote the opinion, said:

> A criminal assault may be committed with an automobile driving along a public street at an excessive rate of speed that endangers the safety of other persons and actually results in such an injury. It requires neither argument nor illustration to show that the excessive rate of speed at which an automobile is driven is a product of the will of its driver and not the result of his mere inattention or negligence. The two cannot be confused any more than the hurling of a baseball bat into a crowd of spectators could be confused with its accidentally slipping from the hand of the batter.
>
> It has been held that responsibility increases with the likelihood of injury, but never the reverse that I am aware of.

BOSTON, MASS., March 5—A bill making the present workmen's compensation law mandatory upon every employer in Massachusetts engaged in any industrial line as well as upon the commonwealth, counties, cities, towns and fire and water districts, has been prepared by the Industrial Accident Board and presented to legislative committee on the judiciary. The only exceptions permitted under the bill are domestic servants and farm laborers.

Driver Must Give Signal to Stop

ST. LOUIS, MO., March 6—The Court of Appeals in a decision this week, defining the motor vehicle law, requiring an automobilist to stop when a driver of horses or mules signals him that his animals are frightened, said a motorist was forced to stop only on signal from the driver himself. In the case under consideration it was argued the teamster had been occupied in trying to stop his unruly steeds and that his father who was sitting beside him gave the warning signal.

Judge Allen held the law could not be construed to mean any more than it says and that if it is nullified by the practical necessities of handling a team, the blame should rest on the law makers and should be remedied by new legislation. A fine imposed by a lower court on the violating motorist who failed to stop on the signal as related above was knocked out.

TACOMA, WASH., March 4—According to the Washington State legislature private automobile trucks are to be taxed from $10 to $25 a year according to capacity. Trucks for hire would be taxed from $20 to $50 a year, Automobile stages running through the country districts are to be assessed $10 to $25 a year according to capacity.

Lewis Consolidated Car President

DETROIT, MICH., March 6—A reorganization of the Consolidated Car Co., which took over the business of the Abbott Motor Co., last December, has taken place. C. L. Lewis, secretary and sales manager of the Edward Ford Plate Glass Co., Toledo, O., has been elected president, succeeding Randall A. Palmer. The latter and A. C. Knapp are no longer connected with the Consolidated company. M. J. Hammers, D. E. Perry and F. E. Sangbush, continue with the company respectively as secretary and general manager, purchasing agent and service manager. Mr. Lewis and his associates in Toledo have the controlling interest in the reorganized company.

Fletcher Heads Remy Electric Co.

INDIANAPOLIS, IND., March 6—On March 1 the annual meeting of the Remy Electric Co., Anderson, Ind., was held in Indianapolis, where most of the officers of the company reside. Officers were elected as follows: President, S. A. Fletcher; vice-president, Hervey Bates, Jr.; secretary-treasurer and general manager, H. W. Griffith and assistant to the president, J. C. Woods. The officers and Theodore Stempfel compose the board of directors.

Timken Buys Metal Products Plant

DETROIT, MICH., March 6—The Timken-Detroit Axle Co. has purchased the plant, buildings and machinery of the Metal Products Co., automobile axle manufacturers. This does not mean, however, that they have purchased the name, good will, etc.

The increasing business of the Timken company made it necessary to enlarge. It was found more advisable to acquire a plant already fully equipped with the needed machinery and equipment rather than to wait until an addition to the plant is completed, as this would have meant a delay of several months before production could have been increased.

The new property will be known as the Timken-Detroit

Metal Products plant and will be operated to its full capacity. Six hundred men are employed in the new Timken acquisition.

Boston, Mass., March 10—A. S. Holly, for several years with Alvin T. Fuller as manager of the truck department of the Packard in this city, has severed his connection with that company to assume the management of the J. C. Tucker Co., distributor for Chase trucks in that territory. B. E. Blackley will manage the Tucker agency in Providence, R. I.

Indianapolis, Ind., March 4—The officers of the Marion Motor Car Co. have made preparations to move their effects to Jackson, Mich., where the parts of Marion cars are being made by the Mutual Motors Co. The moving of the general offices together with the three main officers, J. I. Handley, Guy Monihan and Thomas Marshall, is made so as to bring the management close to the place of manufacture.

Guy Lewin Takes Dodge Agency for London

New York City, March 8—Guy Lewin, head of Guy Lewin, Ltd., London, has received the Dodge Bros. agency for London. Mr. Lewin will make permanent quarters in Detroit, Mich., where he will carry on all business in the interests of the London concern. Confident of his ability to do a good business in England with American cars and accessories, especially in cars selling under $1,000, Mr. Lewin paid a visit to this country last month in quest of automobile agencies, his immediate object. The Dodge Bros. agency is the first one to be taken.

Indianapolis, Ind., March 8—At the annual election of the Indianapolis Chamber of Commerce a few days ago, F. I. Willis was elected president for the ensuing year. Mr. Willis is one of the most active men of the younger element in the automobile industry and is vice-president and manager of the Hearsey-Willis Co. He has always been active in the affairs of the Indianapolis Automobile Trade Assn. During the past year he was vice-president and chairman of the executive committee of the Indianapolis Chamber of Commerce.

St. Louis, Mo., March 5—The St. Louis Automobile Manufacturers' and Dealers' Assn. has decided to issue a price current of used automobiles in this city. Each dealer is to use a special blank on which will be the price which each used car he has sold has brought. The reports are to be inclosed in an envelope bearing the key number of the dealer making the report. When the secretary of the club receives the report he is to check the name of the dealer on his record. A committee will then digest the reports and send the price current to the members. This is the plan followed in Chicago.

Indianapolis, Ind., March 8—P. K. Morrison, of Muncie, Ind., has been appointed receiver for the B. T. K. Gear and Engine Co., of that city. This action was taken in the Federal court in this city on a petition filed by creditors alleging the concern owes more than $50,000 and asking that it be adjudged bankrupt.

Suit has been brought in the county courts by Martin Bright asking that a receiver be appointed for the Bright Carbureter Co., of this city. Mr. Bright alleges the company is insolvent and is in debt to him to the amount of $259.

Hand Klaxonet Sells for $4

New York City, March 9—The Lovell-McConnell Mfg. Co., Newark, N. J., manufacturer of the Klaxon, announces a new hand signal, called the Hand Klaxonet, which retails at $4.

The horn operates on an entirely novel principle. The plunger projects from the back instead of from the top. It operates at the slightest touch. The same permanent guarantee that goes with the other Klaxon horns is carried by the new one.

The new Hand Klaxonet, which sells for $4

Hanlon Patent Valid

Court Sustains Claim Against Rauch & Lang Carriage Co. and N. A. C. C. as Co-Defendant

CLEVELAND, O., March 9—*Special Telegram*—In sustaining the complaint of William D. Hanlon against the Rauch & Lang Carriage Co. and the National Automobile Chamber of Commerce as co-defendant, charging infringement of a windshield patent, Judge John H. Clarke granted an injunction and passed the case on for an estimate of damages.

"Infringement is claimed in the reissued patent No. 13,653," Judge Clarke's opinion reads, "for the patented device of the independent glass rain panel, hinged at the upper edge and mounted in front of the windshield. The problem which Mr. Hanlon undertook to solve is really an important one of providing a clear view for the driver for a fast moving motor car. The only question the Court thinks important is whether the claims of the patent involve the degree of novelty which the law requires."

The evidence shows a painstaking search concerning prior construction and results in the counsel for the defendant placing defiance in the argument for a prior state of art, claiming Hanlon made no discovery on Faulkner's British patent in 1908 and on the Didier French patent in 1906. "It is obvious from the descriptions that these patents did not wholly solve the problems Mr. Hanlon undertook. Clearly Hanlon was the first to conceive the construction, accomplished his aim, and I cannot doubt that it shows the ingenuity and value intended to be rewarded by the patent law. I therefore conclude that the patent is valid and the plaintiff entitled to the relief requested."

It is pointed out that where the visor of the windshield is made stationary no infringement exists.

Lozier Trustee Issues Statement to Creditors

Detroit, Mich., March 8—Terms of the sale of the Lozier Motor Co., were announced today by the Detroit Trust Company, trustee.

The Associated Lozier Purchasers, which recently bought the property at auction with a bid of $1,000,000, are to pay $200,000 in cash and file a surety bond in the penal sum of $150,000. Periodical payments must extend over a period of 1 year from the date of confirmation of sale, Feb. 15, 1915. The purchasers have the right to relinquish to the estate the Detroit real estate, which includes the plant and permanent fixtures and receive credit. A dividend of probably 5 per cent. is to be paid to all creditors as soon as claims are filed and approved.

Receiver Named for Speedwell

Dayton, O., March 9—Acting on the application of the Dayton Savings and Trust Co., as trustee of the bondholders, Judge U. S. Martin, of the Common Pleas Court, on March 1, appointed Carl R. Green, mechanical engineer, receiver for the Speedwell Motor Car Co., under a bond of $10,000.

Though the allegation is made in the petition that the company is in danger of insolvency, the proceedings are based on the charge of breach of conditions upon which the mortgaged bonds were executed. The bonds, totaling $150,000, represent the bonded indebtedness on the plant, which is located in Edgemont, and twenty-three city lots which are part of the company's assets, and all of the tools, fixtures, appliances, etc., exclusive of the accounts receivable.

C. D. Heald, chairman of the creditors' committee, which has been working on a proposition which it was expected would bring the company out of its financial troubles, expressed surprise over the action taken in court. The committee had proposed to the bondholders that they take up the merchandise claims against the company, amounting to $60,000.

Century Rubber Co. Is Bankrupt

Trenton, N. J., March 10—The Century Rubber Co., Plainfield, N. J., has filed a petition in bankruptcy, in the United States Court. F. B. McDermott, of Jersey City, has been named receiver by Judge Haight. The papers set forth that the authorized capital of the company is $3,500,000, assets of about $200,000 and liabilities of $37,000, but that the cash of the concern has been reduced to $400.

A 500-Mile Race for Detroit

Speedway Club to Hold Meet Labor Day—Work Started on 2.5-Mile Concrete Speedway

DETROIT, MICH., March 9—*Special Telegram*—The Detroit speedway project is assured to automobile racing enthusiasts. The speedway is to be inaugurated next Labor Day when a 500-mile race will be held. W. E. Metzger returned from New York City with permission from the American Automobile Assn. to hold the race on that date. Indianapolis capital has interested itself in the venture, which has brought about the organization of the Detroit Speedway Club with practically the elimination of the entire former officers and promoters. The new organization includes prominent figures in the industry and is known as the Detroit Motor Speedway.

Actual work on the construction of the speedway was started today by the contractors, J. M. McCarthy & Co. and S. D. Maddux, of Indianapolis, and by the end of this week all the necessary machinery will be on the ground and a large force put to work, as the contract calls for the completion of the race course by August 1.

The speedway will be located about 10 miles from the city along the Detroit, Monroe and Toledo railroad and also the interurban road. It will be 2 1-2 miles long and made of concrete. The curves will be so constructed that racing cars will be able to take them at full speed instead of slowing down. The grand stands will have seating capacity for 75,000 people. Special boxes and other spaces will be erected to permit a total attendance of 150,000.

The cost of the speedway is estimated at $475,000. The land, which covers about 350 acres, cost about $150,000.

Toledo To Have 2.25-Mile Speedway

TOLEDO, O., March 5—The Toledo Motor Speedway Co. has been incorporated with a capital stock of $10,000, which is merely a nominal capitalization, and which is to be increased later. The incorporators are: A. T. Atwood, of the Atwood Auto Co.; J. Edmund Pierce, New York; Paul T. Gaynor and John O'Leary, attorneys; Edward H. Rockberger. The object of the promoters is to build a speedway 2.25 miles long, modeled after the Indianapolis speedway. Within the main track there is to be a 1-mile speedway for horse races and also a mile track for automobile races. It is claimed that an option on a property has been obtained.

COLUMBUS, O., March 9—Preliminary arrangements are being made by the Columbus Automobile Club for a 2-days race meeting to be held in May, previous to the Indianapolis races, which is expected to attract the best known drivers of the country. The meeting will be held either May 15 and 16 or May 22 and 23 at the Columbus Driving Park. It is planned to hold either a 100-mile or a 200-mile race on the second day of the event. C. C. Janes, chairman of the contest board, has taken up the work of securing about fifteen of the best drivers to participate. The remainder of the program will be made up of shorter distances.

19 Entries for Venice Grand Prix

VENICE, CAL., March 4—The entries for the Venice Grand Prix, to be held on the Venice Parkway, March 17, now number nineteen and represent the automobile racing élite of the country. Entries will be received until noon, March 11. The race management predicts a list of twenty-five cars before the lists close.

The entries made to date include three Maxwells with Barney Oldfield, Eddie Rickenbacher and Billy Carlson nominated Earl Cooper has entered two Stutz machines. The 1913 American road champion will drive his No. 8 and Dave Lewis is to drive his other car.

George R. Bentel of the Pacific Coast Simplex and Mercer agency wired the entry of Louis Disbrow's new Simplex from San Francisco this afternoon and the Mercer trio together with Bentel's Californian are expected as soon as the team returns from San Francisco, where the four cars are entered in the Vanderbilt Cup race.

The Hercules Special, which is also to appear in the 500-mile Indianapolis race with Harold Hall at the wheel, has also been signed up.

Two Chevrolet cars are entered with Jack Lecain and R. C. Durant nominated as drivers. J. Alex Sloan wired a Case entry yesterday and named Eddie Hearne as the probable driver, but it is claimed here by friends of Bob Burman that he has the option of one of the Case cars for the beach city race March 17.

Orville Jones has entered an English Napier and named himself as the driver. J. P. Yates has entered a Neiswender Special and nominated A. A. Cadwell, the former Marmon driver, as the pilot. W. H. Jones has entered the Simplex formerly owned by George Settle. This car is to be driven by Bill Aldridge, one of the greatest amateur drivers in Southern California, who has just turned professional.

A Chalmers and an unknown car entered by wire from San Francisco today by a W. A. A. representative, will be seen.

The Bugatti driven by J. B. Marquis in the San Francisco races has been entered by C. W. Fuller of New York.

Among the entries promised are the Ono, which won third place in the Grand Prix with Hughey Hughes at the wheel; The Parsons Special, entered and driven by Jim Parsons; the King, owned and driven by Arthur Klein; the Gordon Special, which won fifth place at Corona and the two Edwards Specials from San Francisco.

While the postponement worked a hardship upon the Venice race inasmuch as it did not give the drivers a chance to prepare for the faster course in time to be ready for the opening practice at Venice, March 7, it created a great interest in the beach city's Grand Prix, as many of the cars which appeared in the Northern California races did not get a chance to show their speed on account of the course.

A crew of 100 laborers has been at work on the Venice course for the past week, banking the curves to an elevation of 6 feet at the outer edges. Asphaltum is being used on the inside of each curve with lumber on the elevations. While the course is naturally fast, the banked turns give the critics cause to believe that a record will be made which will be in the same class with the mark established by Eddie Pullen with the Mercer at Corona on Thanksgiving Day.

Indianapolis Spring Opening in Full Swing

INDIANAPOLIS, IND., March 8—Under the auspices of the Indianapolis Automobile Trade Assn., the spring opening of automobile and accessory dealers began today and will continue throughout the week. Weather conditions today are ideal and if it continues, there should be a record-breaking attendance.

Each concern is exhibiting in its own place of business, and the decorations in many instances are elaborate. The Gibson Co., for instance, has its sales room decorated to represent a Japanese garden. The down town sales room of the Nordyke & Marmon Co., in addition to being decorated, has an orchestra which will give daily concerts.

There are some sixty different concerns exhibiting. These are showing forty-six makes of gasoline and five makes of electric pleasure cars, twelve makes of trucks and all of the various kinds of accessories.

Dealers and buyers are expected here from all parts of the state, as Indianapolis is the distributing center for Indiana. Many dealers' contracts doubtless will be closed during the week. A number of sales are expected.

A special feature of the week will be the visit of business men to the new assembling plant of the Ford Motor Co. in East Washington street tomorrow afternoon. The plant, a four-story fireproof structure containing 200,000 square feet of space, recently has been completed and placed in operation. The plant expects to assemble 8,300 cars by July 1.

The company will provide 350 Ford cars which will participate in a parade through the down town streets, business men riding in the cars. They will then go to the plant for a trip through it. There will be speeches by Mayor Joseph E. Bell and others. The trip has been arranged by the Indianapolis Chamber of Commerce, who have invited other commercial and civic bodies to join in the demonstration of welcome to the new plant.

Jitney Line Gives 6 Rides for a Quarter

HOUSTON, TEX., March 5—Jitney lines in this city are offering reduced fares. On the Montgomery line there are ten cars called coupon cars, which are to give six rides for a quarter. A sign on the windshield will warn passengers that the cars are coupon cars, which means that with every fare paid a coupon will be given. Five coupons can be exchanged for one ride.

Jitney War On in Tucson

TUCSON, ARIZ., March 5—War is on between the drivers of Tucson jitney cars and the Federal Power & Traction Co., which controls the local street railway system. All Tucson has taken sides. Public sentiment is overwhelmingly in favor of the jitneys.

The most sensational development of the fight was the capture of the midnight car which runs to the University of Arizona. Seventy students chased away the conductor and motorman and with two automobiles towed the car off the track and through the gate onto the campus. No other damage was done the car

At the instigation of the traction company, several jitney drivers have been arrested, charged with violating the traffic ordinance. Most of the cases have been disposed of, the drivers being dismissed.

E. N. Sanderson, president of the company, has filed with the city commission a petition praying for the regulation of the jitney buses He claims that his concern has taken in about $1,000 less than operating expenses since the introduction of five-cent autos last August.

Sanderson's petition asks that the jitneys be required to furnish bond for damages to persons injured in accidents; that they be required to traverse the whole length of any street car line they now parallel in part; that they be compelled to operate on regular schedule and pay a reasonable license fee for the use of the streets.

PORTLAND, ME., March 8—The Jitney Transportation Co. has been granted a certificate of organization to engage in all kinds of transportation by means of automobiles in this city, with a capital stock of $50,000. P. F. Morse is the president.

LOS ANGELES, CAL., March 2—The Los Angeles jitney bus ordinance, which has been hanging fire for several weeks, has been approved by the city council. The ordinance obliges drivers to post an indemnity bond of $5,000 to protect passengers in case of accident. Persons of any nationality or race must be accepted as passengers. The Auto Bus Drivers Assn. made a hard fight on this point, but the council declared that the jitney bus, as a public utility, could make no discrimination against negroes and Chinese.

INDIANAPOLIS, IND., March 5—A bill introduced in the Indiana legislature at the eleventh hour, regulating jitney buses, has been killed. Charges were made that the bill was backed by street railroad companies of the state. It provided that jitney buses should be regulated by the Indiana State Public Service Commission. A bill authorizing the formation of motor car mutual insurance companies also has been killed.

ANN ARBOR, MICH., March 6—The University of Michigan's first short course in highway engineering has been opened with prospects of an average attendance of at least 100 for the semester.

329 Cars and Trucks at Boston Show

(*Continued from page 444*)

ing for $765 incorporating an L-head block 3.25 by 4.5 Perkins motor, Atwater Kent ignition, Disco lighting and starting, a cone clutch, three-speed gearbox mounted on a 106-inch wheelbase with 30 by 3.5-inch tires. It is shown in stripped chassis form and is a good example of low-priced car design.

The National exhibit stands out from the general background rather prominently through the use of a garden-like lattice fence with flowers draped upon it. This surrounds one of the new four-seated boatline bodies. A violet-colored roadster also renders the exhibit distinctive and is an example of the use of unusual shades. Throughout the entire exhibit space will be found examples of this color-display feature. Jackson has a violet touring body with a black hood and black running gear that is an example of contrasting hues on the same car.

Cole is showing a gray car with red wheels, Mercer has a touring car with a dull oil-finish black that appears to be a durable finish for cross-country work. Maxwell is exhibiting a canary-colored roadster with black trimming, a light gray touring car and a cream-colored stripped chassis. Locomobile has a distinctive maroon touring car. Peerless has a town car of café-au-lait shade, with basket-work sides. Winton has a touring car with a cream-colored body finished with a black line around the top of the side and upholstered in green. Another attractive Winton exhibit is a slate-colored touring job. White has a light gray convertible and a touring car having an aluminum finish with black running gear. The Lenox, which is only exhibited at the Boston show, is in the form of a bright red roadster with a polished brass radiator and wire wheels.

The Buick exhibit is another that is distinctive. Separated from the remainder of the exhibit space by a low, brass railed fence is a white roadster which contrasts strongly with the dark background against which it is mounted.

These distinctive color schemes, in spite of their wide variety, harmonize well with the general background of decorative effect. Boston has always boasted of the art displayed in the handling of the show and this year the scenic artists have outdone themselves.

Grecian Decoration Scheme

The scheme of decoration is based on southern Greece in the spring. Entering Mechanics' Building by way of exhibition hall one passes through a Grecian grove formed by more than 100 trees with their branches intertwined. Greek oleanders, azaleas and hedges in combination with the lighting effect produced by thousands of vari-colored electric lamps give a harmonious scheme which in no way conflicts or subdues the exhibits themselves. Grand hall has been made to represent a Grecian court. At the stage end there is a Grecian view shown through the facade of a Greek temple. The rear wall carries a mural painting of the Acropolis. The signs are in glass on white marble pillars. At the intersection of the aisles in Grand Hall there is a temple with its gilded dome studded and surrounded by hundreds of lamps.

Bodies the Feature of Truck Exhibits at Boston

(*Continued from page 445*)

light weight. In this connection it must be understood that the average panel body, constructed more for appearance than utility, is seldom loaded to anything like capacity because of the light weight of the packages and the limited capacity of such bodies.

The body is of unusual width, and equipped with two longitudinal shelves within, providing the maximum carrying space without superimposing packages one upon the other. On the outside, along each side are racks for the accommodation of lengths of matting, carpet and the like. At the front is a seat of unusual width, designed to accommodate the extra helpers often carried to expedite delivery. The entire front of the load-carrying portion is open, permitting the packages to be unloaded from the front.

Another interesting feature of the White exhibit, not in the nature of a body, is the 5-ton six-cylinder tractor-truck. This vehicle is equipped with 48-inch steel wheels in the rear with 12-inch flat steel tires, fitted with removable cone-shaped studs for traction in soft ground. The front wheels are also of steel, 40 inches in diameter and ribbed for steering purchase in loose turf. It is equipped with a standard White steel dumping body.

Other vehicles on exhibit are the Buick, Chase, Garford, G. V. electric and gasoline, I. H. C., Kelly, Kisselkar, Koehler, Lippard-Stewart, Locomobile, Mais, Mack, Milburn electric, Netco, Overland, Pierce-Arrow, Republic, Rowe, Service, Stanley, Stewart, Trumbull, Vim and a Winton.

Factory Miscellany

CONNECTICUT Telephone Adding—The Connecticut Telephone & Electric Co., Meriden, Conn., is adding two stories on one of its present three-story buildings. This will make a building 50 by 100, five stories in height. The past year was the best the company has ever experienced, and up to March 1, 1915, the volume of orders for ignition apparatus alone aggregates more than for any previous year's entire business.

Radiator Co. to Add—The Harrison Mfg. Co., Lockport, N. Y., manufacturer of automobile radiators, will build a $15,000 addition.

Airplex to Move—The Airplex Inner Tire Co., 3147 Locust street, St. Louis, will move its plant to Springfield, Mo., and will increase its equipment.

Newark Body Co.'s New Plant—John Colyer & Co., Newark, N. J., manufacturer of carriages and automobile bodies, will build a factory on Halsey street.

Swinehart Adding—The Swinehart Rubber & Tire Co., Akron, Ohio, is having plans prepared for a three-story reinforced concrete and brick factory addition, 60 by 130 feet.

To Make Portable Garages—C. W. Mower, Spokane, Wash., is planning the erection of a factory at Los Angeles, Cal., for the construction of portable garage and beach houses, to cost $40,000.

Auto Heater's Toronto Factory—A factory for the manufacture of automobile and carriage heaters is to be equipped by the Auto Heater Co. Ltd., Toronto, Ont., which was recently incorporated with capital stock of $150,000.

Rome Co. Mfg. Trucks—W. M. McCormick and M. C. Broach, Rome, Ga., have organized a company with a capital stock of $15,000, to be known as the American Municipal Motor Co. and will erect a plant for the manufacture of motor trucks.

Babcock to Build—The Babcock Automobile Spring Co., 187 Oneida street, Milwaukee, Wis., will erect a brick factory in Milwaukee for production of spring assemblies for automobiles and trucks and also a number of shock-absorbing devices. The factory will be 30 by 100 feet and will be located on Milwaukee street, near Chicago avenue.

Canadian Studebaker Business Good—The Canadian business of the Studebaker Corp. has been increasing at such a rate during the past 3 months that the working force at the plant in Walkerville, Ont., has been increased by more than 200 men. Compared with the first 2 months of 1914 the increase of business has been about 25 per cent. thus far this year.

Trucks Made in Iowa Prison—Warden Sanders of the Iowa state prison at Fort Madison reports that plans are complete and that he now is ready to order materials for the motor trucks which will be built at the prison by the prisoners. He will make several trucks to exhibit to the Iowa legislature so provision can be made to make the motor-truck industry a permanent feature of the work at the prison if the work proves satisfactory. If the plant is established an appropriation must be made.

Prentiss-Wabers Leases Plant—The Prentiss-Wabers Mfg. Co., Grand Rapids, Wis., organized recently with $25,000 capital to manufacture gasoline and oil gauges, auxiliary chairs, motorists' cooking and luncheon sets, etc., has leased for 3 years the former Wipperman table factory at Grand Rapids and will start operations in the near future. The officers of the new corporation are: President, T. A. Taylor; vice-president, D. B. Philleo; secretary and general manager, G. N. Prentiss; general superintendent, H. H. Wabers. Mr. Prentiss is the designer and patentee of the line of articles to be manufactured and comes to Grand Rapids from Racine, Wis.

R. & L. Instrument Co. Formed—The R. & L. Instrument Co. has been organized at Beloit, Wis., to manufacture a unique signaling device for motorists. The device consists of illuminated disks attached to the front and rear of the car and containing two letters, R and L, meaning right and left. A push-button on the steering wheel operates the signal light and the driver is thereby able to indicate to vehicle and pedestrian traffic the direction in which he is about to turn. The new company is capitalized at $25,000 and the incorporators are the patentees, H. D. Ball, Leonard S. Carr, James Keeley and J. C. Floyd. A factory will be equipped for the production of the device at once.

Haynes Adds New Machinery—Five car loads of new machinery have just been received by The Haynes Automobile Co., Kokomo, Ind. The factory is again running 24 hours a day. The crowned fenders which have heretofore been purchased from outside sources will now be made entirely within the Haynes factory, in conformity with the policy of the Haynes company of manufacturing the complete car. The new fender-making equipment consists of presses and rolls for forming the crown or convex surface. The most economical method of producing such fenders is that of rolling the fender proper and pressing the ends. The drop-forging department has also been increased in capacity.

Another New Ford Building—The opening of the new $325,000 Ford branch building in Toronto, Ont., last week added one more large unit to the chain buildings which the Ford Motor Co. of Canada, Ltd., is establishing in the Dominion. Another new building is now nearing completion for the London, Ont., branch, and in the early summer the Ford company will open a $300,000 addition to the main plant at Ford, Ont. The new Toronto building is five stories high and of fireproof construction, the materials being brick and reinforced concrete trimmed with mat glazed terra cotta. The total area of floor space is 132,800 square feet. Part of the building is also devoted to the assembling of new cars manufactured at the factory in Ford, Ont.

(Continued on page 481)

The Automobile Calendar

Mar. 6-13	Boston, Mass., Show, Mechanics Bldg., Boston Auto Dealers Assn., Boston Commercial Motor Veh. Assn.
Mar. 6-13	Savannah, Ga., Show, De Soto Hotel.
Mar. 6-13	New York City, Made in the U. S. A. Exhibition, Grand Central Palace.
Mar. 8-13	Indianapolis, Ind., Annual Spring Opening, Indianapolis Auto Trade Assn.
Mar. 8-13	Des Moines, Ia., Show, C. G. Van Vliet.
Mar. 8-13	Utica, N. Y., Utica Automobile Trade Assn.
Mar. 13-20	Harrisburg, Pa., Show Arena, Harrisburg Dealers' Assn.
Mar. 14	San Francisco, Cal., Panama-Pacific Cup Race, Panama-Pacific Exposition Grounds; Promoter, Panama-Pacific Exposition Co.
Mar. 17	Venice, Cal., Cal. Grand Prix, 300-Mile Road Race.
Mar. 17-20	Elgin, Ill., Show, W. H. Tidmarsh, Mgr.
Mar. 22-27	Bangor, Me., Show, Bangor Auditorium.
Mar. 22-27	Newark, O., Show, Arcade Bldg.
Mar. 24-27	Oil City, Pa., Show, New Armory.
Mar. 25-27	Mason City, Ia., Show, New Armory.
Mar. 30-April 2	Johnstown, Pa., Show, The Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
April 5-10	DuBois, Pa., Show, Moose Hall.
April 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
April 20-22	Oklahoma City, Okla., Road Race, S. W. Auto Racing Assn.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4-5	Tacoma, Wash., Road Race.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.

The Week in the Industry

Motor Men in New Roles

DOOLITTLE Zenith Advertising Mgr.—A. H. Doolittle has sold the A. H. Doolittle Advertising Service to the Louis A. Pratt Advertising Co., 401 Ford Bldg., Detroit, Mich., and is now sales and advertising manager of the Zenith Carbureter Co., whose advertising campaign he has handled for some time. Mr. Doolittle was formerly advertising manager of the Knox Motor Car Co., and of the Continental Motor Mfg. Co.

Bland Resigns—Harry Bland has resigned as president and secretary of the Blue Ribbon Garage, Springfield, Mass.

Pore Ford Sales Manager—O. E. Pore is sales manager of the Roberts-Toledo Auto Co., Ford dealer in Toledo, O. Mr. Pore succeeds H. W. Lancashire.

Hamilton Locomobile Exchange Car Mgr.—The Locomobile Co. of America has appointed H. S. Hamilton, manager of the exchange car department of the New York City branch.

Kenney King Factory Manager—W. C. Kenney has been promoted factory manager of the King Motor Car Co., Detroit, Mich., in place of T. A. Bollinger, who has resigned to go into business for himself.

Michigan Crown Offices Moved—The offices of the Michigan Crown Fender Co., Ypsilanti, Mich., have been moved to Detroit, Mich., where the headquarters are in the Kerr building, East Fort street.

Townsend Reo Sales Mgr.—W. F. Townsend has been appointed sales manager of the E. C. Johnson Motor Co., Broad and Spring Garden streets, Eastern distributors of the Reo, in Philadelphia, Pa.

Gaidzik Jeffery Foreign Representative—G. W. Gaidzik has joined the Thomas B. Jeffery Co., Kenosha, Wis., as a special foreign representative. He will represent the Jeffery Quad in Chile, having left for Iquique on February 27.

Helsing Moon Purchasing Agent—G. F. Helsing, recently appointed chief engineer of the Moon Motor Car Co., St. Louis, Mo., succeeding L. F. Goodspeed, is now head executive over the engineering and purchasing departments of that company.

Palmer Heads Pontiac Chassis—The Pontiac Chassis Co., Pontiac, Mich., has been organized with a capital stock of $100,000 to make automobile chassis. R. A. Palmer, until recently president of the Consolidated Car Co., is at the head of the new concern.

Berau Philadelphia Briscoe Manager—H. G. Berau, formerly Eastern supervising manager of the old Maxwell-Briscoe Motor Co., has been appointed manager of the retail department of the Briscoe Motor Distributing Co., 2033 Market street, Philadelphia, Pa.

Holihan Joins McCord—J. A. Holihan, formerly of the Briscoe Mfg. Co., and the Holihan Mfg. Co., Detroit, has joined the staff of the McCord Mfg. Co., Detroit. The Holihan Mfg. Co. has appointed William Christian as general manager in place of Mr. Holihan.

Mellish with Harrolds Co.—J. A. Mellish, for several years manager of the exchange car department of the Locomobile Co. of America, has resigned his position with that company and joined the sales force of the Harrolds Motor Car Co., distributor for Pierce-Arrow automobiles.

De Sautels Heads Detroit Office—An office will be opened in Detroit, Mich., by the Hammond Steel & Forging Co., Syracuse, N. Y. De Sautels, until recently with the Anderson Drop Forge Co., has been appointed western representative of the company in charge of the Detroit office.

Martindale Establishes Plant—F. N. Martindale, Indianapolis, Ind., has established a factory at Franklin, Ind., for the manufacture of the ultimotor, which he recently perfected. The ultimotor is a motor which may be attached to any horse-drawn vehicle, thus converting it into a motor vehicle.

Rogers Joins Marmon—A. J. Rogers has joined the forces of Nordyke & Marmon Co., Indianapolis, Ind., as head of the sales-service department and will give sales and advertising co-operation to Marmon dealers. Mr. Rogers was formerly manager of the Remy Electric Co.'s New York City office and later with the Jones Electric Starter Co. in Chicago.

Garage and Dealers' Field

Mahan Has S-P Vaporizer—George H. Mahan, for a long time in the motor oil field in New England, has taken the agency for the S-P vaporizer with headquarters at 32 Oliver street, Boston, Mass.

Fisk Agency in Duluth—An agency will be opened in Duluth, Minn., by the Fisk Rubber Co., and Fred W. Neumann, who has been manager of the Duluth Auto Supply Co., during the last four years, will be in charge.

Seattle Pullman Moves—The Parker Motor Car Co., distributor of the Pullman car throughout the Northwest, has leased a new home at 1507-9-11 Broadway, Seattle. Agencies throughout the territory are being established.

O. K. Tire on Market—The O. K. Tire Co., with salesrooms in San Francisco, Cal., and a factory at Oakland, Cal., is now building automobile tires. M. F. Oliver is the manufacturer and Austin Kangee the sales manager of the new concern.

Pennsylvania Rubber Moves in Detroit—The Detroit, Mich., branch of the Pennsylvania Rubber Co., now located at 254 Jefferson avenue, will be moved to 864 Woodward avenue about April 1. This is the former home of the B. F. Goodrich Rubber Co.

Will Handle Sparton Advertising—The Sparks Withington Co., Jackson, Mich., manufacturer of the Sparton horn and other products, is about to enter upon an extensive advertising campaign. This advertising will be handled by the Taylor-Critchfield Clague Co., Chicago, Ill.

Firestone Makes Omaha Lease—The Firestone Tire & Rubber Co. has leased a piece of ground 38 by 140 feet, at Farnam and Twenty-sixth streets, Omaha, Neb., and has contracted for a three-story and basement building to house its local salesrooms and offices.

Goodyear Factory Branch in Tacoma—Tacoma, Wash., is to have a direct factory branch for the distribution of Goodyear tires. Quarters have been secured at 774 Commerce street. C. B. Reynolds will be manager of the new house and J. H. McDiarmid, traveling representative.

Shipping Scripps-Booth Cars to Italy—The first shipment of Scripps-Booth cars was sent recently to Naples, Italy, to H. J. Holder, continental Europe factory representative. Mr. Holder will cover as many of the important European cities as possible in a Scripps-Booth car and will establish agencies en route.

Detroit Diamond Locates—Elmer W. Brown & Co., Detroit, Mich., recently organized to handle automobile supplies are now located at 967 Woodward avenue. The company has been appointed distributor for the Diamond tires. E. W. Brown is president; O. H. Dawson, vice-president and C. Rasmussen, secretary-treasurer.

Secure Osgood Deflector Agencies—H. B. Beattie & Co., 719 North Broad street, Philadelphia, Pa., and L. B. Wagner, 2917 Susquehanna avenue, Philadelphia, Pa., have secured the agency for Philadelphia and adjacent territory of the Osgood glass deflector, a one-piece patented glass prismatic lens.

Seattle Clearing House Opened—W. B. LaMay, for many years connected with the Anderson Electric Co. of Michigan, has located in Seattle, Wash., and opened an automobile clearing house at 1708 Broadway under the firm name of the Auto Clearing House, and its activities will be confined to buying and selling second-hand machines.

Columbus Maxwell Holds Banquet—The Maxwell Motor Sales Corp., through its Columbus, O., representative, the Everitt Auto Sales Co., tendered a banquet to about fifty sub-dealers in Ohio territory at the Virginia Hotel, Columbus, recently. L. F. Smith, district manager, who has been promoted to a position in New York territory, was one of the guests of honor. W. H. Lolley has been made the new district manager and he has opened headquarters in rooms 431-435 Columbus Savings & Trust Bldg.

Motor Car Mfg. Increases Population—Attributable mainly to the motor car business of the city, Kenosha, Wis., is now the seventh city of Wisconsin, having risen from ninth place in 1913 and thirteenth place in 1910. The present population is 29,062, as of July 1, 1914, according to the estimates of the federal census bureau. Milwaukee is credited with 419,054 population and Racine is now in second place with 44,528, having distanced Superior, for 15 years the second city, which now has 44,344 people. Racine as well as Kenosha, credit the motor car manufacturing business and allied industries for the gains.

Recent Incorporations in the Automobile Field

Arkansas

EUREKA SPRINGS—Auto Service & Supply Co.; $14,000; dealer. F. B. and B. M. Stowe, J. A. and E. E. Monagan.

California

SAN FRANCISCO—Spring Hub Automobile Wheel Co.; $200,000; manufacturer. W. T. Kearney, 681 Market street, San Francisco; E. Kreh, C. Westermann.

Connecticut

WATERBURY—Field & Feydt; $50,000; automobile manufacturer. R. C. Field, H. G. Feydt, both of Waterbury; A. H. Dayton, Naugatuck, Conn.

Delaware

WILMINGTON—Federal Motor & Mfg. Co.; $100,000; manufacture automobiles. R. B. Owen, B. Buehner, W. F. A. Buehner.

WILMINGTON—Flexible Traction Motor Truck Co.; $500,000; to build motor trucks. F. A. Conkling, Brooklyn; H. W. Brooks, W. J. Watson, New York City.

WILMINGTON—National Service Corp.; $100,000; manufacture and sell automobiles and allied appliances. C. J. Jacobs, C. H. Bishop, H. W. Davis.

WILMINGTON—Rapid Seal Distributing Co.; $100,000; manufacture of puncture healing liquids for tires. J. A. Vogel, H. H. Loose, G. W. Collins.

Georgia

ATLANTA—Atlanta Auto. Transit Co.; $10,000. J. F. Hazelton, Nelson Schippey, C. R. Linden.

AUGUSTA—Independent Motor Co.; $2,000. Henry Prontaut, W. R. Eve, A. B. Prontaut.

Idaho

AMERICAN FALLS—American Falls Auto Co.; $25,000; garage. Benjamin Adof, A. W. Davis, J. L. McKown.

Illinois

AURORA—Egermann Motor Sales Co.; $8,000; dealer. W. A. Egermann, S. L. Staley, W. O. Shipple.

BLOOMINGTON—Trott & Stubblefield Co.; $20,000; manufacturer of automobiles and motor trucks. E. C. Trott, L. W. Stubblefield, D. O. Hemenover.

CHAMPAIGN—Motor Sales Co.; $1,000; garage and dealer. R. S. Bassett, E. B. Bassett, Elmer Dillon.

CHICAGO—Berlin Motor Co.; $2,500; manufacturer and dealer in machinery, tools and automobile parts. T. W. Prindeville, A. J. Schmidt, J. D. Daly, 30 North LaSalle street.

CHICAGO—Davis Electric Equipment Co.; $2,500. E. S. Davis, J. E. Waters, I. G. Wooden.

CHICAGO—Federal Motor Truck Co.; $10,000; manufacturer and servicing of motor trucks. M. L. Publnor, E. R. Lightcap, J. F. Brown.

CHICAGO—Johnson Variable Speed Gear Co.; $25,000; manufacturer automobile equipment and specialties. C. E. Sullivan, C. A. Johnson, O. C. Olesen.

CHICAGO—Rex Portable Garage Co.; $300; general manufacturing and construction. F. E. Warner, Clyde Stewart, J. R. Guthrie.

LA SALLE—Central Garage of La Salle; $50,000; L. B. Stever, L. Klee, E. S. Schurr.

PEORIA—Peoria Tractor Co.; $60,000; manufacture tractor engines. G. McFarland, C. F. Loomis, E. M. Smith.

Indiana

CONNERSVILLE—Connersville Taxi Co.; taxi business. Grant George, H. W. Williams.

INDIANAPOLIS—Adjustable Auto-Shoe Co.; $10,000; manufacturer. W. A. Parr, L. O. Gillaspy, G. E. Parr.

INDIANAPOLIS—Auto-Matic Lighter Co.; $10,000; accessories manufacturer. C. E. Haviland, E. W. Infield, O. J. Bowlder.

INDIANAPOLIS—I. J. Cooper Rubber Co.; $20,000; tire dealer. I. J. Cooper, A. D. Stocker, H. H. Brenner.

INDIANAPOLIS—Cole Sales Co.; $10,000; dealer. J. F. Minthorne, H. C. Lathrop, A. P. Conklin.

INDIANAPOLIS—Gibson Automobile Co. changed to Gibson Co.

INDIANAPOLIS—Henricks Novelty Co. to Henricks Magneto & Electric Co.

Iowa

CEDAR RAPIDS—L-Ty-To Co.; $10,000; manufacturer tire trouble remedy.

Kentucky

FORT THOMAS—Highland Auto Garage Co., $10,000. C. W. Evans, F. B. Siegeman, R. S. Moore, H. L. Jeffrey.

LOUISVILLE—Banner Transportation Co.; $8,000. J. L. Marshall, J. D. Marshall, W. T. Lewis.

LEXINGTON—Jitney Service Co. of Ky.; $3,500. R. M. Cunningham, F. A. Jack, C. W. Koerner.

LOUISVILLE—Grant Mfg. Co.; $9,000; chemical manufacturer and automobile specialties. A. C. Grant, R. E. Simms, J. L. Lenihan.

Maine

KITTERY—Triplex Inner Tube Co.; $200,000; to manufacture and deal in inner tubes, tires, etc. H. Mitchell, H. A. Paul.

PORTLAND—Gillette Safety Tire Co.; $1,000,000; manufacturer. A. E. Jones, T. L. Croteau, A. R. Farnham, C. G. Trott, J. P. O'Donnell, J. R. Griffin.

Michigan

ADRIAN—Maple City Specialty Co.; $10,000; dealer in automobile accessories. B. E. Giles, R. Cushing.

DETROIT—American Motor Sales Co.; $6,000; dealer. J. C. Pennell, Hanley Dawson, E. E. Sullivan, R. C. Pennell.

DETROIT—Bell Pump & Mfg. Co.; $20,000; to manufacture automobile tire pumps. B. W. Bue, H. L. Morton, M. E. Oakley.

DETROIT—Dadro Auto Service Co.; $1,500. C. Waters, F. Connell, W. C. Farrington.

DETROIT—Detroit Tapering Radiator Co.; $25,000; manufacturer. J. A. and M. S. Moross, H. C. and R. C. Loring.

DETROIT—Magee Sheet Metal Machinery; $20,000. W. R. and D. R. Magee, F. W. Atkinson.

DETROIT—Pilgrim Motor Co.; $200,000; manufacturer automobiles. C. H. Lutz, W. H. Radford, L. C. Welford.

DETROIT—F. H. Primeau Co.; $10,000; garage. F. H., J. B. and J. B. Primeau, Jr.

DETROIT—Schneider Electric Co.; $5,000. G. Schneider, L. Fetes, Jr., A. L. Cook.

DETROIT—Scripps Motor Co.; $250,000; manufacturer. R. V. Warman, A. J. Downey, T. F. W. Meyer, W. E. Scripps.

DETROIT—Wolverine Bus Co.; $6,000; jitney bus line. M. M. Wolff, Eli Cohen, Florence Wolff.

DETROIT—Wolverine Winter Top Co.; $2,000; manufacturer. J. E. Murphy, H. H. Creamer, G. F. Monahan.

FLINT—Hort Motor Car Co.; $500,000; manufacturer. F. A. Aldrich and others.

GAGETOWN—Meyers Hoffman Co.; $50,000; to manufacture contrivance invented by C. E. Meyers, 73 Rosedale court, which is claimed to be puncture proof.

GRAND RAPIDS—Grand Rapids Saxon Co.; $5,000; dealer.

JACKSON—Frost Gear & Forge Co.; $300,000 to $400,000.

LANSING—American Double Service Tire Co.; $3,000; dealer. Hanley Dawson, J. G. Pennell, R. C. Pennell.

Minnesota

MINNEAPOLIS—Shotwell-Harris Co. changed to Shotwell-Hobart-Johnson Co.

Mississippi

JACKSON—Jackson Jitney Car Co.; $2,000. A. C. Smith, L. C. Heuning, S. J. Myers, W. G. Johnson.

Missouri

CHILLICOTHE—Adams Automobile & Supply Co.; $25,000; dealer. C. F. Adams, R. F. Adams, C. A. Adams, T. J. Grothe, A. J. Cole.

KANSAS CITY—Kansas City Motor Bus & Transportation Co.; $2,000. E. C. Belg, J. A. Daniels, S. P. Daniels.

KANSAS CITY—Packard Auto Co.; $5,000; dealer. J. H. White, J. A. Kelly, J. R. Neale.

KANSAS CITY—Summers Motor Devices Co.; $5,000. W. E. Robbins, C. E. Summers, C. E. Adams.

ST. LOUIS—Detroit Electric Car Co. of Mo.; $2,000; dealer. M. B. Strauss, C. D. Long, C. M. Rice.

North Dakota

FARGO—Red River Automobile Supply Co.; $25,000; to job automobile supplies. J. O. Dahl, H. E. Day, R. E. Robinson.

New Jersey

BAYONNE—Air Spring Tire Co.; $250,000; manufacturer. J. D. Milne, W. E. Meyer, E. H. Hintz, W. G. Smith, Jersey City.

CAMDEN—Johnson Rose Auto Co.; $10,000; dealer. Neff Johnson, F. A. Rose, James Kershaw, B. F. Savage, F. G. Homan.

EAST ORANGE—Chevrolet Motor Co. of New York; $100,000; dealer. W. C. Durant, W. W. Murphy.

EAST ORANGE—Motor Sales Agency of the Oranges; $25,000; dealer. H. F. Herdman, A. F. Herdman, A. T. Muir.

EDGEWATER PARK—Edge Auto Devices Co.; $25,000; accessory manufacturer. M. D. Earl, B. W. Earl, F. H. Monels.

NEWARK—Automobile Tire Cooler Co.; $500,000; manufacturer. D. Hall, A. Lindsley, C. C. Leonard.

NEWARK—Estes Airless Tire Co.; $50,000; manufacturer. M. F. Amorell, B. F. C. Rothwell, M. J. C. Walter, Newark.

NEWARK—Gibraltar Tire and Tube Co.; $100,000; manufacturer. H. L. Brown, R. Bradshaw, R. Brown.

NEWARK—Self-Raising Seat Appliance Co.; $100,000; manufacturer automobile, mechanical, electrical, etc., stools, devices and appliances. S. M. Eisner, L. Lauer, O. W. Jackson.

PATERSON—W. H. Richardson Co.; $50,000; to manufacture motor vehicles. W. H. Richardson, C. H. Richardson, B. J. Burke.

PLYMOUTH—International Wire Tire Co.; $1,000,000; manufacturer. J. S. Lyons, G. T. Brown, T. A. Zukoski, Plymouth.

TRENTON—Auto Salvage & Sales Corp.; $50,000; dealer. R. O. Foust, H. P. Clymer, T. C. Moore.

TRENTON—Globe Rubber Tire Mfg. Co.; $650,000; to manufacture tires. W. H. Linburg, J. S. Broughton, H. L. Joyce.

TRENTON—Three Star Tire Co.; $50,000; manufacturer. E. H. Steel, A. F. Updike, D. G. Whitehead.

TRENTON—West End Garage & Machine Co.; $25,000. E. G. Hancock, C. E. Hancock, W. T. Johnston.

New York

ALBANY—Consalus Tire Co.; $15,000; dealer. V. E. Consalus, M. A. Consalus, 432 Clinton ave., E. W. Sanford.

ALBANY—Gordon Motor Truck Co.; $3,000. J. H. Gordon, C. F. Gordon, G. M. Gordon, all of 12 Second street.

BAY SHORE—Bay Shore Motor Sales Co.; $5,000; dealer. C. M. Hart, C. F. Hart, A. B. Capron, Bay Shore.

BRIGHTON HEIGHTS—New York City; Brighton Heights Garage of Staten Island; $2,000. C. A. Furlong, Annie Furlong, H. J. Furlong, 214 Highland Boulevard, Brooklyn.

BRONX—Champion Electric Mfg. Co.; $50,000; electrical devices for automobiles. Mauro Lamparelli, 2312 Hughes avenue, Bronx; Salvatore Scognamillo and Frank Scognamillo.

BROOKLYN—Auto Towing & Supply Co.; $1,500; to rent cars for towing purposes and to conduct garage. G. H. Seeth, W. F. Seeth, C. E. Hiscox, 1121 Bedford avenue, Brooklyn.

BROOKLYN—Bay Ridge Rubber Corp.; $6,000; manufacturer inner tires. M. Seltzer, 215 1st ave., N. Y. City, M. DeWaltherriff, Florence Wimple.

BROOKLYN—Dean Garage; $1,000. F. L. Johanns, P. J. Howard, C. E. Fiske, 20 Fort Greene Place.

BROOKLYN—Dunham & Black; $15,000; dealer. J. G. Stockton, 458 Prospect Pl., Brooklyn; F. G. Dunham, Allan Black.

BROOKLYN—Eveready Tire & Rubber Co.; $40,000; tire manufacturer. W. J. Woodcock, F. W. Woodcock, 102 Gates avenue, Brooklyn; A. W. Norwalk.

BROOKLYN—Hancock Garage and Repair Co.; $6,000. J. P. Murray, Fred Hofmann, A. Brauner, 1314 Stebbins av., Bronx.

BROOKLYN—Hart Waterproof Mfg. Co.; $15,000; manufacturer waterproof automobile slip covers. J. H. Hart, J. F. Hart, 900 Jamaica avenue, Brooklyn; E. E. Berry.

BROOKLYN—Incas Automobile Co.; $5,000; dealer. J. H. Eckhoff, Jr., 835 Union street, Brooklyn; Malcolm McPhail.

BROOKLYN—Norman Tire Repair & Supply Co.; $2,000; dealer. P. Hind, W. Hind, 685 Manhattan avenue, Brooklyn; W. H. Preston.

BROOKLYN—Nonpareil Garage, Inc.; $5,000. J. E. Kerr, Henry Redelsheimer, Samuel Goldberg.

BROOKLYN—S. & K. Oil & Gasoline Co.; $5,000. N. H. Kramer, S. Schenkel, L. J. Kaufman, 591 Bedford avenue.

BROOKLYN—Stuyvesant Heights Motor Car Service; $1,000. V. Fogler, J. Fogler, 73 Stuyvesant; J. F. Broeck.

BROOKLYN—Uno Garage Co.; $1,000. H. D. Bristol, F. W. Shaw, both of Oceanside, N. Y.; Carlo Rossa.

BROOKLYN—Williams Taxicab Co.; $1,200. G. D. Williams, J. F. Diaken, Felix Braguglia, 1404 59th street, Brooklyn.

BROOKLYN—Williams & Tschanz Auto Co.; $1,000. R. Tschanz, A. Tschanz, 640 Prospect Pl.; E. Williams.

BROOKLYN—I. Zagon & Co.; $2,000; dealer. I. Zagon, R. Zagon, 104 Bay 25th street, Brooklyn; Jacob Glassir.

BUFFALO—Buffalo Automobile Spring Co.; $10,000 to $25,000.

BUFFALO—Iroquois Garage; $2,500. E. D. Emerson, C. C. Page, F. J. Handel.

BUFFALO—Kay-See Motor Service Corp.; $15,000; dealer. H. B. Parry, A. E. Bargar, E. L. Marshall.

BUFFALO—Motor Express & Sales Corp.; $600,000; general cartage, transfer and express business. J. G. Berner, J. T. Mooney, Buffalo.

BUFFALO—Sinscott Motor Sales Co.; $10,000; dealer. D. E. Knowlton, R. A. Kellogg, P. A. Sullivan, 535 Ellicott sq.

CENTER MORICHES—Center Moriches Garage; $5,000. J. S. Robert, J. S. Penney, Clarence C. Ross.

EDDYVILLE—Almirall & Co.; $200,000; manufacturing automobile fire extinguishers. J. A. Almirall, W. C. Adams, W. J. Wood, 1 Dominick street, New York City.

HOPEWELL JUNCTION—Clove Branch Shop; $5,000; garage. W. A. Martin, Frank Schler, L. M. Woodruff, 160 West 143d street, New York City.

MAYVILLE—Mayville Hardware & Garage Co.; $25,000. A. H. Brace, Harry Arnold, S. E. Swetland.

MIDDLETOWN.—Lion Sales Co., $5,000; dealer. R. F. Finch, C. M. Breiner, E. A. Heffernan.

NEW YORK CITY—Advance, Alert Auto Co.; $3,000. G. Reif, 108 W. 43d street; E. M. Lichter, M. A. Murray.

NEW YORK CITY—Diamond Carburetor Co.; $100,-dealer. J. M. Baum, C. M. Rosenthal, Max Horowitz, all of 35 Nassau street.

NEW YORK CITY—Auto Trunk and Acme Suit Case Mfg. Co.; $10,000. Julius Schwartz, 1010 Eastern Parkway, Brooklyn; B. Ammerman, A. Zieve.

NEW YORK CITY—Broadway Auto Body Co.; $5,000; dealer. K. Dorjath, J. Licz, E. Grebert, 1026 Broadway.

NEW YORK CITY—Dale Auto Supply & Accessory Co.; $25,000; manufacturer motors, appliances, etc. B. Schane, A. L. Schane, D. L. Schane.

NEW YORK CITY—Diamond Carbureter Co.; $100,000; manufacturer. E. C. Cox, 508 W. 135th street; G. B. Read, August Spindler.

NEW YORK CITY—Economical Garage; $10,000. P. J. Holdsworth, 252 W. 69th street; H. R. Miller, C. A. Miller.

NEW YORK CITY—Economical Tire & Supply Co.; $10,000; dealer. G. Rauchfuss, 1904 Broadway; T. F. MacMahon, A. T. Heimborg.

NEW YORK CITY—Flaum Shock Absorber Corp.; $20,000; manufacturer. S. M. Halper, Julius Flaum, 175 Hudson street; J. E. Duross

Automobile Agencies Recently Established

PASSENGER CARS

Ohio

Dayton	Ford	Dayton & Troy Automobile Co.
Delaware	Regal	Griffith & Cone
Delaware	Oldsmobile	L. H. Carpenter
Delphos	Oldsmobile	Mox Motor Co
Dennison	Haynes	City Auto Co.
E. Palestine	Oldsmobile	M. E. Newhauer
Elyria	Haynes	Elyria Garage Co.
Findlay	Haynes	Castle's Garage
Fremont	Overland	Palace Garage
Greenville	Haynes	W. E. Brown
Greencamp	Regal	R. C. McClelland
Grove City	Regal	E. Emmelheinze
Hillsboro	Maxwell	Hillsboro Motor Car Co.
Jeffersonville	Regal	Guy Carr
Lake	Oldsmobile	Windermere-Euclid Garage Co
Leipsig	Westcott	Dallas Kirk
Lima	Lewis	Shappell Bros
Logan	Haynes	J. S. Case
London	Regal	A. O. Hicks
Lynchburg	Regal	A. R. Pratt
Marion	Regal	U. G. Lawrence & Son
Massillon	Haynes	The Motor Car Sales Co.
Massillon	Oldsmobile	The Miller Garage
Newark	Regal	J. E. Owens
Seville	Haynes	I. M. Overholt
Sidney	Regal	B. D. Heck
Springfield	Regal	B. H. Brunton
Toledo	Argo	H. Francke
Toledo	Kissel	Bunnell Auto Sales Co.
Toledo	King	Litchie Auto Co.
Toledo	Franklin	Standard Garage
Toledo	King	Litchie Auto Co.
Wapakoneta	Overland	J. W. Ellicott
West Jefferson	Regal	W. H. Pence
Williamsport	Haynes	J. Schleick
Xenia	Buick	M. H. Schmidt

Oklahoma

Bartlesville	Moon	R. G. Uhl
Bartlesville	Moon	R. G. Uhl & Son
Cordell	Krit	C. H. Murdock
Cordell	Saxon	C. H. Murdock
Oklahoma City	King Eight	Stapleton Motor Sales Co
Oklahoma City	Oldsmobile	Acme Motor Car Co.
Oklahoma City	Saxon	Fremont Motor Co.
Tulsa	Haynes	Okla-Haynes Auto Co
Tulsa	Dodge Bros	E. Westerman

Oregon

Portland	Chandler	Dulmage Manley Auto Co.

Pennsylvania

Beaver Falls	Herff-Brooks	G. S. Hunter
Chambersburg	Chandler	J. Caulman
Clearfield	Haynes	Wallace Garage
Curtisville	Kissel	N. M. Snyder
Hazelton	Haynes	Adam Aldam
Hazelton	Regal	Spruce St. Garage
Horsham	Westcott	T. W. Tyson
Latrobe	Oldsmobile	Rose & Steele
Mt. Union	Herff-Brooks	F. H. Culver
Philadelphia	Maxwell	Sterling Motor Car Co
Philadelphia	Briscoe	The Gibson Auto Wks
Philadelphia	Briscoe	Ideal Motor Car Co
Pottsville	Haynes	Joseph Davenport
Saltsburg	Oldsmobile	J. W. Woodend
Scranton	Regal	Conrad Bros.
Tamaqua	Haynes	Tamaqua Auto Garage & Repair Co.

South Dakota

Aberdeen	Haynes	T. E. Payne
Deadwood	Oldsmobile	G. Kilker Garage & S. House
Emery	Haynes	J. P. Reighling
Hudson	Haynes	S. F. Hoffman

Tennessee

Knoxville	Franklin	Kuhlman Motor Sales Co.
Nashville	Cadillac	Cadillac Sales Co. of Nashville

Texas

Corsicana	Saxon	L. H. Lee
Dallas	Saxon	Saxon Sales Co.
El Paso	Chandler	Lone Star Motor Co.
Lockhart	Moon	E. H. Lipscomb

Utah

Logan	Dodge Bros	Blair Motor Co
Logan	Ford	Kimball Auto Co
Logan	Buick	Blair Motor Co.
Ogden	Cadillac	Cadillac Sales & Service Co.
Richmond	Oldsmobile	Bair Auto Co.
St. George	Oldsmobile	E. H. Snow
Salt Lake City	Metz	A. A. Sims

Vermont

Brandon	Herff-Brooks	F. R. Barker

Virginia

Chilhowie	Oldsmobile	J. L. Vance & Co
Eastville	Oldsmobile	Eastville Auto Co.
Staunton	Oldsmobile	J. H. Schultz

Washington

Cottonwood	Overland	O. D. Simmons
Fairbanks, Alaska	Hudson	Roy Rutherford
Lynden	Maxwell	A. A. Bausman
Malden	Maxwell	L. F. Rohleder
Rosalie	Overland	Snyder & Fullerwood
Seattle	Pilot	Batager & Stratton
Seattle	Hudson	Northwest Motor Co.
Seattle	Oakland	Mack & Fornsworth
Spokane	Reo	E. R. Foellck
Steptoe	Maxwell	T. A. Bennett
Tacoma	Dodge Bros.	Griffith Motor Co
Tacoma	Studebaker	Cadillac Auto & S. Co
Thornton	Hudson	G. F. Hodgson
Thornton	Maxwell	T. A. Bennett
Walla Walla	Buick	T. S. Steele & Co
Wilbur	Paige	T. F. Miller

West Virginia

Wheeling	Dodge Bros	H. S. Sands Elec. & Mfg. Co.
Marlinton	Haynes	C. H. Copenhaver

Wisconsin

Belgium	Maxwell	Hubing & Husting
Belgium	Ford	Hubing & Husting
Black River Falls	Overland	T. Tollac
Black River Falls	Ford	O. C. Flugstad
Cedarburg	Dodge Bros	Roebken Bros
Chippewa Falls	Dodge Bros	M. Cameron
Clinton	Buick	Terwilliger & Son
Clinton	Dodge Bros	Terwilliger & McCommons
Columbus	Ford	Schunk & Procter
Crandon	Ford	S. Raymond
Delavan	Overland	C. H. Burns
Delavan	Ford	C. H. Burns
Delavan	Ford	C. J. Quinn
Eau Claire	Haynes	Johnson Mch. Works
Eau Claire	Oldsmobile	Darwin Motor Car Co.
Gillett	Buick	C. F. Kitzinger
Hancock	Overland	Jones & Pierce
Hillsboro	Oldsmobile	Picha Brothers
Iola	Overland	Swenson & Rosholt Garage
Iola	Ford	Swenson & Rosholt Garage
Iola	Case	Swenson & Rosholt Garage
La Crosse	Paige	J. Nieetz
Lake Mills	Studebaker	F. M. Seaver
Madison	Overland	Park Motor Co.
Madison	Cole	Park Motor Co
Milwaukee	Velie	Wait Auto Co
Milwaukee	Moline	Wait Auto Co.
Milwaukee	Detroiter	Milwaukee Motor Sales Co.
Milwaukee	Moon	Durbin-Thomson Co., Ltd.
Milwaukee	Abbott	Intersection Garage Co
Milwaukee	Chevrolet	Wells Garage Co
Milwaukee	Monroe	Wells Garage Co
New Richmond	Ford	B. & W. Garage
Pella	Haynes	F. A. Cronkoph
Prairie du Sac	Dodge Bros	Lloyd Tarnutzer
Rhinelander	Ford	Oneida Garage Co.
Rhinelander	Pattn Palmer	Roland Scheibe
Sheboygan	Cole	H. Struebing Garage
Sheboygan	Ford	Gillette Motor Co
Sheboygan	Sphinx	H. Struebing Garage
Sparta	Oldsmobile	E. D. Brown
Spring Green	Glide	L. F. Wells
Sun Prairie	Dodge	E. F. Beers & Co.
Tomah	Oldsmobile	L. G. Guenther
Two Rivers	Dodge Bros	O. Winkelmiller
Wautoma	Overland	A. Cutts
Westby	Oldsmobile	Hanson & Nustad
Whitehall	Oldsmobile	Auto Sales Co.

Wyoming

Rock Springs	Oldsmobile	West Central Auto Co.

COMMERCIAL VEHICLES

Alabama

Birmingham	Denby	T. E. Morris, Jr.

California

Los Angeles	Republic	Mack Motor Truck Co

Connecticut

New Haven	Denby	J. McLay

Florida

Miami	Denby	L. A. Jones Garage

Georgia

Augusta	Koehler	Speth Garage & Sales Co
Atlanta	Signal	Signal Truck Co.
Macon	Koehler	W. E. Cookerly
Savannah	Koehler	J. C. Lamb Auto Repair Co.

Illinois

Bloomington	Koehler	C. F. Williams Son & Co
Chicago	Signal	Siegmund-Baylies Truck Co.

Iowa

Greenfield	Koehler	Coffey & Irwin

Kentucky

Franklin	Koehler	Franklin Hdw. Co.
Lebanon	Koehler	Lewis & Drye
Louisville	Denby	Yager Motor Car Co.

Maryland

Baltimore	Koehler	L. M. Vordemberge

Massachusetts

Beverly	Denby	E. F. Sullivan
Boston	Denby	Denby Motor Truck Sales
Boston	Koehler	Adalian Brothers
Falmouth	Koehler	Crocker Garage
N. Cambridge	Signal	Henderson Bros
Southbridge	Koehler	Weld & Beck

Michigan

Detroit	Denby	Transportation Eng'r Co.

Missouri

St. Louis	Signal	Best Service Truck Co

Nebraska

South Omaha	Koehler	Holmes Adkin Co

New Jersey

Newton	Koehler	Wm. Iliff
Paterson	Koehler	G. & A. Bell

New York

Auburn	Denby	Ross Automobile Co.
Buffalo	Denby	F. A. Lobee & Son
Hamburg	Denby	D. W. Broadbeck
New York	Denby	Markt & Hammacher
New York	Denby	Thomson & Co.
New York	Denby	Walter Stevens & Co.
New York	Denby	Denby Motor Truck Sales Co.
Rochester	Denby	J. Cunningham
Syracuse	Denby	Syracuse Buick Sales Co

North Carolina

Greensboro	Koehler	Greensboro Motor Car Co

Ohio

Chillicothe	Koehler	B. Mallow
Cincinnati	Denby	Frank Bauer

Pennsylvania

Erie	Denby	A. H. Murphy
Greencastle	Koehler	Lininger's Garage
Kane	Denby	Hudson-Bender Motor Car Co.
Meadville	Koehler	W. L. Krider
Pittsburgh	Denby	Andrew Bonson Co.
Pittsburgh	Signal	Stewart Motor Truck Co.
Reading	Koehler	S. A. Stein

Virginia

Norfolk	Koehler	City Garage
Richmond	Koehler	Alsop Motor Co

Washington

Spokane	Signal	Signal Truck Co.

Factory Miscellany — Continued

Cleveland Plant Sold—The plant formerly occupied by the Samuel Austen & Sons Co., at Broadway and Gallup streets, Cleveland, O., has been sold to the H. Wagner Rubber Co., which will manufacture all kinds of rubber products.

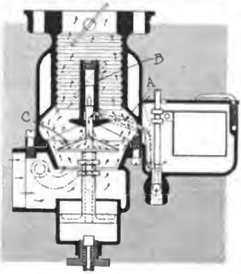
Billings & Spencer Altering Plant—Extensive alterations are now in progress at the plant formerly occupied by the Columbia Motor Car Co., Hartford, Conn., and recently purchased by the Billings & Spencer Co. The forge shop has been entirely remodeled; in fact the whole plant has been subjected to a complete change. The Billings & Spencer Co. is said to be rushed just now with large orders for drop hammers.

Standard Aluminum Adds Warehouse—The Standard Aluminum Co. of Two Rivers, Wis., at its annual meeting decided to increase the capital stock from $250,000 to $500,000 to accommodate the growth of the business. The Alexander warehouse opposite the plant, until now held under lease, has been purchased. The company is running at full capacity and on full time and may make extensions during the present year.

Findlay Co. to Build in Spring—The Electrical Motor and Construction Co., Findlay, O., has increased its capital stock from $15,000 to $30,000, and established branch houses at Fostoria and Norwalk. In the spring the company will build an immense addition to the plant in this city.

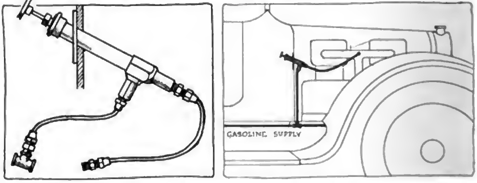
ACCESSORIES

NEW Carbureter — A carbureter called the Economic is of the type wherein the size of both air and gasoline passages are controlled simultaneously, but the instrument is built with the principal parts in a position which is highly unusual. As reference to the illustration will show, the fuel passes downward into the mixing chamber instead of upward, and there is no venturi or choke tube. Fuel passes up the pipe A to the inside of the part B, which is fixed in position and acts as the upper guide for the combined air valve and fuel needle C. The metering part of the fuel needle is tapered so that the fuel flow increases as C is lifted by motor suction, and the gasoline falls upon the conical surface from the edge of which it is supposed to be picked up by the rising air stream. For starting adjustment the little plug seen at the bottom of the dashpot and the extreme bottom of the carbureter can be set up and down so as to leave the correct opening between the edge of the air valve cone and the wall of the carbureter body. For adjusting the working of the valve and fuel needle the lever shown in dotted line behind the carbureter is connected to the steering wheel or cowl board through the medium of a spring, but the weight of the floating portion has the greatest share of this control. To adjust the carbureter to suit different motors the correct floating member has to be chosen, this being done by the factory. It is claimed that the carbureter operates at very low suction, and it is certainly of a most simple design. It can be taken apart very quickly for cleaning and assembled again without danger of disturbing adjustments.—Wellington P. Kidder, Boston, Mass.



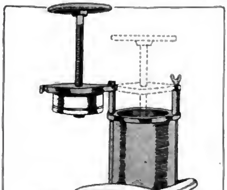
The Economic carbureter

Self-Feeding Primer—A primer known as the Universal has as its special feature a lead which is placed in connection with the main gasoline tank so that it requires no special filling with gasoline in small quantities. On the cowl board or in any other convenient position a small hand pump is located, and this has two pipes, one being the suction lead and the other the priming passage. The former ends in a T-piece, which is inserted at a convenient point in the main gasoline line, and the latter is taken to the intake manifold.—Dodge Motor Vehicle Co., Cambridge, Mass.



The Universal Primer and method of attaching it

Garage Grease Gun—A large gun to hold a gallon of grease and so substantially made that it should last almost forever is a new garage accessory. It is of solid cast-iron, and the sketch shows the way in which the top is removed for charging. The makers suggest that using so large a quantity of grease at one charge saves waste, and the gun registers the amount discharged at any one time, so that it is easy to know how much has been put into any particular car. To carry the grease to the required point a special rubber hose is employed, this material being chosen in preference to metallic flexible pipe because the latter is destroyed if kinked or run over by a car, while the rubber cannot be injured in this way. Two different nozzles are included and there is a cap to prevent leakage of grease when the gun is out of use.—John J. Zwald, Emporium, Pa.



A large grease gun for garage use

Tops and Upholstery — Convertible tops for roadsters or touring cars are becoming increasingly popular, especially as they can be made to fit standard models of various makes of automobiles. Two styles of light weight and good appearance are described in a recent pamphlet, which also deals with one-man tops and a range of seat covers.—Springfield Harness Co., Springfield, Mass.

Portable Garages—These small buildings must be in great demand, if one may judge by the very large number to be seen in any town. The qualities to be desired in them are strength, simplicity of erection and ability to vary size. The Dixie garage is made up from angle iron and corrugated galvanized iron in sections 4 feet long, so it is capable of extension to suit the customer's requirements, and has a very substantial frame. There are a pair of stout double doors, and a second door can be supplied if desired.—C. C. Fouts Co., Middletown, O.

Oxygen Generator—The Oxyphor oxygen generator is a device intended to replace the cylinder of compressed gas used for almost every purpose to which oxygen is applicable. It is intended to appeal especially for use with cylinder-cleaning outfits. There is a metal case, which contains water, and a cartridge of Oxyphor, and the method of using is to punch a few holes in the cartridge and then place it in the container. Gas can be drawn off by a valve and the apparatus used again and again till the cartridge is exhausted. — Arthur Wood, Brooklyn, N. Y.

Tires—The special points in the construction of Cable-Structur tires are dealt with at length in a pamphlet issued by the manufacturers. A feature is made of the fact that the casings are made by hand labor, and hand labor paid by hour rate and not on the piece, so that time is given for careful workmanship. Special pains have been taken to strengthen the bead, which contains cables sufficient to supply all the strength, since a beadless rim is used. The tire fits any of the modern rims with reversible flanges. The whole fabric is built up from cables, and a free use of rubber binds the whole structure together. — Mansfield Tire & Rubber Co., Mansfield, O.

Master Vibrator—The Scudor master vibrator is a simple design of this type of ignition device and is sold at a remarkably low price. Attention is drawn to the large size of the magnet and the condenser, while the platinum points are of platinum-iridium alloy of good diameter and with a long range of adjustment. Special pains are taken with the condenser to reducing sparking at the contact points and it is claimed that the vibrator construction is such that it is impossible for the points to stick together.—Scudor Mfg. Co., Lowell, Mass.

DANN Insert SPRINGS — equipped with DANN [illegible]

Inter-leaf shock absorption, endorsed as [illegible] by leading automobile authorities, is obtained only by use of

DANN INSERT

"The Inter-leaf Shock Absorber"

DANN Insert is a perfect shock absorber *built into* the spring. It is not an attachment.

DANN Insert is entirely unlike other shock absorbers. It permits the car to remain *locked together* as substantially as ever. No rocking, no sideswaying, no loosening of connections between body and driving mechanism.

DANN SPRING INSERT COMPANY
2187 Indiana Avenue Chicago, Ill

The shock absorbing insert extends from tip to tip between every spring leaf. It places a shock and vibration dampener in *direct contact* with every square inch of bearing surface between these spring leaves.

For these reasons DANN Insert is effective not at one point only as with ordinary shock absorbers but effective *throughout the entire length and breadth of the spring*.

The [illegible] perforations in the strips of DANN Insert are packed with a graphite compound. These little graphite pads *cushion* the [illegible] shocks [illegible]. These perforations in the Insert have a further effect in breaking up vibration. A shock cannot be transmitted in a direct line along the Insert strips. It must go *around* the innumerable perforations.

Strips of DANN Insert are of soft *non shock conducting* metal. Now the highly tempered metal of which springs are made is an ideal shock and vibration *conductor*. But the soft metal strips of DANN Insert placed between these highly tempered leaves act upon shocks much as strips of soft lead would. They smother the shock—cut it up—render it harmless. DANN Insert in no way retards natural spring action. By furnishing a glassy smooth bearing surface between the leaves, by filling in the more or less uneven surface of these leaves with graphite compound, the flexibility and sensitiveness of the spring is *increased*.

A Smart Practical Car for Town and Country Use

The Overland Coupe gives you all the conveniences of a limousine without the burden of a large investment.

It is comfortable and cosy on sharp, chilly March evenings; cool as an open car on hot summer days; snug and warm in real cold weather.

Any woman can drive an Overland Coupe.

The electric buttons are located on the steering column. By just pressing these buttons the car is started, stopped and lighted.

It comfortably seats four.

Deliveries can be made at once.

"Made in U. S. A."

The Willys-Overland Company
Toledo, Ohio

Automotive Industries

MAGAZINE LOAN COLLECTION GLENVILLE BRANCH
3-22-15

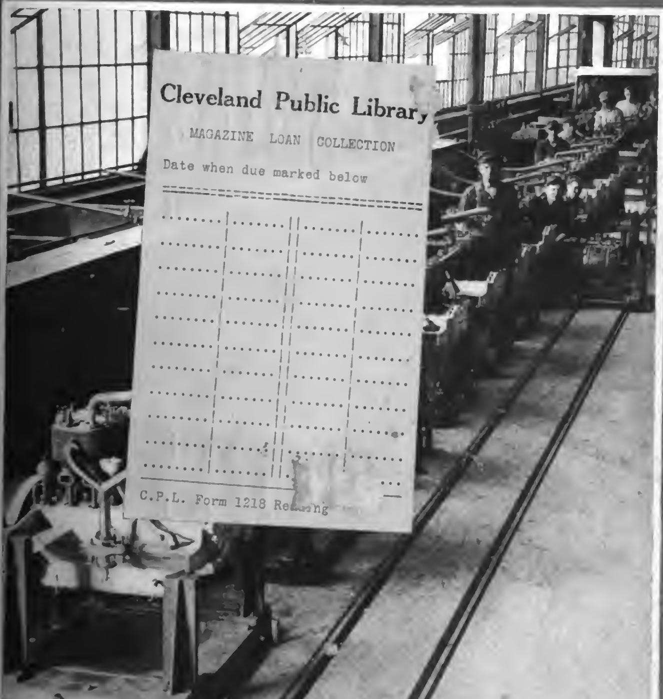
ge

The AUTOMOBILE

MARCH 18, 1915

MAGAZINE LOAN COLLECTION

10¢ A COPY



Cleveland Public Library
MAGAZINE LOAN COLLECTION
Date when due marked below
C.P.L. Form 1218 Reading

BRISCOE

Individuality stands out all over the BRISCOE car. It is not a copy but a creation, possessing an air of exclusiveness that makes an instant appeal to every buyer—built to stand up indefinitely.

In representing the BRISCOE, you are selling a car that gives the purchaser greater value than anything else at anywhere near the price.

You are offering a foreign car, with all that term implies—an automobile of French design mechanically, as well as in graceful foreign body lines—*at an American price.*

The prospect feels instinctively that here is a car singularly worth while, and the more he studies it, the more positive he becomes—an enthusiastic worker on your behalf—a more valuable sales agent than money could buy.

This is one of many reasons that make the BRISCOE the easiest and most thoroughly satisfactory car for dealers to handle.

CONSIDER THE BRISCOE, FROM ITS UNUSUALLY SMART EXTERIOR TO THE INNERMOST PARTS OF ITS MECHANISM, AND YOU WILL FIND BY FAR THE BIGGEST VALUE, DOLLAR FOR DOLLAR, TO BE FOUND IN ANY CAR.

A liberal contract is offered to all responsible live-wire dealers who wish to increase their profits by the sale of BRISCOE cars. But territory is being allotted fast right now. Better get in touch with us without delay.

BRISCOE MOTOR COMPANY INC. JACKSON MICHIGAN

VOL. XXXII NEW YORK—THURSDAY, MARCH 18, 1915—CHICAGO NO. 11

The AUTOMOBILE

W. F. Bradley, representative of THE AUTOMOBILE, meeting English Quakers back of the firing line in France

In the Wake of War

A Tour by Automobile Through the Devastation and Ruin Left by the Battle of the Marne

By W. F. Bradley

Special Representative of THE AUTOMOBILE *with the Allied Armies in France*

ONLY 20 miles to the east of the walls of Paris we reached the fringe of the battlefield. It has become customary to speak of that great encounter, in the early days of September, 1914, between the invading German forces and the allied French and British armies, as the Battle of the Marne. In reality it was a succession of battles, lasting 6 days, engaging between 2,000,000 and 3,000,000 men, and stretching over a front from the eastern suburbs of Paris to Verdun. Some of this front was in the Marne valley; but a considerable amount of the most bitter fighting was carried on many miles to the south of that river, and also some distance to the north.

The plan is now easy of comprehension. After sweeping through Belgium and later defeating the English and French armies in the north of France, the victorious Germans made practically a bee-line for Paris. When almost within striking distance of the capital, the direction of the German army was changed towards the southeast, evidently with the intention of crushing the forces under the command of General Joffre, then retreating towards the Seine, and later returning to take possession of an undefended Paris. But when the German forces occupied the 150-mile line of front between Paris and Verdun, General Joffre gave the order to advance. That advance is known as the Battle of the Marne. It drove the Germans back distances from 15 to 40 miles and doubtless decided the whole future conduct of the war.

We motored from Paris, along the south bank of the Marne, through pretty and hilly country which showed no trace of the gigantic struggle of 3 months previous. From the top of the hill leading to the town of Meaux, there is a fine bird's-eye view of a corner of the battlefield. From this point, in the early days of September, could be seen the line of the Paris army, facing east, its back to the capital, and also the French and British armies coming up from the south in their endeavor to drive the enemy across the Marne.

Meaux had so changed since our last visit, a couple of days after the battle, that we hardly recognized it. The bridge over the Marne, blown up by the English when they retreated south, had been replaced by a wooden structure. The wrecked motor truck which for several days had partly obstructed the road just beyond the bridge, had been removed. A few miles to the north, in the direction of Vareddes, there were still traces of the battle, but in Meaux itself the dirt, disorder, and wreckage which always accompany the passage of masses of troops had given way to cleanliness and a well-ordered civic life. Meaux has a remembrance of anxious days and nights, but no visible battle scars.

At Trilport, 3 miles to the east of Meaux, the main road running almost due east and west crosses the river Marne by a high bridge. When the British retreated over this road they blew up the bridge, as well as the railroad bridge a few yards to the north over the same river. During the night following the destruction of the bridge a German automobile carrying officers rushed westward, coming down the slope leading to the bridge at a high rate of speed, and almost before the driver had time to realize that there was a gap ahead of him had made a 40-foot plunge into the Marne.

"I suppose they were all killed," we remarked to the French guard on duty at the temporary bridge.

"Well, they never came back to tell us how they felt," he drawled unemotionally.

"Any damage done about here?"

"None," he replied, then as an after thought remarked, "Of course they took our fowls, our rabbits and our pigs, especially the pigs. But what can you expect? It's war."

Leaving the main road immediately after Trilport and turning south, the extreme western point of the battle line was reached at Pierre-Levée. There had been some fighting in the neighborhood, but with the exception of missing telegraph poles nothing to indicate a struggle. The first and most westerly sign of the enemy's appearance is at the Ferme des Loges, an isolated group of buildings on the main road from Montreau to La Ferté-sous-Jouarre. The Germans billeted in the farm. When they found that they had to turn round and hurry away from Paris, so temptingly near, the farm buildings took fire—how, nobody knows; the charred walls remain as a grim souvenir of the invader's visit.

Wrecked Motor Vehicles

All the country south to Coulommiers, a thriving town noted for its cheeses, was traversed by the retreating Britishers and fought over when those same Britishers moved northward in their attack on the Germans, but it has little to show. It was a running fight carried out too rapidly for any great damage to be done to villages and townships. On one of the long, straight, well made highways north of Coulommiers the wrecks of German motor vehicles testified to the rapidity of the retreat. A Berlin motorbus lying in the ditch had its radiator riddled with shot; a metal staircase indicated that it had once been fitted with a double deck body. The magneto, carbureter, valves, valve caps, copper piping, etc., had been carried away by economical French or business minded Tommies, leaving nothing portable for the souvenir hunters. A few miles further east, the village of Chailly possessed a wrecked wineshop. In the sum total of the destruction caused by this war that wineshop is an almost negligible quantity. Yet it is typical.. The enemy's forces, tired with marching, but flushed with victory, swept down on sleepy Chailly, looted unprotected houses and burst open abandoned wine cellars. When the order came to flee before the advancing French, some drunken hand overturned a kerosene lamp or put a match to the bedding. A hard working French family returned a few days later to discover that their home was a heap of ashes.

Contrasts are vivid on the battlefields of the Marne. Chailly possessed the blackened walls of a wineshop and a few score of houses which could not show a bullet mark among them. La Ferté-Gaucher, although in the center of the battleline, had nothing more to report than pillaged shops. "But if you turn back 20 yards and run south to Courtacon," advised the sentinel on duty at the railroad crossing, "you will see some destruction." To attempt to get a complete and accurate history of every French village occupied by the enemy's forces would tax the ability of the most painstaking of historians. Roofless buildings, gaping window frames and ashes a foot deep tell the story in its broad outline, leaving it to the imagination to fill in the details. Generally the villagers have fled before the arrival of the enemy; when they have remained they are little inclined to talk. The voluble individual whose imagination and emotion call upon his hands, his shoulders and his tongue to give expression to the feelings within him is not the Frenchman we met on the battlefields of France.

It was a typical French farmer who explained to us that the home forces had just retreated a couple of miles to the south of Courtacon when the advance guard of the Germans came in and immediately set fire to many of the buildings. "The few men who had remained behind were all seized. A young man of 20 who was about to leave for the army was shot. They put me against that wall"—and he pointed to the charred remains of the gendarmerie—"telling me that it would be my turn next. Then they took me over the road there, keeping me under the bayonets for 4 hours. The Germans set fire to most of the buildings as soon as they arrived. The barns were filled with the recently gathered harvest; the corn smouldered for a week."

Montceau-les-Provins, the next village on the road to Esternay, had suffered in patches. On the left-hand side of the main road was a row of what had once been cottages. Opposite was a new stone built postoffice as smart and as spotless as if it had just been left by the builders and painters. The postman came out to explain that the shells had come diagonally across the road, destroying the cottages, but only breaking the windows of his house. The cottagers had sought refuge in the rabbit hutches at the rear of their gardens.

A Desolate Village

Before we ran into Esternay we were advised to climb up the hill side about half a mile to the village of Chatillon-sur-Morin. It was a bright, vigorous winter morning, with a snap in the air which sent the blood coursing through the veins and a cheery sun made nature beautiful in its barrenness. But the hand of death had been placed on Chatillon. We drove down the village street without seeing a living creature. We got out of the car to wander among ruins, to locate kitchens by the big soup pan hanging from an iron bar where the chimney had evidently once been, to note the site of barns by an extent of gray powder covering the ground for a depth of several inches, to discover the former position of sheds by bits of rusted American reapers. Presently a woman and a child appeared; their home was the only one not completely destroyed; a boy was discovered in a cellar putting chaff into sacks; a woman put her head round the doorpost of a cowshed; it was her home, as well as that of the cattle. A young man came out of the wreckage of the village Mairie. He was the only male in the place.

"You have suffered from the bombardment?" we queried.

"Fire," was his monosyllabic reply.

We suggested that it might be incendiary shells.

"Shells don't carry kerosene cans around with them; they don't soak mattresses, and they don't come back if the fire is not burning briskly."

He spoke dispassionately, as a man who had seen too much destruction to be moved, and who had lived long enough in the atmosphere of battles to realize that fire and destruction were inevitable accompaniments of war.

Cattle Burned Alive

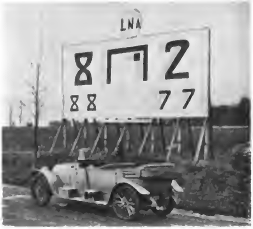
"They took possession of the village," he explained, "on September 6. The French had retreated a few miles further south; but they attacked the following day, and when the Germans realized that their quarters were untenable they set fire to everything. Nine horses were burned alive in that farm; a bull was burned across the road and six cows perished in those ruins at the end of the street."

"But they did no damage to Esternay," we objected.

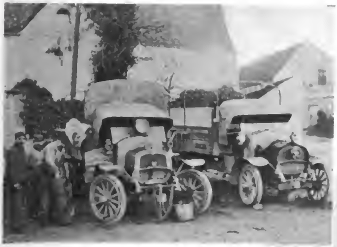
"Hadn't time," was his blunt reply.

Wreckage of the church of Reuves on the St. Gond marshes. It was on this plain that the French attacked and routed the Prussian guard. Note Bradley's car in foreground. It is doubtful if the church can ever be used again as a place of prayer and worship. Most of the houses in this town were hopelessly wrecked

Bridge over the river Marne at Trilport. It was blown up by the English in their retreat. Shortly afterward a German officer's car plunged into the gap, a drop of 40 feet to the river below. Needless to say, none in the car escaped



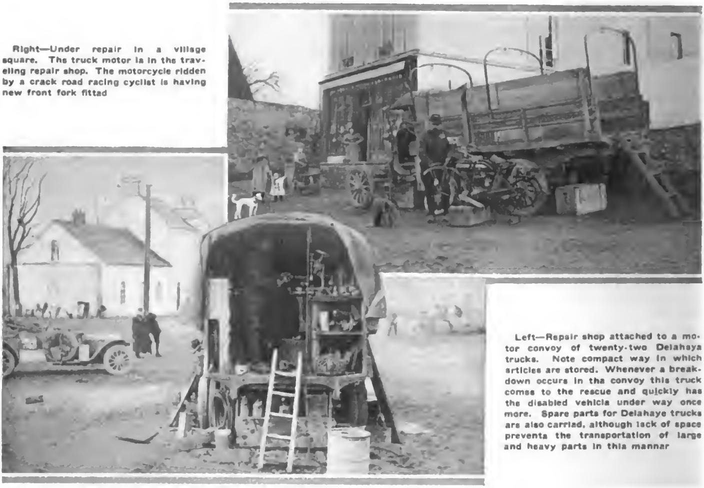
One of the direction boards placed on the route to the German frontier for the benefit of the aeroplane pilots of the allied armies, who are ceaselessly scouting about overhead



Two Delehaye trucks, of a convoy of twenty-two, carrying fodder to cavalry at the front. Note home-made dash and side doors

Above—Hotel de l'Elephant, the leading hostelry at Chateau-Thierry on the Marne. A German shell exploded in the front bedroom window the night of September 2, 1914

Left—Wreck of a Berlin motor bus which was overtaken by the English when they drove the Germans out of the Marne valley. Note radiator riddled with bullets and remains of iron staircase



Right—Under repair in a village square. The truck motor is in the traveling repair shop. The motorcycle ridden by a crack road racing cyclist is having new front fork fitted

Left—Repair shop attached to a motor convoy of twenty-two Delahaye trucks. Note compact way in which articles are stored. Whenever a breakdown occurs in the convoy this truck comes to the rescue and quickly has the disabled vehicle under way once more. Spare parts for Delahaye trucks are also carried, although lack of space prevents the transportation of large and heavy parts in this manner

Esternay, a village normally interested in wines, was the central as well as one of the most southern points of the 150-mile battle line from Paris to Verdun. To the east and west of this town the battle raged most fiercely, and it was here that the greatest number of men fell. As in the case of most of the larger towns in the Marne valley, Esternay suffered little damage. The proprietor of the Hotel de l'Union, a little man who interrupted a game of billiards he was playing with soldiers to greet us, supplied us with an excellent résumé of the German occupation.

"The Germans swarmed into the town on Saturday afternoon. They said: 'Tomorrow, Sunday, you work, we rest.' But when the boom of the French guns was heard on Sunday morning, the German officer remarked, 'Ah, French artillery—courageous.' They worked that Sunday, and on Monday morning they bolted without saying au revoir."

To get the spirit of the battle, 2 or 3 days should be spent wandering about the country between the north of the main road from Esternay to Vitry le Francois and the River Marne. It was within this country that the greatest shock of arms in the history of the world took place, and it is in the villages of this district and along the secondary roads of this neighborhood that signs of battle are most clearly discernible. Practically every village has some bombarded building or burned house; nearly every field has its harvest of blue compressed meat cans, its wine bottles, its splinters of shell, its empty cartridges and its graves defined by a plain wooden cross, by a soldier's hat, the butt end of a gun, a knapsack, or a sword. German graves are hard to discover.

Quakers Rebuild Homes

At Lenharrée, a village to the east of Fere Champenoise, an old man who had stayed behind during the whole of the fighting informed us that 500 Germans had been buried in the immediate neighborhood. It was only an estimate by a man who had seen but a few yards of the battlefield, but seen those few yards at very close range. Lenharrée had the misfortune to be built between the French and the German lines. It had once been an interesting, picturesque and prosperous village. It had lost its prosperity, for of the couple of hundred farms and farm buildings only half a dozen or so remained intact. Two English Quakers, young men of good family and education, were at work in a farm yard putting a roof on a wrecked kitchen. They were members of a party of about fifty who had quietly slipped over to France, had taken up saw, trowel and hammer, and without ostentation, without any self-advertisement, were repairing dwellings which were worth repairing and erecting shacks when the old home had been completely razed to the ground. There was not a paid worker among them; they were not professional joiners or builders, but they handled saw and trowel creditably; they brought their material up on touring cars; they lived in uncomfortable village inns, or they fitted up rough quarters for themselves in a hamlet where the war had left ruin and disease. They had no social intercourse; the day's work was all they asked.

At the back of the wrecked church of Lenharrée a line of trenches indicated the place where the French had dug themselves in on securing possession of the village. A few hundred yards away across the plain an ill defined line showed where the Germans had hastily entrenched themselves. "There are a dozen Germans buried there," said a peasant woman who had followed us through the churchyard to the trenches. She pointed to a plot of land which showed signs of having been freshly turned. "We found them in our cabbage patch; we needed the cabbages, but we don't need that piece of land for the present." Wooden crosses, or a stick with a kepi placed on it marked the resting place of French soldiers. But only the loose nature of the soil told where Germans had been put under a few inches of Mother

Earth. There were many patches of loose soil around that village.

10 Miles of Trenches

Trenches lined the whole of the 10 miles of road from Lenharrée, through Normee, Ecury and Morains into the flat country known as the Marais de Saint Gond, although rarely found on maps under that name. It was in this boggy country, traversed by very few and very narrow roads, that the French army surprised and routed the Prussian guard. At Mondemont, a village picturesquely placed on a hill and overlooking the boggy plain, General Von Bulow had his headquarters. The chateau of Mondemont, in which the general and his staff were quartered, was the scene of a bitter fight, and when finally abandoned was in a wrecked condition. The Germans sought to escape across this boggy plain, northwards towards the Marne. The few available roads were quickly congested and men and war material fell in large quantities into the hands of the French.

Losses were heavy in this neighborhood. On the road from Fere Champenoise to Sezanne, 4 miles west of the former town, the battle raged fiercely around the Ermitage farm. Graves in the fields around the farm told their story; but it was the farmer who supplied most of the details. It was on this road that the best of the German army had to meet the élite of the French when the latter were given the order to attack. "The road ran blood," declared the farmer, "and the house was like a shambles." He indicated a wood about a mile away, on the north side of the road. "It was there that we lost heavily. One of our regiments, the 245th infantry, marched into Fere Champenoise. The inhabitants were delighted that their town was to be protected, and in consequence received the troops with open arms, giving them wine to drink and thrusting upon them bottles of champagne. The regiment went to spend the night in the wood. Heavy with the wine they had drunk the sentries slept at their post, and in the early morning the Germans made a surprise attack. I had climbed into the hills to get a view of the battlefield when at daybreak I saw men without arms, without greatcoats and without hats rushing wildly into the open plain. Only 500 of the regiment escaped."

Little Emotion Displayed

One of the most surprising features of a tour in the war area is the lack of emotion displayed by the victims. Reuves, one of the villages on the Marshes of St. Gond, had suffered heavily from the German fire. It is doubtful if its church could ever again be used as a place of prayer and meditation. It would be cheaper to abandon more than half the houses, rather than attempt to repair them. But both men and material were lacking for the work of reconstruction, and in consequence the women and the old men left behind had made a clearing in the rubbish and fitted a flimsy roof where two walls still retained a certain degree of solidity. It was from one of these homes that a bright-eyed, sturdy old woman came forth to look at us. Un-uniformed automobilists were somewhat of a curiosity in this neighborhood a couple of months after the battle.

"You have suffered severely, madame," we remarked.

"Why yes; there is plenty of damage here. But what can you expect? It's war. Some are worse off than I. Some have nothing; we have half a roof. It's enough to make me happy in my misfortune."

Champguyon, another village in this neighborhood, attracted us by reason of its battered condition, and the voices of women induced us to step out of the car and seek information. They were three in number, an old woman who talked much, a vigorous, intelligent-looking, middle-aged woman who was on her knees washing clothes in a pond, and a young woman, obviously the daughter, kneeling by her side, engaged in the same labor. Their cottages and outbuildings on the opposite side of the court had been destroyed by fire; the blackened walls revealed that fact. We opened conversation by asking how the village had been destroyed.

"By fire, monsieur; Oh, quel malheur (what misfortune)" replied the old woman.

We learned that the Germans had come, there had been a little fighting, and at the same time the village had burst into flames. Nobody ever knew exactly how a village had been set on fire. A week later the German troops came through again, marching northwards this time, and traveling too fast to fight. The old woman talked wildly:

"I went to find the priest, and I said to him, 'Monsieur le Curé, how is it such a misfortune has befallen me?' Brochard always said it was my fault, and if I had not gone away my Eugene would not have been lost. But what could I do? The sergeant said he would turn us all out of the cart if we did not come on quick, and Eugene would go back for his bicycle."

"Then your son has been taken prisoner?" we interposed.

"No, monsieur, they shot him; shot him there against the church." She hastily brushed a tear away, the first tear to accompany the many similar stories we had listened to in our tour.

"But they shot three others," timidly stated the young woman. And she mentioned the names of three men.

"Yes, but two of those were silly, and probably they did not reply properly to the German questions," apologized the mother.

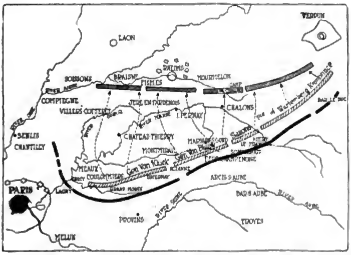
"But my Eugene was not silly, and they shot him. They caught him there," pointing to the orchard behind us. "Eugene hit the officer in the face; they fastened his hands behind his back and took him away in an automobile. Brochard says it was my fault. And I said to the priest, 'Monsieur le Curé, why has such a calamity fallen on me?'"

Being less capable of replying to her inquiry than was the village priest, we hurried away.

In conversation with a cafe proprietor, we had been informed that when the Germans came to the town of Epernay they imposed a war indemnity of 180,000 francs. But an

Upper—A view of the lower portion of Port à'Binson, destroyed by German incendiary shells

Lower—Soudan, in the Marne. Alleging that shots were fired by civilians, the German general staff ordered this village to be razed to the ground. The illustration shows the resulting ruin



How the allied and German forces were opposed before and after the battle of the Marne. The black line shows the positions of the allied troops while the slightly shaded sections indicate the German position before the battle, their later positions being indicated by the arrows and the more heavily shaded portions

Epernay doctor having saved the life of a German prince, the enemy refunded the whole of the amount as an expression of their gratitude. It was the kind of story to send a newspaper man sprinting to the telegraph office. But as the telegraph clerk would not have accepted any message until it had been censored, we decided to take advantage of our presence in Epernay to obtain details from the mayor of that town. In this way we learned something of the life of an important and prosperous town during military invasion.

Epernay—A Hospital Center

The advance forces of the German army entered Epernay on the afternoon of September, Baron Von Plettenberg being in command. The majority of the inhabitants had fled at the approach of the enemy's troops, and before doing so had shut off their gas, water and electricity supply. The mayor of Epernay, Pol Roger, was brought before the commanding officer and told that he would be hanged if the electric current was not switched on immediately. It was possible to meet the German demand. Nevertheless, the mayor and three of his assistants were arrested and kept as hostages in the city hall while the German officers dined at the best hotel in town. Fire broke out in the town during the evening; this incident bringing forth a threat that the mayor would be shot if a similar event occurred. The following day the life of the mayor was again in danger, for a German soldier had been shot in the leg by some unknown person, and Pol Roger was threatened with death if the culprit was not forthcoming. The intervention of General Von Teichmann prevented this threat being carried to execution. Later the mayor was brought before the German officers to answer the charge of having allowed the German flaw flying over the station to be replaced by the French tricolor. The town was threatened with a heavy war indemnity. It was proved that a German flag had never been hoisted over the station, and to repair this defect the town authorities were ordered to make a German flag and attach it to the flagstaff above the city hall. If a hand was laid on it the mayor would be shot, and the town pillaged and burned, declared the commanding officer. With a French flag and a janitor's apron, a German flag was manufactured and nailed to the flagstaff over the city hall, the window being nailed up by the mayor to prevent any person tearing it down. The German troops needed canned foods, but as Epernay's specialty is champagne, it was unable to meet the demand. In consequence, a war indemnity of 176,550 francs was imposed and paid, this amount representing the value of the food stuffs the town had failed to furnish. In making the calculation the French franc had been counted at 80 centimes.

When the German forces came in contact with the French army south of the town, Epernay became an important hospital center. The head doctor of the city hospital had fled at the approach of the enemy; his assistant had followed his example. But Dr. Veron, although 69 years of age, and retired from practice, displayed the energy of a man of 30 and devoted himself so disinterestedly to the 800 German wounded in the establishment that the general staff decided to refund the whole of the war indemnity before leaving the town. Epernay was saved; its important champagne cellars were untouched, its public buildings undamaged; only the bridges over the Marne were blown up to hinder the French advance. Individual citizens declared that their houses had been pillaged, but this does not prevent Epernay occupying the unique position of having undergone a German occupation without the loss of a cent and without the disfigurement of a public building.

There are few signs of war along the main road from Epernay to Chateau-Thierry. It is an agreeable run, with the river Marne on the right and vineyards from time to time, but with the exception of the lower portion of Port à Binson destroyed by incendiary shells, and an occasional soldier's grave marked by a plain cross, there are few indications that vast armies crossed the river by the various bridges, first chasing south, then fighting northward.

Tragedy Where Hill-Climb Was Held

Years ago, when the ability of automobiles to get up main road gradients might be open to doubt, Chateau-Thierry had a sporting reputation as a hill-climbing center. That hill, starting from the edge of the Marne and winding its way up the steep bank, was the scene of a tragic occurrence during the night of September 2 to 3.

For several days previous hordes of Belgian refugees, pushing their meager belongings on all kinds of vehicles, had swarmed through Chateau-Thierry. They were followed by civilians from the northern provinces of France, then by the Belgian army, then by the French army and a small portion of the British troops. The sight of the retreating armies sent the civilians fleeing in terror. A small body of territorial troops probably 200 strong, waited to meet the dense masses of the German army. They had not received definite orders to retreat, and they would not run away. The resistance was as effective as that of a brood of chickens opposed to a steam roller. Eighty of the men were shot down on the Soissons road and the huge German war machine swept on without stopping to drag the bodies to the side of the road. All night long artillery trains, motor trucks, touring cars, infantry and cavalry, rolled and tramped over that corpse-lined road. We were introduced to the town official who removed the bodies the following morning. "We scraped the road," he remarked significantly.

All Automobile Traffic Stopped

When the natives were fleeing from Chateau-Thierry, the authorities decided that all automobile traffic should be stopped. Civilians who owned cars were unable to make use of them to get to a place of safety, for soldiers barred their passage over the river and along the roads leading out of town. German officers appreciated this kindly attention on the part of the French civil authorities. They were somewhat less appreciative of the offer of a neighboring farmer that he should drive his own horse. The German army wanted the horse, not the man; but as the man insisted that the horse would never do good service in the hands of strangers, he was at last allowed to accompany it. The man disappeared from the life of Chateau-Thierry. He was looked upon as dead when, after an absence of 2 months, news was received that he had been made a prisoner of war in Russia.

Report on British Lamp Standards

Engineering Standards Committee Fixes Dimensions for Tungsten Filament Glow Lamps

TUNGSTEN filament glow lamps, vacuum type, for automobiles which purport to be in accordance with the British standards shall comply with the following recommendations and with the particulars shown in Figs. 1-10.

Tungsten filament glow lamps for the following purposes in connection with automobiles are dealt with in this report: head lights, side lights, tail lights, dash lights, dome lights and festoon lights, for interior lighting.

The standard voltages for tungsten glow lamps for automobiles shall be 6 volts and 12 volts.

For head lights and side lights the bulbs shall be spherical with pip, Figs. 1-4, while for tail and dash lights and dome lights the bulbs shall be pipless, Figs. 5 and 6.

No recommendation is made as to the form of filaments to be employed.

The sectional committee on automobile parts was appointed by the main committee at their meeting on July 18, 1912, and for the purpose of dealing with the various details in connection with the standardization of the automobile parts referred to them, ten sub-committees were formed upon each of which additional members having special knowledge of the matters to be dealt with were co-opted.

Sub-committee M on tungsten filament glow lamps for automobiles, which was responsible for drafting this report, was formed at a later date, having been appointed at the meeting of the sectional committee held on May 4, 1914.

The question of standards for tungsten filament glow lamps for automobiles was referred to the engineering standards committee by the Society of Motor Manufacturers and Traders, and in drawing up their recommendations the sub-committee were able to avail themselves of the report submitted by the accessories section of the society as the result of the work undertaken by a sub-committee appointed by that section, and they were also assisted by some further proposals which were put forward by a committee of the Tungsten Filament Lamp Manufacturers' Assn.

The lamps dealt with are intended to have an approximate efficiency of 1 watt per candle and the description "Vacuum" type is used throughout this report in order to distinguish them from the new "gas-filled" or "half-watt" lamps which have been recently introduced. It is intended to increase the scope of this report to cover the lattr type of lamp when further progress has been made with their manufacture, and at the same time to deal with the tolerances to be allowed on the lamp cap dimensions.

The question of whether electric glow lamps should be rated by candlepower or by watts is engaging the attention of the sectional electrical committee, but as it is desirable to issue the recommendations on tungsten filament glow lamps for automobiles with as little delay as possible, the designation "Actual Watts or Nominal Candlepower," used in the present report, is put forward without prejudice to any decision which may ultimately be come to by the sectional electrical committee.

This report was adopted by the sectional committee on automobile parts in December, 1914.

This report was approved by the main committee at their meeting on December 11, 1914.

Position of Filament

For head lights, Figs. 1 and 2, the distance from the bulb side of the bayonet pins to the center of the filament shall be 30 mm.

For side, tail and dash lights, Figs. 3, 4 and 5, the center of the filament shall be approximately in the center of the bulb.

For dome and festoon lights, Figs. 6 and 7, no recommendations are made.

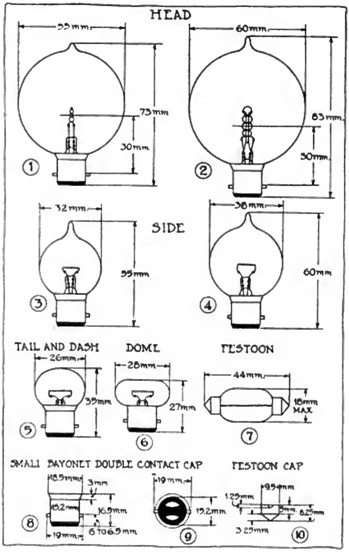
It has not been thought possible to recommend a definite standard in lamp efficiency in view of the fact that improvements in manufacture are constantly taking place, but for the purpose of estimating the nominal candlepower of the lamps dealt with, the lamp efficiency has been taken as 1 watt per British candle.

Lamp Caps

One standard small bayonet double contact lamp cap, Figs. 8 and 9, shall be adopted for all head lights, side lights, tail and dash lights, and shall comply with the dimensions given in Figs. 8 and 9.

In the case of the dome lights, which are intended for interior lighting, the cap, see Fig. 6, shall be of the same dimensions as for head lights except that the flange portion next to the bulb is omitted owing to the restricted total depth from contact to the top of the bulb. This does not interfere with the fit of the lamp into the holder.

The dimensions for the lamp cap for festoon lights are given in Fig. 10.



Figs. 1 to 10

50,000 Cars for Iowa in 1915

Prosperity Predicts Big Car Sales—1914 Crops and Live Stock Worth Over $1,000,000,000—Des Moines Show a Success

By C. G. Sinsabaugh

DES MOINES, IA., March 13—Iowa farmers contributed a billion dollars to the general wealth of the great Hawkeye state as a result of the bumper crops of 1914 and the boast is made and not questioned that the state's pocketbook could show $8,000,000,000 on appraisal, taking into account its rich farm lands, its live stock and its manufacturing interests. Its wealth per capita, figuring on farm wealth alone, is $1,682, while a rough estimate would give complete returns of at least $3,500 per head.

Because of these evidences of wealth it would not seem impossible that the Hawkeyes will buy at least 50,000 cars during the present year, according to a careful estimate made by Secretary of State Allen, who takes a keen interest in motoring affairs and is justly proud of the fact that Iowa ranks sixth in the United States in the ownership of cars.

To Distribute 20,000 Cars

And it is because of this great prosperity, tangible and not imaginary, that the 1,500 dealers who attended the sixth annual Des Moines show, which closed this evening, have gone home elated over the prospect. Most of them spent the week here, and as a result it is predicted tonight that Des Moines alone will distribute at least 20,000 cars in 1915 throughout the territory controlled by this city. This territory extends approximately to the Missouri line and also radiates in other directions. Sioux City looks after the northwest section of the state, while Omaha and Lincoln, Neb., claim jurisdiction to within 100 miles of Des Moines on the west.

As a show, the Des Moines affair was a great success. There were twenty-four members of the association displaying their goods, while six not holding franchises in the local body were allotted space. Forty-four makes of passenger cars were shown, while the accessories also had good space. Then, too, the car manufacturers of the country, learning their lesson at Kansas City when few attended despite the great demand for cars, as pointed out recently by THE AUTOMOBILE, were well represented here. President Bull of the Case company, President Jewett of the Paige, President Ford of the Saxon, Vice-President McDonald of the Moon, and General Manager Olweil of the Chalmers were among the big men of the industry who personally attended the show. In addition, dealers' dinners were given by Studebaker, Chalmers, Paige and Overland, so that quite a national tinge was given show week.

In addition there was a convention of thresher men here this week, which brought in an additional 2,000. And it was found that these thresher men are interested in automobiles and that they found time outside of their own convention to attend the show and inspect the cars.

So much for the show itself. Now for the 1914 returns which point the way to a big business for the industry—a dollar-mark confetti that should put Iowa among the motoring leaders of the country by the end of 1915. Let us first of all take up the Hawkeyes' resources and show why it will be possible to sell 50,000 new cars in the state before the end of the year and make good the prediction of the secretary of state.

$465,509,163 in Crops

Getting down to bald facts, which are backed up mainly by government reports, we find that the returns on December 1, 1914, show the total value of soil products in 1914, which include corn, oats, wheat, barley, rye, flax, hay, etc., to be $465,509,163, as against $438,157,163 in 1913. Corn, of course, is Iowa's best crop, this cereal's value totaling $200,029,280 for the yield of 263,689,600 bushels.

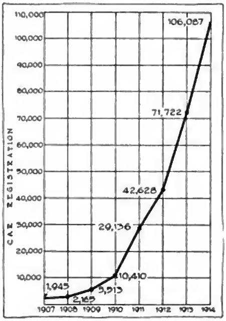


Chart showing increase in Iowa car registration, year by year, from the beginning of 1907 to the end of 1914

An even greater contributor to the state purse was the live stock, the value of which was $470,271,700 on January 1, as against $456,453,900 on the preceding New Year's day. When the count was made less than 3 months ago, Iowa farmers owned 1,600,000 horses, 58,000 mules, 1,377,000 milch cows, 2,683,000 other cattle, 1,249,000 sheep and 8,720,000 swine.

Still later returns from the weather bureau of the United States Department of Agriculture, announced March 1, show that on that date the farmers of Iowa had in their granaries, and ready to convert into money at any time, 3,010,000 bushels of wheat at $1.37 a bushel, as against 4,264,000 at 79 cents a year ago; 140,000,000 bushels of 65-cent corn, as against 125,171,000 56-cent corn in 1914; 61,000,000 bushels of 50-cent oats, as against 67,260,000 bushels at 34 cents in March, 1914; and 2,060,000 bushels of 68-cent barley, as against 2,300,000 bushels at 52 cents a year ago.

While these returns show that the farmers had less grain on hand March 1, 1915, than they had on the same date in 1914, yet the value was much greater. At the prevailing rates this year, this supply of grain would be worth $124,014,500, as against $94,571,106 12 months before. Of course, the European war has been largely responsible for this, but just the same this represents money, part of which will buy cars.

217,044 Farmers in Iowa

Iowa is particularly proud of the fact that it leads all other states in the production of corn, oats and hay. The 1914 yield of corn, 389,424,000 bushels, was worth $194,712,000, with Illinois second with 300,034,000 bushels. Iowa had 165,000,000 bushels of oats, worth $67,650,000, while its hay yield of 4,071,000 tons was valued at $323,953,000.

So much for the crops. Now let us take up the selling possibilities among the rural inhabitants and we will find

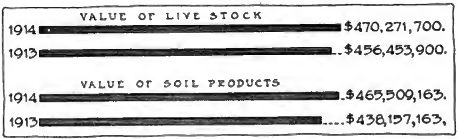


Diagram of some of Iowa's resources. Above is shown the live stock value for 1914 and 1913 and below the values of the crops for the 2 years are compared

just why the secretary of state thinks that Iowa will absorb 50,000 new cars this year. Again referring to the statistics, we find that in Iowa there are 217,044 farms averaging 156 acres each, and that there are 33,930,000 acres devoted to farming. There are 217,044 farmers in the state.

Now we swing for a moment from farm statistics to the state house, where we consult the statistics of the secretary of state, who tells us that in 1914 there were 106,087 cars registered during the year. All of these, of course, did not come from the rural district—probably three-quarters of them—so that it will be seen that the field has hardly been scratched so far as the farmer and the automobile are concerned. Inasmuch as it is freely admitted that the time is not far distant when each farmer must own at least one car, not counting tractors or commercial vehicles, we find that seemingly there are at least 150,000 tillers of the soil in the Hawkeye state who can be listed as prospects.

Sixth in Registration

With such an outlook, it is small wonder that Iowa has climbed so high on the registration ladder. It now ranks sixth among the commonwealths, having added 34,241 cars during 1914, but it is the proud boast of R. M. Williams, in charge of the automobile registrations, that Iowa has conducted this department at a lower percentage of operating cost than any other state. It also ranks fourth in the amount of fees collected from registrations. Also, Williams points out that Iowa registered 1,119 more cars in 1914 than the combined registrations of Colorado, Florida, Idaho, Kansas, South Dakota, North Dakota and Montana. To be exact, Iowa added 35,241 names in 1914. To quote the report:

State	Cars Registered	Fees	Operating Expense Per Cent.
New York....	168,223	$1,529,852.36	20
Illinois	131,140	699,725.30	....
California ...	123,504	1,338,785.25	11.6
Ohio	122,348	685,000.00	11.8
Pennsylvania.	110,963	1,184,645.50	6.9
Iowa	106,087	1,040,135.54	5.6
Massachusetts.	77,246	922,469.75	13
Michigan	76,014	183,169.30	36
Indiana	66,500	430,307.55	11.1
Wisconsin ...	53,160	293,580.00	8
Missouri	50,998	235,873.50	43

These figures come as near being official as it is possible to get them. Mr. Williams compiled them after corresponding with other states, even going so far as to telegraph several times to stir up those which had been slow in replying. This work was undertaken to prove the economical operation of the office in Iowa. Of the $1,040,135.54 collected, Iowa spent $58,382.68 to tag the cars, of which amount $22,665.91 was spent for the plates alone. Supplies, printing, stamps, etc., used up $25,516.17; the regular employees $7,600 and the extra help $2,600.

Iowa estimates that 60 per cent. of its registrations come from the farmers and also reports that there are 38,000 Fords in the state. Also the secretary shows with pride the growth in car registrations. In 1907 the count showed 1,945 cars; in 1908, 2,165; 1909, 5,513; 1910, 10,410; 1911, 29,136; 1912, 42,628; 1913, 71,722; 1914, 106,087. Figuring at an average of $1,000 per car, Iowa at present owns more than $100,000,000 worth of power-propelled vehicles.

The Hawkeyes spend most of the registration fees on the roads. According to the law, 85 per cent. goes direct into the highways, 8 per cent. goes to the highway commission, and the remainder is used to maintain the automobile regulation department of the secretary of state.

$11,000,000 for Roads

With all this motoring enthusiasm it goes without saying that the Hawkeyes are great good-roads boosters. They spent $11,000,000 on the roads last year, $850,000 of which came out of the registration funds. Probably no other state in the union has so many different cross-state routes, each of which is kept in apple-pie order. Crossing east and west we have the River-to-River road, from Dubuque to Council Bluffs, 337 miles; the Great White Way, paralleling it, 412 miles; the Blue Grass trail, from Burlington to Council Bluffs; the Hawkeye trail, from Dubuque to Sioux City; and the North Iowa pike, from McGregor to Sioux Falls, S. D., among the leaders.

Running north and south there are the Red Ball route from Burlington to Minneapolis; the Interstate trail from Kansas City to Minneapolis, and the Ayrline route also connecting Kansas City and Minneapolis.

Boosters for Iowa have statistics at their fingers' ends to prove why their state is the greatest in the union. In addition to what has been told in the foregoing they say:

Burlington has the largest furniture factory in the United States.

Muscatine has the largest food products plant in the United States.

Dubuque has the largest millwork establishment in the United States.

Charles City has the largest traction engine factory in the United States.

Fort Dodge has the largest wall plaster and mortar board factory in the United States.

Waterloo has the largest cream separator factory in the United States.

Ames has the largest plant for the manufacture of felt pennants in the United States.

Iowa City has the second largest jewelry manufacturing business in the United States.

Ottumwa has the largest plant for the production of hay-working machinery in the United States and the largest independent pork-packing plant in the United States.

Des Moines has the largest burial casket and hearse manufacturing plant, the largest independent cement plant, the largest paving producing plant, the largest plant for the manufacture of women's ready-to-wear wool garments, the largest egg-desiccating plant, the largest roofing tile plants and the largest patent medicine plant in the United States.

In Iowa there are 3,434 general stores, 2,675 grocery stores, 1,706 banks, 1,047 implement dealers' stores, 709 clothing stores, 375 dry goods stores, 1,053 shoe stores, 1,091 furniture dealers' stores, 1,076 milliners, 813 jewelers, and approximately 2,000 motor car dealers.

There are 1,100 postoffices in Iowa. There are only seventeen towns of over 10,000 inhabitants and one of over 50,000.

The per capita wealth is almost 50 per cent. greater than the average for the United States.

The number of manufacturing establishments in Iowa is reported in the 1910 census as 5,528, with an average number of wage earners of 61,635, ranking twenty-ninth among the States of the Union in this respect; value of manufactured product, $259,238,000; value added by manufacture, $88,531,000, ranking twenty-second in this respect.

Capital to the amount of $171,219,000 is employed, the salaries amount to $10,972,000, the wages to $32,542,000, the material cost, $170,707,000.

Having absorbed all these figures, one's respect for Iowa increases materially and one can readily foresee the great future ahead for the automobile industry. The 2,000 dealers all report a great business.

Bankers Favorable

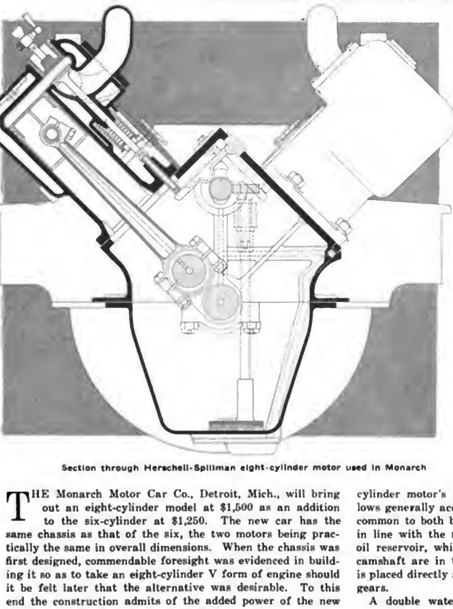
Leading distributors also say that bankers are looking more kindly on the automobile business than last fall, when the feeling existed that the moneyed interests were somewhat antagonistic and were refusing to loan farmers money with which to buy cars.

Jitneys in Des Moines

Des Moines is trying out the jitney. There are forty-three of these buses running at the present time, but it is declared they are not meeting with much favor. The city council is considering an ordinance which will fix the fares, name the routes and determine the terminal points, and require bus owners to give bond to "pay for any damage caused by their carelessness or negligence."

Monarch Adds Eight-Cylinder Model

Herschell-Spillman Motor Interchangeable with Continental Six in Same Chassis



Section through Herschell-Spillman eight-cylinder motor used in Monarch

THE Monarch Motor Car Co., Detroit, Mich., will bring out an eight-cylinder model at $1,500 as an addition to the six-cylinder at $1,250. The new car has the same chassis as that of the six, the two motors being practically the same in overall dimensions. When the chassis was first designed, commendable foresight was evidenced in building it so as to take an eight-cylinder V form of engine should it be felt later that the alternative was desirable. To this end the construction admits of the added power of the new engine, while being exceedingly light, and the result is that the ratio of weight to power, considering the use of either the Continental six-cylinder engine or the Herschell-Spillman eight-cylinder design, is such that unusual economy, speed and pulling qualities are claimed.

While the chassis of the eight is the same, mechanically, as the six, the body has more refinement, is somewhat better finished and boasts of full leather upholstery. Its general appearance, however, is much the same as the six, with which it easily might be confused at first glance.

The Herschell-Spillman motor is the latest of its type and has a bore and stroke of 3 inches to 5 inches; it incorporates the gearset in unit. The design of the engine has been described in detail in a recent issue, and it will be remembered that the chief distinction between it and most of the other eights is in the method of attaching the connecting-rods to the crankshaft; since, instead of using the yoke-end construction, the rods are placed side-by-side on the same crankpin. Consequently, the two cylinder blocks are staggered with respect to one another by an amount corresponding to the width of the connecting-rod lower bearings.

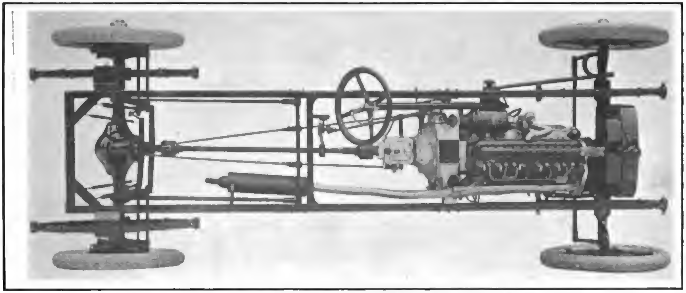
The S. A. E. rating of the motor is 28.8 horsepower and it weighs 550 pounds, exclusive of the gearset. Other features are the double pump cooling and pressure feed lubrication. The chassis has 125-inch wheelbase, has three-quarter floating Salisbury rear axle, three-speed gearset, elliptic rear springs, left drive and 33 by 4-inch tires.

The six-cylinder Continental motor which also fits to this chassis is an L-head block-cast type with 3 1-2-inch bore and a stroke of 5 inches, the S. A. E. rating being 29.5 horsepower. The ignition in this case is Atwater Kent, while starting and lighting are provided for by a Ward Leonard system with drive through the flywheel for starting, the Bendix apparatus making the temporary connection. As with the eight, the three-speed gearset is in unit with the engine.

In taking up the details of the eight-cylinder motor's construction, it is to be noted that it follows generally accepted practice. The aluminum crankcase is common to both blocks of cylinders and is split horizontally in line with the main bearings. The lower part forms the oil reservoir, while the mountings for both crankshaft and camshaft are in the main or upper portion. The camshaft is placed directly above the crankshaft and is driven by spiral gears.

A double water pump is driven by a cross-shaft, also

Side view of Monarch six. Eight-cylinder motor is interchangeable in same chassis

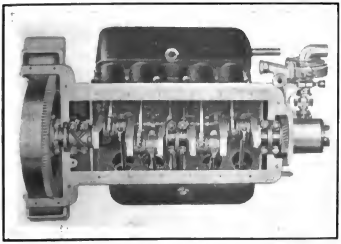


Plan view of Monarch chassis showing six-cylinder motor. Eight-cylinder motor fits the same chassis

through spiral gear connection with the crankshaft and an aluminum cover at the front of the engine houses all the gearing in compact shape. On the other end of the cross-shaft is the generator of the Ward Leonard two-unit electric system, the starting motor being attached to the left side, and drives through the Bendix.

In this engine, special attention has been given to the cooling system, the circulation being maintained by the double centrifugal pump already mentioned, one portion of the pump maintaining circulation in one set of cylinders while the other takes care of the opposite block. The pump has two discharges and separate pipes connect with each cylinder set, and the return path of the water is provided for by four outlets from each block of cylinders. These openings are opposite each exhaust valve and, in order to maintain as uniform a temperature as possible, at each exhaust valve, the size of the openings has been determined with the thought of making the temperature constant at all outlet points. Each cylinder is completely surrounded by the cooling water, there being a 1-2 inch jacket space between.

Oiling is by pressure entirely, with the minimum 10 pounds per square inch and the maximum 40 pounds, under extreme conditions. Located in the bottom of the crankcase the gear pump is beneath the oil level and it is driven by a vertical shaft operated by spiral gear connection with the camshaft. A horizontal passage in the crankcase leads the oil to the bearings through individual branches; thus taking care of the camshaft bearings as well as the crankshaft. Through 1-4-inch holes drilled in the arms of the crankshaft throws, the oil passes from the main bearings to the lower connecting-rod bearings and thence through tubes attached to the connecting-rods, it runs to the wristpins. A relief valve allows the discharge of oil to the timing gears, and from them it eventually finds its way back to the reservoir.



Bottom view of eight-cylinder motor showing side-by-side method of attaching connecting rods to crankshaft

Camshaft and crankshaft are each mounted on three bearings and the single camshaft has sixteen integral cams, this making a rather interesting job considering the offset of one set of cylinders with respect to the other. Main crankshaft bearing sizes are: front and center, 2 by 3 inches, diameter and length, respectively, and rear, 2 by 3 3-4 inches. The pistons are 3 1-2 inches long and have three rings each 3-16 inch wide, and the wristpin bearings are 7-8 inch diameter by 1 7-8 inches in length. Valves are of conventional design also, and have carbon steel stems welded to nickel-steel heads, their clear opening being 1 3-8 inches and lift 11-32 inch.

The timing is the same as that of other eights on the market and the firing order the same for each set of cylinders as it would be if that set alone were working. That is, it is 1-3-4-2 for each side, with No. 1 cylinder on one side following No. 1 on the opposite side.

The bell-housing forming the attachment for the gearset behind the flywheel is in accordance with standard S. A. E. dimensions, being of the form in which there is an integral arm running from either side to the frame as the rear support for the power plant. It should be remembered that in these Monarch cars, the same design from the clutch backwards holds, regardless of the power unit. The clutch is a Hartford cone with spring inserts to aid in easy engagement; behind and housed with it, in the usual unit-power plant fashion, is the compactly designed gearset with provision for center control. There are the customary three forward speeds and reverse, obtained selectively. An open propeller shaft is used, having a joint at either end.

The rear springs being elliptic, elaborate precautions have been taken to free them from any driving stresses, since there are two torque and radius members located just within the side rails of the frame on either side.

A streamline form of body is fitted with all the little refinements that make for grace of outline, and the standard color is a dark blue. Individual front seats with a passage between them for access to the rear portion of the body are supplied in according with the modern trend.

A Three-Quarter Cabriolet Coupé

Three Passenger Design for Moderate-Priced Made-to-Order Jobs

By George J. Mercer

CABRIOLET coupés have become so popular recently that they are carried as stock bodies by many car manufacturers. This type is really an all-weather body and, since it came out, has been improved, the flush side effect having been accentuated and the cowl line blending better with the hood line, while the folding arrangement of the top and the fasteners is now on a sensible working basis. Staggered seats are used to some extent and, by having the body slightly wider, seating for three persons can be provided. The closed-in leather quarter still remains, however, though purchasers are continually asking about the practicability of having a window in its place.

With the larger bodies it is necessary to have a quarter window, but with the small two-passenger bodies, the operation of folding the top must be simple and the fixtures automatic in adjusting themselves. The design herein illustrated has fixtures having all these features and besides it is comparatively inexpensive to make, a most necessary condition, in order that it may be used on moderate-priced bodies of the made-to-order variety, where one or two bodies are made up at a time.

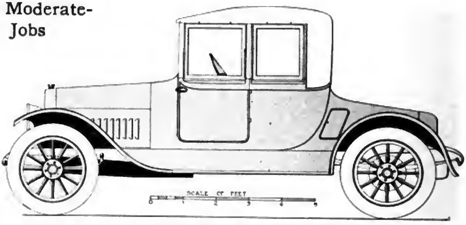


Fig. 1—Three-quarter cabriolet coupé on 122-inch chassis. Note compartment at rear

For Left Drive Chassis

Fig. 1 shows the completed body design mounted on a left drive chassis with 122-inch wheelbase, the tank being at the rear and the tires 34 by 4.5. The frame has the kick-up at the rear for spring clearance and is low hung forward. Some users like the privacy that the closed quarter affords, but the majority want all the window space possible. In this design the windows are large and are made to drop level with the body line when down; in addition the usual outside top joints have been dispensed with and the body has the clean exterior appearance of the permanent-roof job. Seating accommodations are for three on staggered seats and the compartment at the rear has space to store two extra tires, these being pushed in from the rear end, and there are small doors on the sides for access to the space in front when the tires are in place.

Fig. 4 shows the detail of the top construction and Fig. 5 is a side view and plan of the hinge that operates the folding of the toprail. In Fig. 4 the top is shown in both up and down position, one dotted and the other in solid lines, while the arrows show the line of travel from one position to the other. A is the permanent front partition that supports the windshield; B B are the windows, which drop completely out of sight when lowered; C C are the flappers that support the door windows when up, and the arrows indicate the folding movement; D is the pillar that supports the toprail and quarter window and folds toward the rear; E E is the toprail and F is the cut, the hinge for this point being formed by the scissors G G which are explained in detail in Fig. 5. The toprail rests on D and is secured from slipping by a dowel pin on the pillar that engages in a plate in the rail. At the front the toprail is locked to the pillar A, by a fastener that is operated inside the body. At the rear the toprail is connected to the pillar J by the hinge H and this pillar has a regular landau hinge at the bottom cut while the pillar D is hinged at I.

Scissors Bow Hinge

Fig. 5 shows the detail of the scissors bow hinge G G and the two views X and Y are the side elevation and plan, enough of the top framing being included to illustrate the manner of the folding operation and the method of fastening. The scissors hinge is formed of 9-16-inch round c. r. steel and each member is continuous from one side to the other of the

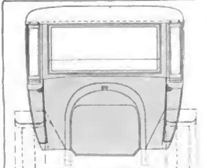


Fig. 2—Front view of the design

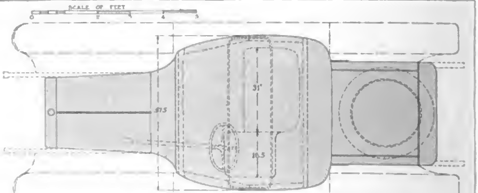


Fig. 3—Plan view, with principal dimensions. Note staggered seating and spare tire

body and forms the support of bow of the roof leather, each end being flattened as shown in the upper view, Fig. 5, and to make them pair they are flattened from opposite sides and riveted at L, while the ends form another hinge with the plate M M. These plates are forgings, the flat part being 1 inch wide by 3-16 inch thick, and the knuckle, milled to receive the end of G, is riveted at this point. M is let in flush in the toprail E and fastened with wood screws. G G is bent at the lower end half the width of the stock, so that when folded it will lie compactly and the space between the sections E E will be only 9-16 inch or the thickness of one iron, the forward member G folding inside the rear one as indicated by the arrow V, at the right of the lower view, Fig. 5. The forward member E is indicated in dotted lines folded on the rear member and the two sections of G are indicated in the space between the members E E.

Folding the Top

When folding the top down, the first operation is to release the button fasteners that secure the top goods to the toprail, then release the lock at A, Fig. 4, and raise the toprail until it disengages itself from the dowel pin at D, when the pillar J will fall horizontal and rest on the block K. This block extends horizontally from the cut on pillar J to the back bar and the trimming inside finishes along its top edge. There is no top lining inside the bows on this design, permitting this block to be used for a top rest. The toprail is folded flat on J by means of the hinge H and the forward part of the toprail revolves back by means of the scissors hinge so that the members fall as shown in the full lines. The scissors show at G-1, Fig. 4, and the bow part is well back of the body and way beyond the chance of interfering with the seating. D is then revolved on I and the flappers C C are turned down on the doors, the only upright member being the front partition A. The top falls flat, there being no folds of top goods between, the top leather being fastened permanently to the roof frame only at the extreme front, on the top of the back bow and along the back line of J up to a point equal with H, so that the goods fall outside the framing, as illustrated.

Constructional Details

The windshield is divided, the upper part being the visor and the lower part forms a ventilator, the door is wide and free passage is allowed to the seats from either side without raising them. In the rear compartment all the doors lock and the door at the back is shown in its open position in dotted lines, the extra tires indicated by dotted lines and the space forward of the tires is used for small articles that can be taken in and out of the sidedoors.

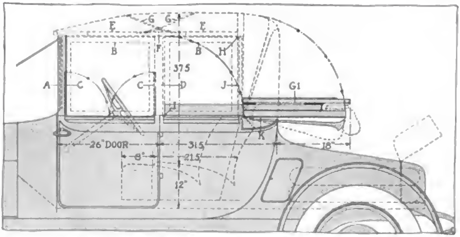


Fig. 4.—Detail of top construction, showing method of folding

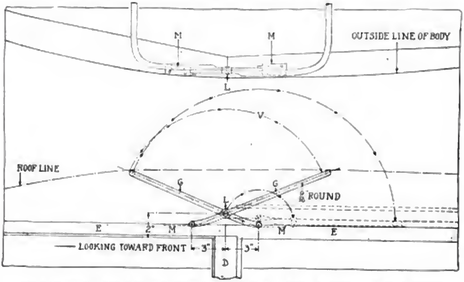


Fig. 5—Upper—Plan view of scissors bow hinge. Lower—Elevation of the scissors bow hinge

The construction of this body, assuming that it is to be a single order, would best be carried out with combination steel and aluminum panels. Wood for the framing and top should be used in all cases with 16 gauge aluminum sheet hammered to the proper shape for the body and cowl panels. The rear part can be all steel, the side and top panel being joined under a moulding as shown in Fig. 3 and the rear door, while more difficult to construct of steel will be stiffer and worth the extra labor. As illustrated, Fig. 3, the cowl is concaved from the hood to the front of the door where it is flattened for a short space to allow for the lap of the door moulding, and also to prevent the opening under the moulding from being too noticeable from the front. This flat space is shown by the perpendicular line in front of the door, Figs. 1 and 2.

Wood frames are used for the windows, on account of using flappers for supports on the doors. Wood is natural finish, either mahogany or walnut, with interior finish mouldings to match. Trimming material can be either cloth or leather, preferably the former, and the quarter window can have a curtain, in which case the curtain silk and carpet will match the material used in color. One electric reading lamp may be secured at the center of the back bow and pockets on the doors are in order.

Style of Trimming

The style of trimming is to have soft cushions and backs with few buttons in either, the absence of laces is marked and the borders are finished with welts of the trimming material not over 3-4 inch wide. Lift straps for the windows are of the goods material and the ends disappear either in the glass runway or in pockets in the trimming. The top is of leather and faced on the under side with imitation morocco. This is close to the leather and the framing and bows show beneath, where they are either covered with the same material or painted dull black, in which case the wood garnish mouldings and the window frames will be painted to match.

The Rostrum

Is Cranking by Hand Becoming a Lost Art

EDITOR THE AUTOMOBILE:—In these days of self-starters, cranking by hand is fast becoming a lost art. It would seem at first glance that the subject were so simple that no explanation could be made of it. Such, however, is not the case, for the writer has several times helped persons who were not only unfamiliar with cranking but did not know how to apply the hand crank to their self-starting machines that failed on account of no electricity or no compressed air. The first usual mistake made by the beginner is the failure to properly engage the cranking lever before turning. He then stands directly over the crank, holding the crank handle firmly between his thumb and forefinger, preparing himself for a mighty heave down to the right hand. If the spark is well retarded and the crank lever properly engaged, the motor will probably start off in good shape and the novice operator will be very proud of his first attempt. "There is many a slip twixt the cup and the lip" and a crank that has not been properly engaged will slip at the first heave, allowing the operator to fall down to the crank's low position. The operator will still retain a firm hold on the crank handle, which, suddenly stopping at the bottom position, will strain or sprain his right thumb. In the meantime the operator's head, which started right over the radiator, has bumped the radiator, probably making a nasty cut over a left eye or some other part of the head. It is no uncommon sight to see a motor of an automobile running with nobody near the car for the simple reason that the operator is afraid to crank his machine because of an experience similar to the one quoted being fresh in his memory. If, in the above case the operator had had his spark well advanced instead of well retarded, and his cranking lever had been properly engaged, the compression cylinder would have fired just as the greatest pressure was vertically exerted on the crankhandle. The engine would have kicked back, either breaking the bones of the right wrist by direct telescoping or by flying out of the operator's hand, making a complete circle, and breaking his wrist by slapping it on its back. If the cranking lever be held in the left hand and pulled up from the left after being engaged, the slipping of the lever will obviously result in no damage to the operator, and should the engine kick back the crank handle will be jerked out of the operator's hand flying around hitting his fleshy forearm, not breaking it due to the flesh cushion. When it is necessary to spin the motor with the right hand the operator should grasp the crankhandle in such a way as to have his arm as far from the vertical as his strength will allow. This position not only lessens the danger from kicking back, but makes the following up of the cranking lever easier.

A broken arm spoils the usual pleasure derived from a car for about 2 months, and a sprained right thumb will be found to be very annoying when handling tools and adjusting parts as necessary.

U. S. S. New Jersey. A. S. KIBBEE

Ford Hard to Start When Warm

Editor THE AUTOMOBILE:—Would like to have you tell me why I have trouble in starting my 1914 Ford when warm? Several times I have had to get help from some one who could spin it. Spinning always starts it but this I am unable to do. It always starts readily if thrown into high when rolling down a grade. It runs well when started.

Some have suggested that I have batteries put on; others a Master vibrator, while easier starting is claimed for the Atwater Kent and other advertised ignition systems for Ford cars. Would any of these things help me or can you suggest something else?

When the motor is cold I have little trouble in starting unless weather is quite cold.

Lakeport, N. H. M. P. B.

—The fact that you have no trouble in starting the motor when cold would indicate immediately that the trouble is probably not in the ignition system. If you will try a slightly richer mixture on the carbureter it may relieve the trouble. Another possible cause is that the valves may be adjusted too close so that when cold they close but when warm there is an air leak that dilutes the mixture. Carbon trouble also acts this way at times and if the motor has not been cleaned out lately it is suggested that the carbon be removed. Another possible feature which does come under the head of ignition is that the dry batteries may be weak.

Mystery Motor Was Motorboat Type

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for February 18 J. N. Liolios asked for information in regard to the Pierce engine. As I operated one of these a few years ago I can give the following information:—

The Pierce engine was built by the Pierce Engine Co., Racine, Wis. It was built purely for motorboats and I found it a very satisfactory machine in its class, that of an engine turning about 400-600 r.p.m. So far as I know it is no longer manufactured, at least by the Pierce Company. If your correspondent would write the Truscott Boat Co., also of Racine, they might be able to tell where parts can be secured as they used many of the motors in their boats.

If Mr. Liolios has any questions about the engine I would be glad to answer them if he will write me at 630 W. 147th street, New York City. I am a motorboat fiend and it was just by chance that I saw the query.

New York City. W. G. Randolph.

Thinks Mystery Motor Is Racine-Made

Editor The Automobile:—I think, from J. N. Liolios' description in the Rostrum for February 18, that this Pierce single cylinder gasoline engine was manufactured by the Pierce Gasoline Engine Co., which was in business, I think, in Racine, Wis., 20 years ago. The engine was cranked over compression by rocking the flywheel. The writer and his partner, E. I. Boies, had one of these Pierce gasoline engines in use in their printing office at Sycamore, Ill., 20 years ago. It was a good engine, too.

Rock Island, Ill. F. O. Vangalder.

Wants Dual Ignition Explained

Editor The Automobile:—Will you kindly explain in your next issue of The Automobile the dual ignition system?

2—What is the advantage of it in racing cars?

Bangor, Me. Chas. V. Jasquith.

—Dual ignition, as has frequently been explained in these columns, is hat system of ignition in which there are two sources of ignition current with a single distributor and a single set of spark plugs. Its purpose is to provide an easy current for starting and a steady current for running. To meet these conditions we often find that one branch of the dual system comprises a battery with a vibrator coil and the other branch a high-tension magneto. For starting, the vibrator coil is efficient at the low speeds of hand cranking. For continued running the high-tension magneto supplies a steady current without exhausting a definite supply and without material drain on the power of the motor.

2—Evidently from this question you are under the belief that dual ignition furnishes two sparks at the same time in the combustion chamber. This is not true. The ignition which supplies two sparks at once is a synchronized two-point or two-double ignition. The advantage claimed for it is quick ignition of the charge.

Overhauled Mitchell 1912 Six

Editor The Automobile:—Am submitting the following details of a job which I recently did and would like you to give your opinion of same:

Recently I had a 1912 Mitchell six runabout to be overhauled and in order to make the car as nearly perfect as possible, I made the following changes: On dismantling the motor I found the piston assembly varying as much as 7 ounces out of balance and the cylinders (3 3-4 bore and 5-inch stroke) having a .004 to .005 inch wear in the head and .002 to .004 out of round. I sent the cylinders to the Houpert Machine Co., N. Y. C. to be rebored and ground. Instead of five 5-16-inch rings I had same made with three 1-4 rings. The piston was machined from 1-4-inch above the wristpin to 1-4 below 1-16 of an inch in depth so rings would have no wearing surface on cylinder. Oil holes were drilled so no oil pocket would form.

I also ordered the following piston clearance: .0035 clearance at base of piston and .008 at the head. Cylinders were bored straight, wristpins were locked by set screw instead of piston ring.

The flywheel weight was reduced from 72 to 50 pounds by removing metal from top of rim and perfectly balanced. The pistons were made a little too heavy as same were only 4 ounces lighter than those of the former. By reducing the number of rings from five to two and 1-16 less diameter do you not think it will make much less piston friction and by perfectly balancing pistons and connecting-rods and flywheels, don't you think same will materially increase the speed of the motor? Have lengthened piston assembly 3 ounces and balanced same so there is absolutely no difference between any one of the four assemblies on a druggist's scale, which shows 1-16-ounce.

2—What valve timing would you advise for this motor for speed and power results?

3—What timing would you advise on a 1914 Trumbull 2 7-8 by 4?

Manchester, N. H. Dana L. Reed.

—The steps which you have taken in this work seem to be correct. The use of the fewer rings cuts down the bearing surface of the rings from 25-16 of an inch to 12-16 thus giving less than half the frictional surface. If these rings will hold compression, this condition will be desirable as the object is no doubt to secure the best possible compression with the least possible bearing surface. By decreasing the unbalanced forces the speed at which you may run the motor will be materially increased.

2—A good timing for this motor is that used in the Continental sixes having dimensions nearly similar and designed to run at high speeds. In these the inlet opens at 10 degrees past top center and closes 28 degrees past bottom center. The exhaust opens 40 degrees before bottom center and closes 2 degrees and 30 minutes after top center.

3—The timing of the 1914 Trumbull is as follows:—Inlet opens 10 degrees past top dead center, inlet closes 24 degrees past bottom center, exhaust opens 45 degrees before bottom center and closes 5 degrees after top center.

Liquid Carbon Removers Harmless

Editor The Automobile:—1—I drive a Stevens-Duryea model AA car. They recommend for the transmission case and rear axle gears a heavy black cylinder oil which must be free from acids so as not to injure the annular ball bearings, an oil known as 600-W is mentioned. Will you please tell me whether I should use Mobiloil C or Mobiloil D for this purpose or can I buy the so-called 600-W? Mobiloil D is said to take the place of 600-W but is for steam cars while Mobiloil C is a dark oil for transmissions.

2—What can you tell me regarding the so-called liquid carbon removers, which are put in a cylinder and left in over night, then withdrawn with an oil gun. Will it remove carbon and will it injure the motor?

Detroit, Mich. D. R. Martin.

—The C grade of Mobiloil should take care of the lubrication of your gearset.

2—The liquid carbon removers are as a rule quite efficacious. The point to be guarded against in the use of these is that they very often cut away the lubricating oil, rendering it necessary for a slight amount of lubricant to be injected into the cylinder before running the car. If this is done there is hardly any fear that any of the well-known solutions will damage the motor.

New Pins for E. M. F. Piston

Editor The Automobile:—Kindly tell me the way of adjusting the wristpins in a 1910 model E.M.F. Is it necessary to fit new pins or bushings?

Marquette, Mich. A. A. Young.

—Unless the wear is quite bad it will not be necessary for you to fit new bushings but merely to put in an oversized pin. These you can secure from the factory for 60 cents apiece. They are made from .003 to .004-inch oversize especially to take up the wear of the bushings. Should you find it necessary to renew the bushings, there are two of

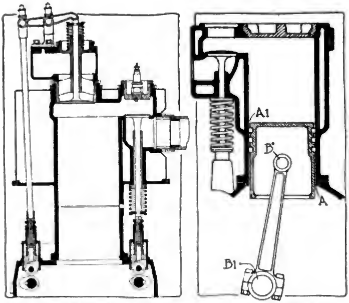


Fig. 1—Left, Sectional view through Chadwick motor. Right, Points of wear on a piston

these in each connecting-rod and they cost 50 cents apiece. The difficulty with these is in the reaming, which is necessary in order to get them to fit.

Chadwick Has 3-Inch Valve

Editor THE AUTOMOBILE:—Will you kindly publish in the Rostrum a diagram of the Chadwick cylinder construction, showing how the copper jacket is applied, spark plug location, and the method of attaching inlet, exhaust and water piping.

2—What is the diameter of the valves used in these motors?

3—What is the maximum speed in revolutions per minute?

4—What is the maximum speed of the Chadwick runabout with a 2 to 1 gear ratio?

Haverhill, Mass. FRED B. HORSCH.

—Referring to Fig. 1, a sectional view of the Chadwick motor will be noted. This illustrates the method of applying the copper water jacket, the location of the spark plugs, and the method of attaching the manifolds.

2—If the Chadwick motor referred to is one built within the last 3 years, the inlet valves are 3 inches in diameter and the exhaust 2.125.

3—While the engine will run at a maximum speed of 2,500 r.p.m. the best pulling speed is between 1,600 and 1,800 r.p.m.

4—According to the Chadwick Engineering Works, the manufacturers of the Chadwick car, at 1,600 r.p.m. with a gear ratio of 2 to 1, the car will have a speed of 80 miles per hour. By gearing the car a trifle lower, say 2.125, or 2.25 to 1 it may be a trifle faster as this would allow the engine to develop its maximum horsepower.

Viscosity Bears Relation to Clearance

Editor THE AUTOMOBILE:—I am writing this manuscript in an effort to correct one of the commonest and worst errors made in making repairs on gasoline motors. It has been my experience and observation that not one out of a hundred of our very best garage mechanics have a clear idea of the proper ratio of wear to the viscosity of lubricants.

Suppose you or I take a car to the best repair shop in town to be overhauled. The machinist in charge will tighten the frame, tighten the motor on the frame, properly grind the valves, adjust the valve mechanism so that it is again practically noiseless and a hundred and one other things, but when he comes to the motor, he gives the connecting-rod bearings and the crankshaft bearings the same adjustment that they had when the car was new.

Now then, referring to the drawing, in a car that has been used some time, there is bound to be a certain amount of wear A and A1 at the right, Fig. 1, and between the piston rings and their grooves; if the repairman gives the bearings B and B1 and the main crankshaft bearings—not illustrated— a tight fit, a thin lubricating oil is necessary in order to lubricate them, and this thin oil will work past the pistons into the cylinder hears, forming carbon deposits and excessive smoking.

If a thick enough oil is used to make good compression and prevent leakage, the bearings will not be lubricated and they will either burn out or cause a seized crankshaft.

By adjusting the aforementioned in proportion to the wear in the cylinders and then using a thick enough oil, an old motor can be made to work perfectly again.

Of course, if the wear in the cylinders has progressed to such an extent that even thick oil works out, new pistons should be made, the bearings readjusted and a thin oil used as when the car was new. Just a little study and application and perhaps some experimenting along the lines of this article should mean a much more quiet and powerful motor after being overhauled.

Knoxville, Tenn. D. C. GOFF.

S. A. E. Ratings of Sixes and Eight

Editor THE AUTOMOBILE:—1—What is the S. A. E. horsepower of a six-cylinder motor with 2 7-8-inch bore and 4 1-2 inch stroke?

2—What is the S. A. E. horsepower of a six-cylinder motor with 2 7-8-inch bore and 4 1-2 inch stroke?

3—What is the S. A. E. horsepower of an eight-cylinder motor with a 3-inch bore and 4 1-2-inch stroke?

Carver, Minn. EDWIN HURTIG.

—Horsepower equals 20.00.

2—20.00.

3—28.80.

You will not doubt think it extraordinary that the motor with a 4 1-4-inch stroke and that with a 4 1-2-inch stroke will have the same horsepower by the S. A. E. rating. That this is true is due to the fact that the formula is based on the hypothetical piston speed of 1,000 feet per minute.

Buick Quit Racing in 1910

Editor THE AUTOMOBILE:—Please give a complete summary of the track, club and association rules under which the Decoration Day races are run at Indianapolis?

2—What are the qualifications expected of drivers?

3—What is the difference between what is known as brake horsepower and the S. A. E. rating?

4—How long has it been since Buick stopped racing?

5—Please explain the dynamometer test for gas engines?

Kansas City, Mo. W. C. BROWNS.

—It will be impossible in this space to give the entire rules governing long distance track races. A copy of these may be had from the American Automobile Assn. Contest Board, 437 Fifth avenue, New York City. In addition to these rules the following are generally adopted by the Indianapolis Motor Speedway Co.

A—The cars may show 75 miles per hour for one full lap of 2.5 miles to qualify.

B—All steering knuckles, front axles, frame hangers and steering mechanisms must be approved by the Indianapolis Motor Speedway mechanical engineer before they are allowed to start.

2—Drivers must be registered by the A. A. A. before they are allowed to compete and must be at least 21 years of age. The referee passes upon the fitness of the driver for the contest.

3—Brake horsepower is that measured on an instrument to determine the actual output of a motor. The horsepower by the S. A. E. rating is that calculated by the formula $\frac{D^2N}{2.5}$ where D equals the bore in inches and N is the number of cylinders.

4—As a company, Buick withdrew from racing in the fall of 1910 at which time the paid racing team of this company was disbanded.

5—The dynamometer test for gas engines consists of mounting the motor upon a testing stand in connection with some form of dynamometer. The motor is then run under its own power driving this dynamometer. In connection with the dynamometer, there is a measuring device which enables the engineer to register the horsepower at the r.p.m. at which the motor is operating. This is obtained throughout the entire range of speed and the results generally plotted in a curve of horsepowers.

Comparative Weight of Cantilever

Editor The Automobile:—I wish to use No. 3 gauge steel in a pair of half-elliptic rear springs.

Weight of loaded car is 1,000 pounds on each spring. I desire a depression of 5 inches under this load and to allow for a further surge of 5 inches, when the fiber stress shall be limited to about 100,000 pounds. Please give width, length and number of plates necessary in such a pair of springs.

In this estimate, please ignore variation of capacity on account of the rise of the spring, and, therefore, in giving the length of the spring, use developed length of main plate from center to center of eyes; springs should be as light as possible.

Please give approximate weight of these springs, ignoring weight of eyes, cutting the long plate 2 inches back of center of each eye, and cut the short plate 12 inches long.

Also for a pair of cantilever springs, use same weight of car, same depression, surge, and fiber stress, and give the necessary dimensions, including gauge of steel. Lay out and estimate the weight in the same manner as above. Cantilevers to be in center. These are also to be as light as possible.

A clear and concise reply in your next issue will greatly oblige.

What I want to find out is the comparative weights of these two styles of springs under the same conditions.

Incidentally, I could hardly understand your article on this subject last May.

New York City. Constant Reader.

Cannot Locate Elusive Knock

Editor The Automobile:—Will you kindly inform me what you think would be the cause of a knock? I have been unable to find the cause, although I have tried first by removing the carbon, also looking for loose main, connecting-rod and wristpin bearings. I have taken the engine apart three times and carefully inspected the parts. I tightened up all the parts mentioned, thinking that the knock would cease, but I find that it is still there. Probably it is in the ignition. I would like to have you explain what you can about a knock caused by ignition and if it is possible, mention other causes for such trouble. I could then decide more easily what would be the best thing to do.

Marlboro, Mass. H. E. Moineau.

—Carbon behind the piston rings, causing them to stick and thus allowing oil to get into the cylinders and carbonize, very often is the basic reason for these knocks, but from your letter it would seem that you had thoroughly cleaned all the parts. It is possible to have a knock from ignition by having the spark timed too early. The full retard position of the magneto should allow the spark to occur on upper dead center. If the motor is revolving slowly, it will knock should the spark occur at this point on account of the tendency of the explosion to act against the inertia of the upwardly moving parts.

Another cause which you have not mentioned is piston slap. A loose piston will give a knock that is very difficult to locate.

Another part that sometimes is loose and causes knocks is in the fly-wheel connection. Timing gears are also capable of giving distinct knocks and if you have not examined these, would advice you to go over them carefully.

The Fit of Piston in Cylinder

Editor The Automobile:—Please advise me how many thousandths smaller the piston should be than the cylinder, considering ground surfaces?

I have a cylinder grinding machine and I am about to refit old cylinders with new pistons. If the clearance varies in different cars, please advise what is the best in each case of the different cars that you know of, especially the Ford.

Prattsburgh, N. Y. H. C. Morgan.

—The clearance between the piston and the cylinder varies for the uses to which the motor is to be put. It is also different at the top of the piston from what it is at the bottom, as a rule tapering from the top to the wristpin, after which it is constant for the remainder of the cylinder. The clearance in an average piston would be somewhere in the neighborhood of .005-inch at the wristpin and .006 or .007-inch at the top. In the Ford car the clearance is .0035 at the top and .002-inch at the wristpin.

Garage for Two Cars and Driver

Editor The Automobile:—Would greatly appreciate any suggestions that would assist me in planning a garage I find necessary to build. The building should be large enough to accommodate two cars and provide sleeping room for the driver. It should also be in keeping with my suburban home, which is a frame shingle-roof-and-sides cottage style.

Steubenville, O. I. M. S.

The simplest and most economical garage for you to build, would be according to that shown in the accompanying drawing, Fig. 2. This gives you room to put the two cars in position side by side and also to accommodate the driver in the space above. The dimensions could be slightly altered to take care of the two cars you wish to accommodate. With this arrangement the driver should have a protection about the entrance to the stairway from above. The one objection to this type of garage is that if it is in the sun the heat in the upper compartment becomes very objectionable. Therefore if the building can be placed under trees where the sun does not beat directly down upon the roof it had better be done. To put the driver's room upon the same floor as the cars would be to give a straggling appearance to the garage which would perhaps mar the layout of your grounds.

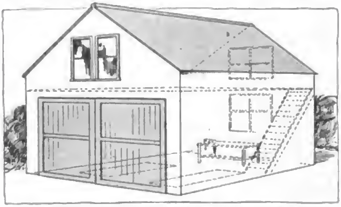
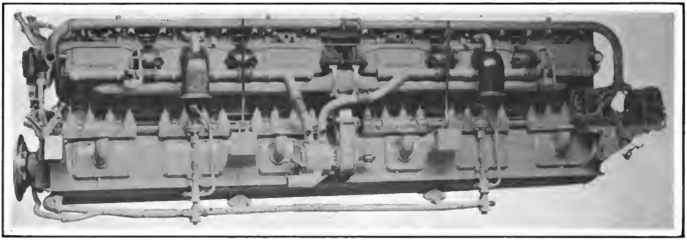


Fig. 2—Skeleton view of simple garage for two cars and a driver's sleeping apartment



A twelve-cylinder tandem motor built for a boat by the Wolseley Motor Co., of England

History of the Twelve-Cylinder Motor

Early Types Built for Motor Boat Work, Though Aeroplane and Automobile Designs Appeared Later

By Eric W. Walford

MOTOR boat racing was responsible for the introduction of the twelve-cylinder gasoline motor, and, curiously enough, two widely different types appeared at the same time, being fitted to the two highest powered motor boats taking part in the Monaco meeting of 1910,—the Ursula and Maple Leaf II.

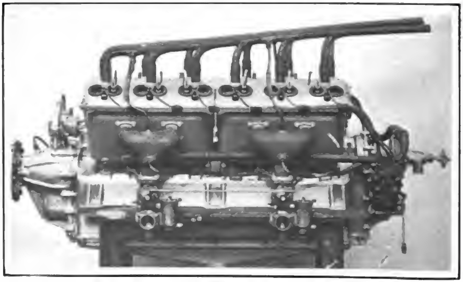
The former was provided with two twelve-cylinder engines made by the Wolseley Motor Co., England, and, it will be seen from the picture, that the cylinders were all in line. There were two propellers, each being driven by a separate twelve-cylinder engine of 7 1-4 by 7 1-2-inch bore and stroke. To all intents and purposes each set consisted of a pair of six-cylinders coupled together and placed in line, each unit being provided with a six-cylinder magneto. There was a single carbureter supplying one long induction manifold with branches leading to the cylinders, and all the exhaust discharged into a single central expansion chamber. Added to these were two longitudinally arranged water pipes and various oil pipes; so accessibility was not a strong feature of the motor which was built solely for power, and did very well.

The engines of the Maple Leaf were a considerable novelty, in that they were of the V-type with two rows of six cylinders mounted upon a common base chamber in a fashion which has now become more general. These engines were made by the Orleans Motor Co. and had a peculiar history, as they were first placed in a 50-foot racing boat, and a cracked cylinder caused withdrawal from the Monaco meeting. They were repaired and then set up in a new hull which entered for the British International Motor Boat trophy competed for in Huntington Bay, U. S. A. This time the *boat* failed, so the engines were taken out and rebuilt in a new boat.

After many vicissitudes it was decided to build another boat, Maple Leaf IV, and the engines were then sent to the Austin Motor Co., England, for reconstruction.

The illustration at the top of page 501 shows the engine as rebuilt. With a bore and stroke of 7 by 7 1-2 inches nearly 400 b.h.p. was developed, and the running was so satisfactory and reliable that the boat took the B. I. trophy back to England.

The chief constructional features of this engine will be recognized from the illustrations and it will be noticed that the induction pipe was of the continuous, or circulating, type



The Sunbeam twelve-cylinder aeroplane engine there being in fact, two pipes connected together by a bend at each end, and each bend communicated with a White and Poppe carbureter. The inlet valves were arranged over the exhausts and the latter discharged into a water-cooled expansion chamber carried over the cylinder heads. Each line of cylinders was provided with its own magneto, but a single camshaft was used for the operation of all valves.

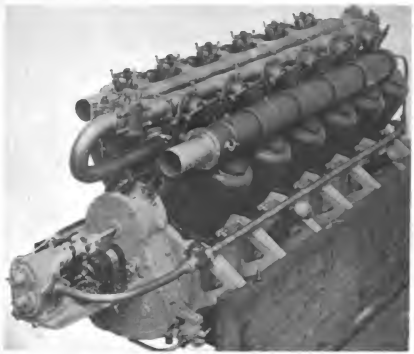
Sunbeam Racing Car

Coming down to more recent times we arrive at the Sunbeam racing car engine, which is well known throughout the motor racing world. In this motor the cylinders were cast in sets of three with a single camshaft and water pump, and a 60-degree angle was used for the V so as to keep down the width. A twelve-cylinder V-type engine with the cylinder lines at 60 degrees is very good as regards uniformity of torque and balance and it is therefore a luxurious engine. It is also light for its power, owing to the fact that it employs a single crankshaft, camshaft, etc. Therefore when high power and light weight is required it is not surprising to find that this type of engine is becoming more and more widely used. Based upon its experience with its twelve-cylinder racing car engine the English Sunbeam Co. has for some time been making twelve-cylinder aero engines, of which one is shown in the illustration at the bottom of page 500.

On the car engine there was one carbureter for each line of cylinders and the two carbureters were arranged at the rear ends of the cylinder lines, while the induction manifolds were located on the outer sides of the cylinders. In the aero engines the induction pipes are in the same position but each cylinder block is provided with a carbureter, making four carbureters in all.

Manifold Arrangement

The arrangement of the various pipes and manifolds is a matter of great trouble to the designer of a twelve-cylinder motor, but on an aerial engine there is some latitude and the Sunbeam scheme of arranging the carbureters at the sides of the engine is good on the score of accessibility, since between the cylinder lines there are merely the exhaust manifolds; though of course, in an aeroplane engine nothing much in the way of an exhaust pipe is necessary. Contrast this with the Maple Leaf engine and one will understand readily that valve accessibility is not a strong feature of this type of engine if a single camshaft is used. So far as I am aware no twelve-cylinder engines have been made with two camshafts, one on each side; though the Rolls Royce Co. made an eight-cylinder engine on these lines many years ago. Even with the all-in-line type of engine illustrated at the top of page 500, there is considerable congestion of piping. The carbureter was located in the center of the engine and communicated with by means of a branch passing between cylinders numbers six and seven with the inlet manifold. The exhaust manifold is not shown but two exhaust branches are visible. When the exhaust manifold is in place the valves are practically inaccessible. It is well known that a single straight inlet or exhaust pipe does not give the best results in a six-cylinder engine, and consequently simplification of the piping system does not seem practicable. If a V-type six-cylinder engine were fitted with slide valves most of these objections would be overcome. Then the piping could all be arranged between the cylinder lines, making a very neat engine.



Austin motor built for Maple Leaf IV, the Canadian racing boat

As stated, most of the twelve-cylinder engines so far produced in Great Britain have been for motor boat and aerial work, where accessibility is not of extreme importance as these engines are usually attended to by a staff of mechanics, the conditions for automobile work being different.

Family Head Responsible for Accidents

DENVER, COL., March 12—A verdict holding the head of a family responsible for an accident caused by an automobile owned by the wife or other member of the family has just been rendered by a jury in Judge C. C. Butler's division of the Denver district court. The jury also awarded the plaintiff $3,750 damages for injury, which is said to be the largest amount ever allowed in Denver in an automobile accident case. The suit was brought against Mr. and Mrs. Ben Kemper by J. A. McIntyre for injuries caused by Mrs. Kempers' electric car, which she was driving at the time of the accident and which she also personally owns. Mr. Kemper's defense against responsibility was based on the ground that his only connection with the accident or with the ownership of the car itself was through having bought the car and given it to his wife as a present.

Mr. Kemper's lawyers have filed a motion for a new trial, and if this is denied they threaten to carry the case to the state supreme court.

The developments of the case are being watched with interest by representatives of companies writing liability insurance for automobile accidents.

Killing by Reckless Driving Is Manslaughter

DES MOINES, IA., March 12—The state supreme court of Iowa made a decision of far-reaching importance to automobilists last month in which it laid down the rule that automobile drivers who kill persons in the highway by reckless driving may be convicted of manslaughter.

The decision came in the case of G. W. Blewen, of Keokuk county, a farmer, who was convicted for the killing of Clarissa Hammes, a child 18 months old, in the road between Harper and Richland on August 16, 1913. He was sentenced to a term of not to exceed eight years in the penitentiary and on appeal the supreme court affirms the decision of the lower court

The case is the first in Iowa in which a driver has been sentenced for manslaughter while using an automobile as a "dangerous weapon." The record shows that Blewen went on and did not offer to aid the injured child. The mother of the baby witnessed the accident.

Fellowcraft Finds Figures To Justify Using Same Springs for Vertical and Horizontal Shocks—Helpful Criticism Answered

Discussion of "The Improvement of Spring Systems"

First Definite Conclusion of Series Draws Qualified Support.

A Question of the Elastic Limit of Springs in Practice

By M. C. K.

FEW combine the training, the interest and the vitality of intellect which would enable a single individual to formulate and present final conclusions on a complicated subject quite correctly at first trial. Until the foundations of a chain of reasoning have been well worked over everybody overlooks one thing or another. The automobile is the best modern example of a complexity in requirements which baffles single-handed solutions in both theory and practice, while its problems cannot await the completion of life studies or slow academic evolution. Some of the simple formulas of kinetics agitated master minds, among them Newton, Leibnitz and Descartes, for more ehan 200 years before they were crystallized and became common property, with erroneous views eliminated.

Public Scrutiny of Figures Helpful

In the transition from slow-speed motors to high-speed motors the consequences and changes, with regard to engine balance, lubrication, valve-timing, bearing-dimensions, etc., which were unavoidable and might have been foreseen by a super-intellect, were not, as a matter of fact, realized in advance by any single individual. Co-operative analysis and figuring were necessary. The academic prejudice to the effect that figures MUST BE final, correct and conclusive when first publicly presented hinders perhaps constructive industrial progress more than any other factor. But it is giving way to a less cramped view of the functions and value of publicity. In every design-problem which arises figures must now battle against other figures until those that are both right and important stand clear and proved. So long as only indefinite words are used, erroneous statements pass muster with facility, unchallenged but also ineffectual. The indefinite cannot be disputed or corrected. It does not dictate new design; it does not help. In accordance with this view the current series of articles on Improvement of Spring Systems, which does not represent an impossible life study but a practicable amount of incidental work, is not a treatise but an inquiry in figures, the figures being intended to make the expression of ideas definite and useful by making them subject to criticism. The method has realized its object at once, for no sooner was the first definite conclusion advanced relating to the need of cushioning the horizontal components of road shocks, before engineers actively engaged in the industry attacked the reasoning on the basis of the figures and thus caused the subject of spring suspension to be entered among those discussed in definite terms; and these lead by the shortest possible route to definite demands in design and construction.

Fair Criticism

The communication from A. Fellowcraft which follows will be found very interesting. It is a rational onslaught on the writer's figures. A division under sub-heads has been inserted and it is especially the last portion under the heading "A Constructive Contribution" which is thoroughly appreciated, as it is believed that the proposed method for determining the horizontal component is essentially more correct than the writer's and sweeps aside some cobwebs relating to the possible influence of the wheel rotation with which the writer's presentation was encumbered. However, another element seems to have been underrated by Fellowcraft at this point, as explained in the attached comment, and, on the whole, the writer's practical conclusions seem strengthened rather than shaken by the criticism. The required revision of figures may change them very little.

Letter from Fellow Craftsman

My dear M. C. K.

The writer has followed your series of articles on Improvement of Spring Systems with considerable interest and is heartily in accord with your first definite conclusion, that provision should be made for an elastic resistance to the horizontal component of the road shock.

A little later, however, you show by concrete figures that a "combination" spring is not possible, or as Mr. Ego in his letter of Feb. 25 puts it,

"You cannot cushion 8524 foot pounds of horizontal stress in a 1 to 2 inch movement of the same spring combination from which you expect to use a 4 to 5 inch movement for cushioning 3180 foot pounds of vertical stress."

Such a condition would certainly preclude the efficient use of a "combination" spring if the ratio of horizontal to vertical stress as given is correct.

It therefore seems necessary, out of a sense of fairness to our old friend the combination spring, to point out a mathematical error at the very beginning of the reasoning, and likewise, as it would appear to the writer, an error in the mechanics of the subject.

Challenged Figures

In series III you say relative to Fig. 6: "It is not necessary to find α in degrees, as it is known that 20" sin α = 17" and 20" cos α = 10.53" and the same proportion holds good for any other radius than 20". Dividing in this proportion, one has BA = 117,187 × 10.53 : 27.53 = 44,650 footpounds, and the mean between this and zero is 22325 footpounds."

The energy represented by BA is clearly K. E. cos α or 117187 × 10.53 : 20 since cos $\alpha = \frac{10.53}{20}$ as you *show* above and not $\frac{10.53}{27.53}$ as you *use* in all the computations.

Likewise sin α = 17 : 20 instead of 17 : 27.53 as you have invariably used.

These mathematical errors are sufficient in themselves to render the final shock figures valueless unless corrected, but it appears to the writer that an error in the reasoning has been introduced that is farther reaching in its effect on the final results than the mathematical ones.

You say, still relative to Fig. 6, "To simplify the estimates, the center of gravity is supposed to lie in the line NB, and while horizontal shocks can be resisted *at B* by the energy of the whole vehicle and a mass determined by 3000 pounds of material, the vertical shocks can be delivered only against 1000 pounds."

This statement is absolutely true if the condition given is rigidly adhered to. That is, if the horizontal force be applied *at B*, in the plane NB.

Values of the Components

The resisting force *is* applied in the direction AB making an angle α with the plane of NB. Its vertical component has a value AB sin α and its horizontal component a value of AB cos α is that proportion of AB that is applied in the plane NB and is therefore capable of resisting horizontal kinetic energy.

NOW FROM THE VERY DEFINITION OF THE COMPONENTS OF A FORCE, THEIR GEOMETRIC SUM MUST *EQUAL* THAT FORCE. AND THE COMPONENTS OF AB MUST BEAR A *FIXED* MATHEMATICAL RELATION TO EACH OTHER, THAT IS A FUNCTION OF THE ANGLE α.

You have shown that with a vertical reaction of 1000 pounds upon the front axle, 3180 footpounds of energy were necessary to impart to that 1000 pounds of material a vertical velocity of 14.25 ft. per sec., that being the velocity acquired in raising it 3" in height, over a lineal distance of 10.53", at a lineal speed of 50 feet per sec.

3180 footpounds is therefore the *maximum* resistance possible in a vertical plane. It is therefore the maximum possible value of the vertical component of AB.

The maximum possible value of AB is therefore $\frac{3180}{\sin \alpha} =$ 3180 × 20 : 17 = 3740 footpounds.

The maximum possible value of the horizontal component of AB is AB cos α = 3740 × 10.53 : 20 = 1975 footpounds.

For the given angle α then, the ratio of the horizontal to vertical shock stresses is in the proportion 1875 : 3180.

Since the vertical component of AB varies with the sine of α and the horizontal component with the cosine, it is evident that for all values of α greater than 45° the sine or vertical component will predominate making the ratio of the horizontal to the vertical stress less than unity, and this condition will probably prevail for 95% of the obstacles encountered.

In a spring suspended vehicle, there is another condition demanding consideration. Your chosen condition is that of a perfectly level roadway previous to the encountering of the obstacle A.

In practice this is rarely the case and the value of the vertical reaction or the vertical load upon the axle B is largely affected by what has just previously occurred. The instantaneous value of the normal weight of 1000 pounds may be much greater or much less, depending upon the instantaneous perpendicular direction of motion and velocity of the platform mass supported at B, that is, it depends upon the inertia of the mass of the platform supported at B.

A Constructive Contribution

If this inertia or resistance to acceleration during the time the obstacle is being surmounted be represented by a mean value R, the horizontal component—H—of the shock force may be expressed by the equation H = R cotan α. Apparently, the horizontal component of the shock force is not a function of α alone as you show from the reasoning relative to Fig. 6, but is a combined function of α and the vertical reaction of the axle receiving the shock.

Doesn't it seem reasonable that this statement is correct, when one considers different loading conditions of the platform. From the equation that the horizontal component H = R cotan α it is evident that the greater the proportion of the load carried by the front axle, the greater the value of R and therefore of H, while a zero value of R makes horizontal shock impossible.

It would therefore appear to the writer that a construction as you suggest in Fig. 21 in which the axle yields obliquely to the shock force might work out very well in practice, particularly on a vehicle using pneumatic tires, and that similar constructions using the condemned "combination" spring may through their simplicity give better *general* results than the more complicated "separate element" construction.

Let me say in conclusion that if there be any doubt as to the correctness of the mechanics of the above solution, try synthetically, to construct a force triangle with the two sides having the values of 8524 and 4450 respectively (your Fig. 6) and obtain a resultant in the direction AB.

Yours for a clearer understanding of the art.

March 10, 1915. A. FELLOWCRAFT.

Answer to Criticism

The reason for using the values 10.53 : 27.53 and 17 : 27.53 instead of using 20 as the divisor in both cases, and doing this throughout after having shown that the ordinary value of the components is that obtained by dividing by 20, is simply that the figures relate to work values and not to pressures. It would be easy to arrange perpetual motion if the two components of a work value $ks = mv^2/2$, amounted to more than ks. This probably only requires to be mentioned to show that in the figures actually used the s-values, which do not occur in the parallelogram of pure forces, have simply been restored. A comparison of the work and the pressures applied to a toggle joint will illustrate the correctness of the figures used. This was originally very briefly referred to.

The alleged error in reasoning which Fellowcraft thinks more serious seems to he partly the same error, which is not

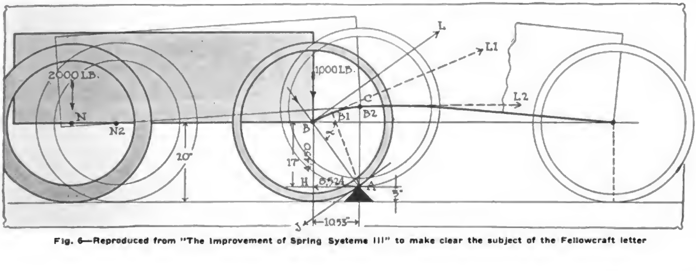


Fig. 6—Reproduced from "The Improvement of Spring Systems III" to make clear the subject of the Fellowcraft letter

an error, and partly another matter. The geometric sum of the components should equal the original force. True for force but not for work. Here the plain sum of the components, not their squares, should equal the original work or kinetic energy; none is lost. BA plus BL represent the whole energy. But when it comes to figuring the vertical and the horizontal components of BA the word "component" is evidently no longer used in the same strict sense, because only the speed and the 1,000-pound front-axle load determine the vertical component while the horizontal component is determined largely by the whole vehicle weight. They are therefore components of different forces, or work values. Their relations to one another are not a function of $\sin \alpha$, and one cannot be calculated from the other, as Fellowcraft does. Only by ignoring the weight of the vehicle as a whole does he obtain a low value for the horizontal component.

But when Fellowcraft urges the relation of the horizontal component to R cotan α—which under the supposition of a level road before the obstacle is reached means 1,000 pounds multiplied by cotan α—the writer is bound to admit that this element certainly should have been considered in figuring the horizontal component. The mere fact that when $R = 0$ the horizontal component also becomes 0 does of course not exclude the vehicle weight from consideration, but it does admit R as a factor. That the vehicle weight cannot be mathematically excluded is evident from any consideration of a case in which the value of $\sin \alpha$ approaches zero.

The difficulty in formulating just how both factors enter arises probably from the complicated nature of the actual condition, the point of attack for the resistance moving in a curve from B to C during the impact, while the acting force—and therefore also the resistance which is its reaction—is complicated by the gravitation or inertia of 1,000 pounds. It was the intention of the writer to find a somewhat acceptable approximation to a correct value for the horizontal component, and now Fellowcraft has shown that in such an approximation some function of the 1,000-pound axle load should be included as a factor. But it seems also clear that a function of the 3,000 pounds of vehicle weight cannot be eliminated and that it will increase the value of the horizontal component considerably, as compared with that upon which Fellowcraft bases his belief in the practical sufficiency of a single or "combination" spring element for cushioning the whole shock.

Until a way is found for estimating the horizontal component with proper regard for both elements in the shock, the question of the preferable means for cushioning both of them may therefore remain in abeyance to a certain extent. Separate spring elements have it in their favor, however, that they permit the proper flexibility for the great majority of shocks, in which the horizontal component is negligible.

For the rear axle this should, in the writer's opinion, be decisive, whether the value of the horizontal component for sharp and dangerous shocks comes nearer to his or to Fellowcraft's estimate. Both valuations are, after all, only estimates and only for one out of a thousand possible conditions.

The force triangle suggested by Fellowcraft is not convincing when the components represent resistances to two different forces: one the gravitation of 1,000 pounds and the other the kinetic energy of 3,000 pounds.

It may be added that the objections relating to the figures 20 or 27.53 in the matter of—components of force *vs.* components of work—have also been made by another engineer.

Variations of the Elastic Limit

Another letter has been received as follows:

Editor THE AUTOMOBILE:—M. C. K. in his articles on "The Improvement of Spring Systems," near the bottom of page 280 in the February 11 issue of THE AUTOMOBILE, says:

"The retarding factors can reside in the metallurgical properties, which make the spring live or sluggish—and those which are sluggish generally take a permanent set sooner or later—in the friction between spring leaves or in friction in other parts of the vehicle which are subject to movement when the springs are working."

I would like very much to have M. C. K. explain this more in detail, especially in regard to whether or not he considers this action to reside in the metallurgical properties if the steel is worked within the elastic limit, also to what extent does he consider the modulus of elasticity of spring steel to vary?

American Steel Foundries G. S. CHILES.
Chicago, February 26, 1915. Mechanical Engineer.

By its definition the elastic limit of steel involves a complete return to the original position of a spring, but, as the writer understands it, not necessarily as prompt a return in one case as in another, though the length of the spring and other factors be alike. That is, the metallurgical properties (including those due to the presence of nitrogen compounds and oxides which can be removed by scavenger alloys or by electric smelting) which are found to change the elastic limit in course of time, probably impede the resilience at all times and steels exemplifying them probably have no perfectly stable elastic limit, although the shortcoming in returning to the original position is too small for measurement on any one occasion. The modulus of elasticity is determined by multiplying exceedingly small values ascertained by measurement by very high figures, and the unavoidable errors in this process cover, in the writer's opinion, a much wider margin than those variations to which any one piece of steel may be subject by reason of molecular changes, unless these are due to an annealing process or the hardening has been finished without relieving excessive or irregular tensions.

Buick Experiment Station at Chattanooga

FLINT, MICH., March 12—The Buick Motor Co., has designated Chattanooga, Tenn., as the location of an experiment station for at least 6 months each year. All new models of automobiles to be manufactured by the company will be tested in Chattanooga fully a year before announcement of their completion, and before the factory at Flint, Mich., actually begins supplying them for the market.

General manager Nash and general sales manager Collins were in Chattanooga recently and approved the selection of that city as the site of operations for the head of the company's designing and mechanical staff. W. L. Marr, chief designer of the Buick cars, has purchased a $5,000 home on Signal Mountain near the Inn. He expects to reside there from 6 to 9 months each year. Mr. Marr already has two mechanical engineers employed under his direction executing paper designs for the Buicks of the future.

Operations of the experiment station will also be devoted to the testing of new inventions and improvements calculated to make a car faster, more durable and superior from every standpoint.

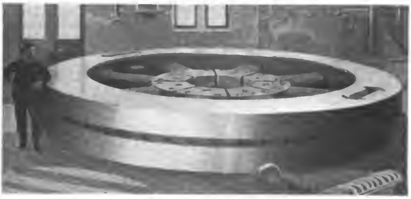
Cheaper Freight for Return Tanks

INDIANAPOLIS, IND., March 12—A hearing was held at Indianapolis recently on the complaint filed with the Interstate Commerce Commission by the Prest-O-Lite Co. against some twenty-five railroad companies in which more equitable freight rates on Prest-O-Lite empty tank shipments returned for refilling is sought. In less than carload lots coppered or plated empty tanks go as third class, whereas if they are painted they go as fourth class. In carload lots empty tanks, whether coppered, plated or painted, go under the same classification. The hearing was conducted by A. O. Bell, a special examiner for the commission. The company says a proper classification would result in a saving in freight charges of from $20,000 to $25,000 annually.

Huge Flywheel for Ford Plant

Casting and Machining Wheel Weighing 180 Times as Much as Ford Car Prove Difficult—Power House To Be Built Around Engine

FOR many months, the power plant buildings at the Ford plant in Detroit have been boarded up and one of the world's largest gas engines has been slowly nearing completion within: when all the heavy parts are in position, the building will be completed around them. The building and placing of the parts for the monster prime mover has made the engineers scratch their heads many a time, since the weight is such that new methods of moving them and special rigging to put them in position have been necessary, and have called for all the ingenuity of those in charge of the work.


Flywheel for big gas engine now being installed in the Ford plant

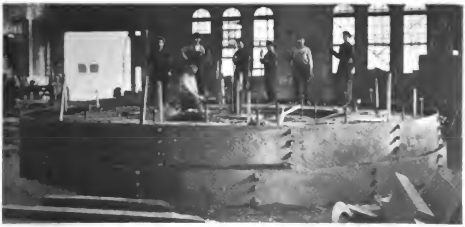
Perhaps the most difficult of the many problems was the building of the huge cast-iron flywheel which is a most essential part of the new engine. It was a big undertaking, for the wheel weighs 220,000 pounds and is 20 feet in diameter. Some idea of the enormous size is given by the fact that it would take more than 180 Ford cars, five average street cars or one good-sized locomotive to equal it in weight. Its diameter is two-thirds that of the average city lot, and it is more than double the height of the ordinary room.

Thus it will be seen that to cast and machine such a flywheel called for some interesting and novel tactics. It is the usual practice with heavy flywheels to make them in two halves and then to link these together when put in position. This wheel was made in two pieces, though it was cast as if it were all one, but instead of digging a pit in the floor of the foundry and pouring the molten metal into a mold made in that way, the Hooven, Owens, Rentschler Co., Hamilton, O., builder of the giant, decided to make up the form entirely above the ground and in the center of its casting floor.

One of the illustrations shows the mold in practically complete form ready to receive the metal. Curved plates of steel of comparatively short length were used and, for strength, were bolted together at the joints. These plates were short in order to insure the curve being a perfect one and, as they were not wide enough for use singly, two rings one above the other had to be made. Half a dozen men were employed to tamp down the molding sand into solid form and brick played an important part in the construction of the mold.

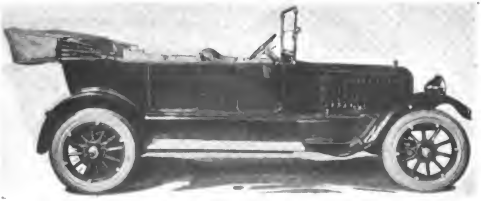
Then the next problem that confronted the maker was how to pour such an enormous quantity of metal so that the flow would be continuous, for once the pouring is begun, it must be continued without a break in the flow until the mold is full, or otherwise the casting will cool unevenly. It required a big melting capacity to heat enough metal all at once, and besides it is no small job to convey this from the point of melting to the mold.

Three overhead traveling cranes were pressed into service, and it was arranged for each crane to handle two huge ladles from which the liquid metal was poured into the mold. Having solved the method of transporting the metal, the next step was to arrange a time schedule for filling and pouring from the ladles. The force of employees was carefully instructed as to the system and everything moved with military precision, each ladle being given a number and their movement arranged so that while any three ladles were at the form pouring, the other three were at the furnaces being filled. Thus the flow was kept continuous until the pour holes showed the mold to be filled completely.


Making the mold for casting the two halves of the huge wheel simultaneously

In machining the big casting more difficulties had to be surmounted and firstly the joints where the two halves came together had to be smoothed down to a very minute exactness. A large draw shaper specially built to do such jobs was employed for this part, after which a big vertical boring mill was called upon to machine the hub and to turn down the diameter to its proper size. Of course, for these boring mill operations, the halves were joined.

Stanley Steamer Has Radiator Condenser



The new Stanley steam car which differs radically from the previous product of the company

Wheelbase Increased 10 Inches—Drilled Burner Replaces Slotted Type—Brakes Enlarged—Many Refinements

BY adding 10 inches to the wheelbase and placing a V-shaped honeycomb radiator at the forward extremity, the Stanley Motor Carriage Co., Newton, Mass., has entirely changed the outward appearance of its new product. In spite of this exterior revamping, the fundamental principles of Stanley construction are maintained in the new model, although a great number of refinements calculated to increase the efficiency of the vehicle have been added.

Drilled Burner Used

One of the most important features of the new car is the drilled burner used instead of the former slotted type. By the use of this new burner the Stanley company has found it possible to secure 30 per cent. more power from the same boiler than that used last season. In fact, it was at first intended to replace the boiler of last year by a larger design, but the new burner has worked out so satisfactorily that the desired amount of power has been secured without any increase in tube surface. It will be remembered that this boiler is a vertical fire tube of 750 1-2-inch tubes. A minor improvement has been made in the boiler, also, by brazing the tubes on the inside, thus enabling the tubes to carry off a greater amount of heat should they become empty through accident and thereby greatly decreasing the danger of burning out the boiler.

The same type of pilot-light system as was employed in the 1914 model 710 Stanley is found in the 1915 model 720. This is an independent system in which a separate source of fuel is used under independent pressure and under ordinary circumstances will burn for about 4 days without attention.

Automatic Feed-Water Control

Another refinement which will be found in the new car is the use of an automatic feed-water control for increasing or decreasing the supply to the boiler. The hand control employed on former Stanleys is continued and the driver is therefore perfectly free to adjust the water supply according to his own ideas. Should he not care to pay any attention to the water level the automatic device will take care of this for him.

Radiator as Condenser

It is in the use of the honeycomb radiator that the biggest change has been made. By the successful employment of this type of condenser the car may travel 200 miles on one filling of the 24-gallon water tank. Last year the amount of water carried for a trip of this length was considerably greater thereby adding much to the weight of the car. The successful use of a radiator condenser has been a stumbling block in the way of steam-car designers for a long time due to the fact that since the lubricant is introduced into the cylinders it is naturally carried with the steam exhaust into the radiator, forming a deposit on the interior surface of the cooling medium, thereby rapidly cutting down its efficiency and soon clogging the entire system.

The method by which this difficulty has been solved is in the use of a graphite lubricant in which the graphite is carried in a deflocculated condition. In addition to this only enough oil to prevent the cylinders from rusting is introduced, 1 gallon sufficing for about 500 miles.

Left Drive Adopted

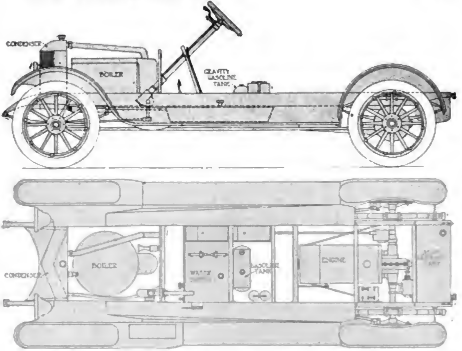
Owners of former models of Stanley steam cars will not note a great difference in the control except that it has been shifted to the left side in response to public opinion as exemplified in the greater number of cars now on the market. The steering gear is a new Warner design this season and the brakes are 14 by 2 inches, which is a larger size, although the car is said to be of less weight due to the use of an aluminum body, the carrying of only 24 gallons of water instead of 40 and the lighter construction in the body itself. Another feature of the new model is the use of the Splitdorf-Apple system for electric lighting. A very simple installation of this has been made as it has been geared directly to the differential, thereby adding only one moving part, the armature of the dynamo.

Pumps Driven from Axle

Another new departure from previous Stanley practice is to drive the pumps for fuel and water from the rear axle instead of from the engine. A more efficient pump has been secured and one in which noise has been eliminated by having a longer stroke at one-quarter engine speed. The changing of the pumps was not due, however, to difficulty with the engine installation used last season, but was a necessity to meet the changed position of the water tank which is considerably lower, due to its mounting underneath the condenser. In the engine itself only one change has been thought wise, and this is the installation of plain bearings instead of ball bearings in the cross-head. The Stevenson link motion for the valve has been continued.

Detail Refinements

The above review of the changes are the most radical departures from previous practice although throughout the



Above—Elevation of new Stanley steam car chassis, showing new radiator-condenser
Lower—Plan view of the new Stanley, showing layout of radiator-condenser, boiler, engine and drive members

chassis other detailed refinements will be noted. For the general facts of Stanley construction it may be noted that the Stanley Motor Carriage Co. builds but one type of passenger car, this being the five-passenger touring type illustrated. The engine is rated at 20 horsepower, although, due to the characteristics of the steam-propelled power plant, horsepower is merely a question of steam pressure and torque, a question of the steam pressure and point of cutoff. Steam is admitted to the cylinder for about one-quarter stroke during ordinary running and expanded for the remainder of the strokes. In starting the links are shifted over and steam is admitted for practically the entire stroke. There are only two positions utilized on the Stevenson link motion in this engine.

Narrow Turning Radius

The wheelbase of the new design is 130 inches, but, due to the use of the V-radiator, it has been found possible to narrow the frame at the front end, allowing a shorter turning radius than the previous model which was 10 inches shorter. The engine is bolted rigidly to the rear axle and is braced from the front of the engine back to the mounting, thus making a single unit of the engine, differential and rear axle. The suspension of the car is unique in that the body rests on a built-up platform made up of the two axles and perch rods through which the drive passes.

The unit formed by the engine differential and rear axle is attached to the car by a three-point suspension method, each of the points of attachment being an oscillating bearing.

The frame is of channel steel and the springs are semi-elliptic front and elliptic rear. The rear axle is carried on Timken bearings and the front is also a complete Timken unit.

Blow-Off Valve on Radiator

In operation, the water, which is the medium of power, passes through the following cycle. From the water tank it passes through the feed water heater, thence to the boiler and in the form of steam passes into the cylinder where it expands. The exhaust steam from the engine passes into the radiator and is condensed there, the water immediately draining into the tank below, so that when the steam ceases to pass into the radiator, the latter becomes empty and dry. An overflow pipe in the top of the water tank allows any steam coming into it to escape and on the radiator a blow-off valve set at a very low pressure prevents this unit from being subjected to any injurious internal pressure. While running at an ordinary speed on fairly level roads, very little steam is ejected from the water tank.

Electric Lighting System

The price of the model 720 complete with full equipment is $1,975 f. o. b. Newton. The body, as stated, is full aluminum five-passenger fore-door design. The doors are 19 inches in front and 20 inches rear. The front seat is 44 inches wide and 18 inches front to rear. The cushions are 8 inches deep. The rear seat is 48 inches wide, 20 inches from front to back and has 10-inch cushions. The tonneau space is 30 inches from the back of the front seat to the front of the back seat. A one-man top, side curtains, clear-vision windshield, and the electric lighting system with a Willard 6-volt 80-ampere battery and a full set of lamps are included with the equipment. The body and wheels are a dark blue with fine gray striping, while the running gear is black, an attractive combination.

Boiling Point Standard for Gasoline?

NEW YORK CITY, March 12—The Standard Oil Co. has entered upon a campaign to educate the public to gauge its fuel not by specific gravity or rather by Baumé, but by boiling point instead. The first gun in the campaign sounded recently when an almost inconspicuous note appeared simultaneously in a number of newspapers throughout the country. This was labeled S. O. Gasoline Reader No. 1, which would indicate that it is to be followed by others of a similar nature.

This points out that gasoline of low gravity really is more desirable than gasoline of high gravity, because it contains a greater number of heat units and therefore has more latent power, and that boiling point is the only true test of the quality of gasoline intended as fuel for internal combustion engines.

With the first of these contentions, the independent producers would seem to have no quarrel; they do not attempt to controvert this physical fact. But they are by no means agreed that boiling point—in the particular way in which it is referred to by the Standard Oil Company—can be used as an accurate indication of the quality of fuel.

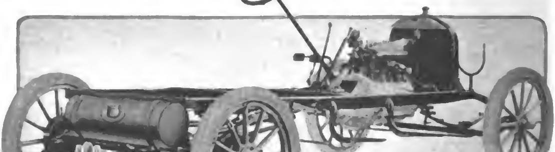
The independents point out, for example, that the initial boiling point and the final boiling point are entirely different factors, and that both should be used as a gauge of quality. These two temperatures should be nearly equal, state the independents, to indicate that gasoline is of good quality. And this contention is upheld by the Standard, which states in its notice: "The first requisite of a motor fuel is that it be a homogeneous, straight-distilled product." This means the gasoline which is obtained from a straight cut of one fraction of the crude during the process of distillation. In other words, it is impossible to obtain a truly homogeneous mixture by adding high gravity gasoline to low gravity gasoline in order to raise the average gravity.

It is pointed out by the independents that there is no difficulty in obtaining a low initial boiling point with blended gasoline of this kind. But when gasoline is blended, the lighter fuel is used up first and the residue contains a certain percentage of heavy oil and carbon, the first causing difficulty in starting and the last causing deposit. It is the presence of these heavier fractions which raises the final boiling point. From which it becomes clear that it is the final boiling point temperature, rather than the initial boiling point temperature, which should be used as a gauge.

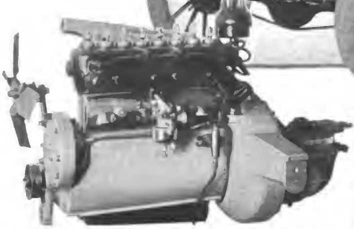
The Standard Oil Co. states that typical figures for average motor fuel would be an initial boiling point of 110 degrees F. and a final boiling point of about 340 degrees F. These are for "straight distilled" gasoline. "Blended" gasoline may boil at as low a temperature as 70 degrees or 80 degrees F., but the final boiling point likely will be as high as 500 degrees F.

Herff-Brooks Adds a Small Four Chassis

New Car Has 106-Inch Wheelbase, and Block Motor—Model 25 Brings Vacuum Fuel Feed Line to Three Cars



Three-quarter view of Herff-Brooks small four chassis, showing layout of control units



Four-cylinder block motor used in new Herff-Brooks small four, showing mounting of fan, gearbox, etc. Note Atwater Kent distributer

TO supplement the six and four-cylinder cars put out by the Herff-Brooks Corp., Indianapolis, Ind., a new small four has been announced under the name of model 25. This car is in the low-priced class marketing in touring form with all equipment at $765.

Five-Passenger Design

Although essentially of light car type, this car is of ample size to carry five passengers, having a 106-inch wheelbase and a power plant of sufficient dimensions to carry the consequent weight. The motor is a Perkins design, having its L-head cylinders cast in a block. The bore is 3.25 inches and the stroke 4.5. Referring to the accompanying illustration, it will be noted that the valves are on the left side and are covered by two plates which are removable by the use of two large cam screws.

The motor is of clean exterior appearance having the intake and manifolds contained in a single casting. The carbureter is quite high and although on the same side as the valve cover plates, it does not interfere with their removal and still allows an accessible arrangement of the carbureter adjustments and mounting.

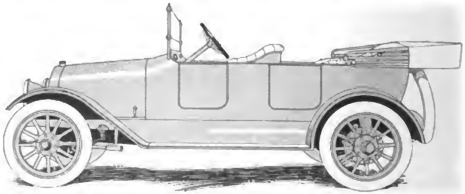
Three-Point Suspension

The power plant is a unit with three-point suspension. It has an aluminum crankcase and the housing of the gearbox which bolts directly against the crankcase bell housing is also of the same material. Cooling is by thermo-syphon and the radiator is tubular in form. Ignition is by a single-battery system with an Atwater Kent distributer. The carbureter is a Holley and is bolted directly to the manifold flange without any separate interposed header. Throughout extreme simplicity is used in all the connections. The casting which contains the intake and exhaust manifold is bolted directly against the cylinder casting by stud bolts, and the fan bracket is held in place by two bolts which are simply elongated timing gear housing bolts.

The clutch is a leather-faced cone, having engaging springs beneath the leather facing. It transmits the power of the motor to a three-speed selective gearset mounted in the same housing with the clutch. The gears in the gearset are nickel-steel and the bearings on the main driveshaft of the gearbox are New Departure ball. The drive is taken by shaft through two universal joints through a Salisbury floating rear axle equipped with both ball and roller bearings. The wheels are artillery design of hickory and are fitted with 30 by 3 1-2 Goodyear tires on demountable rims.

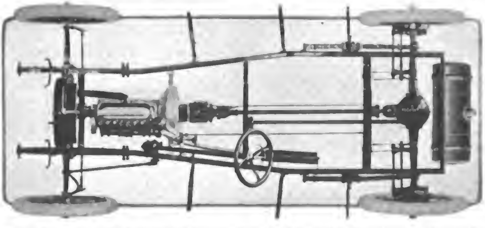
Vacuum Fuel Feed

The gasoline feed is by the Stewart vacuum system carrying the main gasoline tank at the rear in the customary manner and feeding to the carbureter by gravity from a small tank placed behind the dashboard. Disco starting and light-



The new Herff-Brooks small four five-passenger touring car ing is part of the equipment included in the fixed price. The brakes are in two sets, both acting on the rear wheel drums, the service being an external contracting design operated by pedal and the emergency controlled by hand lever. This brake is internal expanding. The front axle is a drop-forged I-beam carrying the spring pads for the semi-elliptics as a unit. The rear spring suspension is by cantilever.

The tread is standard 56 inches, the wheelbase 106 inches and the body is finished in black with running gear of the same color. The wheels are natural wood finish. The equipment includes electric starting and lighting, head, tail and dash lamp, electric horn, one-man mohair top, two-piece ventilating windshields, Stewart speedometer, demountable rims, one extra rim, robe rail, tire irons, tire straps, tire repair kit, tool kit, jack, pump and other usual equipment.



Plan view of new Herff-Brooks small four chassis, showing tapered frame and simple, but strong, construction

Automobile Trades Assn. of Colorado Formed

DENVER, COL., March 12—The Automobile Trades Assn. of Colorado has been incorporated by the following six Denver dealers in automobiles and accessories: W. W. Barnett, R. C. Peete, Tom Botterill, R. R. Hall, J. D. Quinn and E. H. Bull. The chief objects of the organization are to encourage cordial relations and active co-operation for mutual benefit among all Colorado dealers in automobiles and allied lines, to improve trade methods and practices, to gather and dispense useful information for advancing efficiency in the establishments of members, to establish and maintain a credit bureau, to give each branch of trade represented better chances for development, to affiliate and co-operate with other trade organizations throughout the United States, to secure concerted action relative to legislative matters affecting the industry, etc.

The officers are as follows: President, C. T. Bruckman; first vice-president, J. W. Foster; second vice-president, H. P. Sebolt; treasurer, Tom Botterill; secretary, R. C. Peete. Headquarters were opened yesterday in the Majestic Building in this city.

20,000,000 Feet of Brake Lining

A PORTION of automobile make-up that is perhaps seldom thought about is the brake lining; if one thinks of it at all it is as a petty detail, yet the manufacture of woven asbestos material for lining automobile brakes has become quite a large industry. There are now in use something like 2,000,000 automobiles in this country alone, and there are only a few that have not woven lining in the brakes, so there is at least 20,000,000 feet of brake lining in use, for the average length taken to line all four brakes would not fall far short of 10 feet.

Tremendous Production

Every driver knows that the linings of the brakes are not expected to last for more than a certain number of thousands of miles, and few cars find their way to the junk heap till they have used up a good many linings and relinings, which means that, allowing for the new cars being made in the factories and the old cars in the repair shops, the annual consumption of brake lining is probably about equal to the total amount in use. It is easy to see that the production of even 1,000,000 feet of brake lining is a fair undertaking, let alone 20,000,000; that such an output must give employment to many men, call for a deal of capital investment and be a large, interesting business. The huge total quantity explains why so many different concerns have entered the field and accounts for the size of the principal specializing factories.

How Brake Lining Is Woven

Brake lining is woven on a loom just like any other kind of ribbon, only instead of using threads of cotton or silk, each strand is a strong brass wire covered with asbestos. Weights or springs put a heavy pull on each thread and the shuttles oscillate to and fro, weaving the strands together as they are drawn slowly through. This work calls for looms of heavy, strong construction, and the hard nature of the threads is troublesome in several ways, one of the greatest difficulties having been to ensure the width and thickness of the lining within fine limits. Experience has now made it possible to work to thousandths of an inch on the weaving, while small errors on the material as it comes from the looms can be corrected in the rolling process which follows. This rolling has for its purpose the consolidation of the material, which comes from the rolls even harder than it left the looms.

There is a good deal of difference in the kinds of asbestos which are dug up from various parts of the earth's surface, and the sort preferred for brake lining manufacture is that in which the natural threads are of good length. These threads are twisted around the wire center by automatic machines, the original purpose of the wire being to act as a carrier which will permit the close weaving of the asbestos. The impregnation with the brown binder used for most linings is for the purpose of holding together the asbestos after it is woven, it assists the wire when use of the brakes wears through the strands, and the added stiffness given by this "glue" makes the lining easier to cut, drill and rivet to the brake.

Apart from linings for brakes, quite a quantity of the same kind of material is being demanded for clutch lining, especially for dry disk clutches, and it is now customary for the disks to be made up in finished form from lining specially woven for the purpose. Of course, the consumption of clutch lining does not compare in any way with that of brake material, but it is considerable.

It is often assumed that one brake lining is much the same as another, that the different makes are different only in name, but this is very far from the truth. There are good, bad and indifferent materials just as in other kinds of goods and the best brands cost most to make.

Experiments Show Action of Mixtures

Simple Tests with Inexpensive Materials Clearly Illustrate Action of Different Combinations of Air and Gasoline Vapor

By H. S. Webb

An idea of the behavior of rich, lean and and perfect mixtures of gasoline vapor and air when burning, and a demonstration of the fact that gasoline vapor is heavier than air, which must be taken into consideration in ventilating garages, can be arrived at by the following very simple experiments. These experiments are not dangerous in the least. The apparatus is shown in Figs. 1, 2 and 3. It consists of a metal can, such as a medium size ordinary baking powder can, and a piece of sheet metal somewhat larger than the can, and notched at the edge. The zinc cup of a dry battery will answer equally as well as a can. The top of the can is not needed. The gasoline can be handled with perfect safety if put into a small oil can, such as is used for typewriters and sewing machines.

Temperature a Factor

The place where the experiments are made should be free from draughts of air. It is assumed that the temperature is about the same as that of an office or living room. If the temperature is higher, the vaporization of the gasoline will be more rapid and the experiments will require less time. If it is colder, it will take longer for the gasoline to vaporize, but the can can be kept warm by burning some additional gasoline in it, and this will expedite the work. If the can is very cold, the vaporization is apt to be so slow that considerable of the vapor will leak out unless the cover is a very close fit.

The quantities of gasoline to be used are given for a can about 3 inches in diameter by 5 inches high. Blow into the can or move it rapidly through the air after each experiment to remove the burned gases after the flame has burned out.

1—Set the can on a table so as to stand upright and drop two large drops of gasoline into it on the bottom. Let it stand 15 or 20 seconds for the gasoline to evaporate or vaporize. Then apply a lighted taper or splinter of wood long enough to reach down to the bottom of the can readily. If there are no air draughts about the can, the light will have to be put well down toward the bottom before the vapor will ignite. If the vaporization has been complete, the mixture will burn rapidly with a blue flame and a gentle puff or explosive sound.

If the mixture lights near the top of the can it is probably on account of air curents stirring it up. In such a case try the experiment again, but put the sheet metal plate over the top as soon as the gasoline is dropped in, so as to cover the can closely and cut off air draughts. The notch in the cover should be beyond the can so as to leave no opening. Leave standing half a minute or more, then remove the cover by sliding it off and immediately apply the light. Even if the can is left standing several minutes it will be found that the vapor is still at the bottom and will not ignite till the light is put well down into the can. If it lights near the top, try again with less gasoline. With a small enough quantity of gasoline, and the can closed air-tight as with a rubber seal, so that there can be no possible air circulation between the interior and exterior of the can, the vapor will remain at the bottom a long time.

2—Put two drops of the gasoline into the can again, lay the cover on so there will be no leakage and shake the can while holding the cover in place. This will distribute the gasoline throughout the can by giving it a circulation throughout the interior. Continue the shaking for 10 or 15 seconds and at the end of the time when the mixture is thoroughly distributed, place the can on the table, and immediately slip the cover off and apply the light. The mixture will light at the top of the can and the burning will be more rapid than before.

3—Put in four drops of gasoline, lay the cover on the can and leave for 2 or 3 minutes; then slip the cover off and apply the light. The mixture will ignite at or near the top of the can. The burning will probably be more gentle than in 2, especially toward the finish.

The increased amount of gasoline produces a correspondingly greater amount of vapor. A given volume of air, as a cubic inch, can absorb only a certain maximum amount of vapor, just as water cannot dissolve over a certain amount of salt. The vapor, being in greater quantity, therefore, rises higher in the can.

4—Put in four drops again and follow the same procedure as in 2. The burning will be more rapid than in any of the preceding cases.

Too Rich—Incomplete Combustion

5—Put in ten drops and proceed as in 2. The burning will be slow and the flame yellow or incandescent part of the time. This is because there is more vapor than the air in the can will burn. More air generally circulates into the can and completes the burning, although there may not be enough circulation in some cases to burn all of the gasoline.

6—Put in two drops of gasoline and immediately invert the can on the plate so that it is closed. Set them together on the table so that the notch in the plate projects over the edge of the table, the can still inverted. Let them stand for ten or fifteen seconds, then slip the can over the plate so as to cover most of the notch, the can still resting on the plate. Apply a light at the notch. A weak explosion will follow, and the can may be lifted slightly by it. This shows increase of pressure by combustion; also that the vapor of gasoline settles to the bottom of the can.

7—Put in four drops and proceed as in 6. The explosion will probably be stronger than in the case of 6.

8—Put in four drops again, cover the can and shake. Then place the inverted can on the table as before and light immediately. The explosion will probably be stronger than in any other of the experiments.

9—Put in ten drops of the gasoline. Otherwise repeat 8. The explosion will be gentle, and the flame shot out will be white or yellow, part of the time. Immediately apply the light again if the flame does not continue around the edge of the can; a second, but less strong, explosion will follow. This can generally be repeated several times. Sometimes a second explosion will immediately follow the first of its own accord.

The cause of the second explosion in either case is that there is more vapor than the air will burn at first. After the first explosion the immediate cooling of the hot gases still in the can draws in fresh air and a second combustible mixture is formed. Sometimes the first mixture is so slow-burning that the flame is still continuing in the upper part of the can when the gas cools and contracts enough to draw in the fresh air. This lingering flame ignites the fresh mixture.

10—Put in twenty drops or more of the gasoline. Shake well, invert the can on the table with the notch covered by the can as before, and apply the light. The mixture will ignite quietly around the lower part of the can where it is leaking out, and burn quietly. It will not explode on account of being too rich to burn before it is diluted with air.

Alcohol Slower to Vaporize

The experiments can be carried out with alcohol, but more alcohol will have to be used and longer time allowed for vaporization. The flame will always be blue with alcohol.

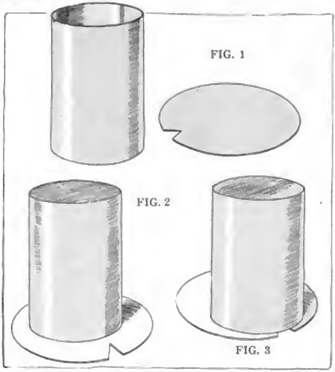
Conclusions

The first and sixth experiments show that gasoline vapor remains, or settles, to the bottom of the inclosing space. It is evident, therefore, that a room cannot be ventilated so as to carry off gasoline vapor by openings at the ceiling; but that openings through the floor or under the bottom of a door will allow the vapor to pass out. The room can also be ventilated by a flue whose bottom opening is at the floor when there is a current of air passing up through the flue. There may be no natural draught up the flue in damp, heavy weather, so it must then be induced by some artificial means, as a fan or steam coil in the flue.

The second and fourth experiments show that air currents will carry the vapor through the entire body of the air in the enclosed space, and that the entire volume will become a combustible mixture if the right proportion of gasoline is vaporized.

The seventh and eighth experiments, compared with the sixth and ninth, show that increasing the amount of gasoline from a minimum up to a certain extent also increased the strength of the explosion, but that an excessive amount of gasoline not only does not give a stronger explosion, but a weaker and slower burning one.

The tenth experiment shows that a very rich mixture will not explode at all. If the mixture were entirely cut off from communication with the outside air, as in an engine cylinder, it would not even ignite. As the experiment is carried out there is always a small proportion of combustible mixture where the air and rich mixture meet and the light is applied.



Apparatus consisting of a tin can and cover with a notch cut in it necessary for these experiments

It will be found that when there is not an excess of gasoline vapor present so as to cause a yellow flame, the blue flame will scarcely affect the brightness of the metal of a polished can. But when the over-rich mixture is burned with the accompanying yellow flame, there will be a decided black deposit of carbon on the sides of the can.

Recent Court Decisions—Must Pay for Injuries

By George F. Kaiser

IN Wisconsin a party in a law suit who desires a jury must pay a $12 fee.

A motor company recovered a judgment of $93.35 for repairs and storage of an automobile. The court held that the Wisconsin statute providing that the party who demands a jury must pay $12 as a jury fee, which he may recover from the other party if he is successful in the action, is not an unreasonable regulation of the right to a jury trial guaranteed by the Constitution, which provides "Every person . . . ought to obtain justice freely and without being obliged to pay for it."—*Reliance Auto Repair Co. vs. Nugent*, 149 N. W. (*Wisconsin*) 377.

15 M. P. H. Negligent on Slippery Streets

A livery man sued a motorist for damages arising out of a collision between an automobile and a team and carriage. One horse was killed and the carriage and harness were damaged. The automobile was also considerably damaged. The livery man recovered a judgment for $250. The automobile was going west at a speed of 15 to 20 miles per hour and the carriage was going north. The automobile skidded and nearly turned over, crashing into the team and carriage.

The court held that, as the accident happened at the intersection of streets where there was a great deal of traffic, knowledge on the part of the operator of the automobile that the streets were wet and slippery was evidence that the accident was his fault.—*Right vs. Young and Warnock*, 170 *S. W.*, 25.

Insurance Company Pays

A motor car owner's right of recovery on a theft policy was upheld in a recent New York decision.

The action was on an insurance policy on the ground that the car was stolen and afterwards destroyed.

The car had been taken to a paint shop to have some work done upon it. The painter's brother took the car, after he had asked for permission to use it and been refused, and, while he was driving it had an accident in which it was destroyed.

The court held that, as the policy insured the owner against loss by theft of any person other than those in the employ, service, or household of the insured, the insurance company was liable and would have to pay.—*Troy Automobile Exchange vs. Home Insurance Co.*, 149 *N. Y. S.*, 978.

Starter Wagner giving the flag to Resta, in the Peugeot, as he crossed the finish line, winner of the Vanderbilt Cup

Resta's Generalship Won Vanderbilt

Rough Course Kept Speed Low but Brings Out Skill of the Drivers—Police Work Well Done

By A. G. Waddell

SAN FRANCISCO, CAL., March 8—For the seventh time a foreign-built car has won the Vanderbilt Cup. The course, with its rough planks and sharp turns, provided a thorough test for both driver and car, and Resta and his Peugeot are deserving of much praise. While the Grand Prize, raced over the same course last Saturday, was more a race of drivers' endurance than of the speed of machines, the Vanderbilt combined both. The distance called out every ounce of pluck and fight in the drivers, and the speed attained gave an opportunity for the carefully-wrought mechanism to show its worth.

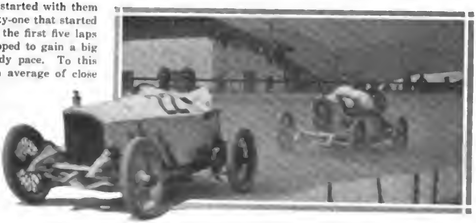
Compared to the 87.8 miles per hour averaged by Pullen in the Corona road race last November, the 67.3 miles averaged by Resta looks puny. But even those who have seen nothing but a map of the course realize that to attain this speed the drivers must have been forced to travel at close to 80 miles an hour on the straightaways. And when it is known that the longest of these is less than a mile, some conception of what 67 miles an hour means can be had. Add to this two right-angle turns, a sharp loop around a status, a 45-degree turn following a straightaway and some thousands of bumpy planks which floor a hairpin curve and you have a fair geometrical picture of the Exposition track.

Someone said that the course was the finest in America for the reason that it required great skill on the part of the driver. But it requires more than mere skill. Any skilful driver could get around the course without trouble if he took his time, but if he made the round at a 50-mile an hour pace he would have to add to skill a dash of daredeviltry. The man who mentally pictures smash-ups when his car begins to skid has no place on the Exposition course. The barest whisper of fear in the mind of the driver would be cause for an accident.

No delays or hitches discontented the spectators at the Vanderbilt. The race had been set at 12:30, instead of 10:30, early in the week. By 10 o'clock over 18,000 spectators had paid admissions to the grounds and by noon the number had risen to 50,000. Before the race was done 100,000 people had gathered along the track. Without the excellent policing furnished by the soldiers from the Presidio accidents to the spectators would have been inevitable. In place of the call of "car's coming" and a scurrying and running to clear the track, the course was always clear and at the most dangerous corners spectators were held 15 feet from the track. The courteous, efficient work of the 348 guards was a credit to both the army and the Exposition officials.

Shortly after the start Mrs. William K. Vanderbilt, wife of the donor of the cup, entered the stand and became an enthusiastic spectator. Her box was directly above that occupied by Governor Johnson. Mayor Rolph, of San Francisco, was as excited as a small boy and found that even his office could not move the guards. The mayor arrived late, just after Starter Fred Wagner had given orders that no one should be allowed to cross the track. The obdurate guard refused to be moved by the dignity of silk hat and a swallow-tail, so Wagner came to the rescue.

It was rather odd that Resta, winner of the cup, and De Palma, twice holder of the trophy, should be in the first three to start. The Chevrolet which started with them went out, but the first two of the thirty-one that started finished in the money. The pace for the first five laps was terrific. Tom Alley evidently hoped to gain a big lead and then settle down to a steady pace. To this end he tore around the course at an average of close to 75 miles an hour for five laps, or about 20 miles. The pace was too great. Alley soon found it out and settled down to a more sane speed. All this time Resta hummed along, not in the least worried over the burst of speed by the Duesenberg. He was apparently concerned with but one thing—to keep his Peugeot running steadily at an even pace. That he accomplished this may well be seen from the time reports which show Resta continually in the front after Tom Alley settleddown.



Ralph DePalma in his Mercedes having a brush with Resta in the Peugeot. DePalma finished fourth

Rickenbacher, in the Maxwell, also had his burst of speed at the first and then went out. He was the first to make a round of the course and for a time he and Resta engaged in a brush which provided some pretty racing on the straightaways. But Resta's tactics were different from Rickenbacher's. Rickenbacher was out to pass the foreign driver and to lap him; Resta was content to speed up only enough to keep himself abreast of his competitor and not to pass him. Resta appeared to drive with his eyes on a stopwatch, Rickenbacher with his eyes on the car ahead of him.

Then Pullen drew into the contest and began with Resta a forty-lap brush which called cheer after cheer from the spectators. But the story was much the same. Resta would not be drawn out into a too dangerous pace. He held his own and was satisfied. He was racing against time, not against cars. DePalma seemed to feel much the same way about the contest. He was wise enough to know that great speed was foolish. He drove smoothly and carefully, always alert, but taking no unnecessary chances and coming in for the money when many of his more reckless race-mates were lying wrecked along the course.

Shortly after Pullen had begun his fight with Resta, Ruckstell worked up into a position where he could contend with the winner. The safe lead that Resta had attained by this time made him pay even less attention to Ruckstell than he had to Pullen. Ruckstell's efforts came to naught, however, for in the seventy-second lap he broke an axle and went out.

It was then that Wilcox and his Stutz had their big chance and took advantage of it with a great burst of speed. He overhauled Pullen and gained second place at the finish of the race because of the time allowance given for the start.

Carlson had trouble all through the race with a leaky radiator and lost valuable minutes at the pits in an attempt to repair it. The attempt was useless and several stops were made for water.

Much favorable comment was caused by the performance of the Overland, which finished twelfth. The Overland was the lowest priced car in the race and finished without a single stop for mechanical adjustment.

Hay Embankments Save Lives

Again the hay embankments at the turns and angles proved their worth. Edward O'Donnell and P. Henderson, driver and mechanician of the wrecked Duesenberg, owe their lives to a bale of hay. When their car struck the sand in front of the Indiana State building it began to do a fantastic dance, skidded wildly from side to side for 200 feet down the track. When O'Donnell and Henderson realized that the car was bound for the side of the track and that a turn-over was inevitable, they crouched in the cowl of the car and threw as much of their bodies out of the car as was possible. When the car stopped it lay on its back with the hood resting on a bale of hay. The space between the hay and the ground was all that saved the men from being crushed.

It was the same sand that caused Bob Burman to cut the top off of a 6 by 6 post as though it were a piece of match wood. He swung the big Case into the curve at a high speed, skidded and neatly clipped the top of the heavy post and then continued on his way.

Plan 1,000-Mile Race for $100,000

INDIANAPOLIS, IND., March 13—A 1,000-mile race for $100,000 is being planned by the Indianapolis motor speedway management. First prize will be $50,000. A. C. Newby of the National Motor Vehicle Co., this city, is the father of the plan. Mr. Newby plans to make the race strictly invitational, limiting entry exclusively to makes of cars having won previous 500-mile races. Four such makes are eligible to date, Marmon, National, Peugeot, and Delage, with possibly a fifth after the next 500-mile race, May 30. Providing each manufacturer of those cars would enter five cars, a field of twenty-five cars would start the race.

A qualifying speed of 90 m.p.h. for twenty laps of the speedway is to be necessary, and the race is to start at 6 a. m. The drivers are to alternate driving the cars during the contest, 250 miles each, two drivers to a car.

Resta's winning Peugeot passing the corner of the fine arts palace at the Panama-Pacific exposition. The fine arts lagoon and two of the national pavilions are shown in the distance

The AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, March 18, 1915 No. 11

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Better Springs Coming

SINCE the almost acrimonious discussion which took place at the winter meeting of the S. A. E. after the reading of the paper on cantilever springs little more has been heard on this subject, but whatever may be decided as to the theory of spring action and design, when the full discussion comes to be published there is no doubt but that new kinds of springs are in course of being tried out by most of the engineering departments in our automobile factories. In Europe it was found that the light car offered a particularly difficult problem for the spring designer, and it seems that the same experience is being had here, while it is also to be observed that the work of improvement which the coming of lighter chassis has rendered imperative has resulted in some discoveries that will be of value to cars of all weights.

In the whole history of automobile engineering there has never been a wave of interest in any one particular problem that has not had a good effect, ultimately; so we may safely rest assured that the average 1916 automobile will have a better suspension than its predecessor, but this does not mean that a boom in cantilever springs is to be looked for. It would be absurd to deny that there might be such a boom, but, be this how it may, the investigations now being made will show methods for improving all kinds of springs.

At the S. A. E. summer meeting the subject is sure to come up again, even if it is not included in the program, and we may then hope to hear the results of the researches now in progress. It is not to be expected that they will be spectacular in any way or that the knowledge gained will show up in exhibition halls. What is needed is agreement on the proportions of load, spring length, spring thickness, number of leaves, and so on, and the effect of thus widening the data possessed by the engineer and spring maker will only be noticeable on the road.

Lamp Bulb Standards

THE British Engineering Standards Committee has issued a report containing sundry recommendations as to standards for the bases of lamps used for automobile lighting, the sizes of bulbs and the voltages being also suggested subjects for standardization. No doubt the most important part of these standards is the regulation of voltage, and for this two standards of 6 volts and 12 volts respectively are put forward. This cuts out the 24-volt systems altogether and also the 8-volt, which has been popular in Europe for small cars. It is premature to attempt to pass a verdict upon these suggestions till the matter has been considered by the S. A. E. committee for similar standardization in this country, but it seems likely that the British recommendations will be hard to reconcile with American practice if the British decision is to fix upon the double contact lamp base. The natural feeling is that it is scarcely time to settle for or against the single contact system yet, that the two systems ought to be allowed a little longer to fight it out between themselves with the public as judge. Still any attempt to bring order out of the chaos that now exists among voltages and bulb patterns is to be hailed with acclamation since some reasonable standards would be of infinite benefit to users of automobiles, and still more advantageous to dealers who now have to carry a very complicated lamp stock.

Iowa as a Car Buyer

MANUFACTURERS with their fingers on the pulse of the buying powers of the different sections of the United States have not over-rated Iowa. Sixth in car registrations as it is, with 106,087 on its list, the surface has not been so deeply furrowed that there is any fear of a decrease in the number of car purchases. Des Moines alone, it was predicted at the close of the show, will distribute 20,000 cars during 1915. The accessory business that this carries along with it is almost as important as the car business because it endures from year to year, starting when the car is originally purchased and not ending until it is on the border of the scrap heap. Grumbling on the effects of the war is not heard in this state where the crops have increased in value $27,342,000 in a single year. What percentage of this surplus is available for the purchase of cars is beyond estimation, but the optimistic atmosphere at the show in Des Moines prophesies good.

United Kingdom Is Still Best Car Buyer

Purchased 1,389 American Cars in January, or 359 More Than in January, 1914—Asia and Oceania in Second Place

WASHINGTON, D. C., March 16—The United Kingdom still remains the largest buyer of American automobiles, the latest figures of the Federal Bureau of Statistics showing that in January King George's country bought 1,389 passenger cars valued at $1,770,966. In the same month of last year the purchases amounted to 1,030 cars, valued at $855,973. France's purchases in January last amounted to 236 cars, valued at $527,869, a large increase over the purchases for the same month of 1914, when sixty-three cars, valued at $47,506 were shipped to France. Under the head of Asia and other Oceania, the records show that 293 cars, valued at $808,793 were shipped there, as against 193 cars, valued at $163,641, shipped there in January of last year. Commercial vehicles showed a great increase, from forty-five in January, 1914, to 935 for the same month in 1915, the values of which were $74,491 in January, 1914, and $2,545,527 in January, 1915. For the 7 months ending January, 1915, both the commercial vehicle and passenger car exports totaled $16,707,541, as against $13,254,854 for the same period in 1914. Export of tires increased from $137,889 in January, 1914, to $353,914 for the same month in 1915. Great Britain's tire exports for that month amounted to $165,715.

Process for Making Synthetic Rubber from Crude Oil

New York City, March 13—By chance one of the chemists of the Baku, Russia, oil fields, in the course of fractional distillation of petroleum, recently discovered that certain fractions boiling between 98 and 106 degrees Centigrade yield about 20 per cent. of their weight in adipic acid, which is a compound formed by the action of nitric acid on fats.

It has been known for some time that adipic acid can easily be converted into butadiene, through its own amide, which is a compound derived from ammonia by replacing the hydrogen atoms with univalent acid radicals, and the discovery of an unlimited supply of adipic acid is very likely to be a long step forward in the production of synthetic rubber. Butadiene can be converted into caoutchouc by means of a simple and inexpensive process.

New York City, March 17—A paper entitled "The Internal Combustion Engine in the Motor Boat," by C. F. Chapman, associate editor of *Motor Boating*, will be delivered before the Metropolitan Section of the Society of Automobile Engineers, Thursday, March 25, at the Automobile Club of America.

Exports and Imports of Automobiles, Trucks and Accessories in January and Preceding 7 Months

	January				7 Months Ending January			
	1914		1915		1914		1915	
	Number	Value	Number	Value	Number	Value	Number	Value
AUTOMOBILES AND PARTS:								
Automobiles—								
Commercial	45	$74,491	935	$2,545,527	436	$714,261	3,972	$10,989,442
Passenger	2,481	2,174,392	1,803	1,313,153	13,553	12,540,593	6,904	5,808,099
Total	2,526	$2,248,883	2,738	$3,858,680	13,989	$13,254,854	10,876	$16,797,541
Parts (not including engines and tires)	....	$475,299	....	$615,185	....	$3,609,488	....	$2,789,246
Total automobiles, and parts of	....	$2,724,182	....	$4,473,865	....	$16,864,342	....	$19,586,787
BY COUNTRIES								
Automobiles:								
France	63	$47,506	236	$527,869	464	$361,803	2,024	$5,017,488
Germany	94	56,483	....	....	482	333,544	16	17,364
Italy	64	33,763	3	2,412	195	137,710	26	23,722
United Kingdom	1,030	855,973	1,389	1,770,966	3,512	2,805,325	3,448	4,758,702
Other Europe	175	121,245	130	229,065	889	713,091	701	1,894,278
Canada	370	423,093	263	226,533	1,895	2,659,482	1,378	1,890,693
Mexico	9	15,109	3	1,410	124	207,457	39	48,427
West Indies and Bermuda	58	50,651	102	66,980	334	312,745	468	341,012
South America	145	120,079	104	54,276	1,348	1,412,340	471	270,685
British Oceania	174	146,672	155	124,751	2,142	1,846,576	1,354	1,084,885
Asia and other Oceania	193	163,641	293	808,793	1,269	1,251,814	683	1,246,244
Other countries	151	214,668	60	45,625	1,335	1,212,967	268	204,041
Total	2,526	$2,248,883	2,738	$3,858,680	13,989	$13,254,854	10,876	$16,797,541
TIRES								
Belgium	....	....	....	....	....	$15,429	....	....
Germany	....	$2,940	....	....	....	59,294	....	$6,090
England	....	34,027	....	$165,715	....	804,635	....	891,660
Canada	....	48,031	....	41,317	....	459,718	....	358,066
Mexico	....	4,236	....	12,197	....	88,262	....	60,856
Philippine Islands	....	9,110	....	25,079	....	94,162	....	125,161
Other countries	....	39,545	....	109,608	....	361,181	....	466,724
Total	....	$137,889	....	$353,916	....	$1,882,681	....	$1,908,557
IMPORTS								
AUTOMOBILES AND PARTS:								
Automobiles ....No dut.	12	$40,754	14	$27,013	221	$508,784	219	$367,855
Parts of (except tires)..dut.	....	42,192	....	69,149	....	355,784	....	536,955
Total automobiles, and parts of	....	$82,946	....	$96,162	....	$864,568	....	$904,810
BY COUNTRIES								
AUTOMOBILES:								
France	7	$24,213	7	$16,419	99	$248,763	36	$86,853
Germany	....	....	....	....	15	37,307	6	13,606
Italy	1	1,000	1	1,000	39	58,666	90	94,920
United Kingdom	4	15,541	3	4,947	34	105,676	53	133,453
Other countries	....	....	3	4,647	34	58,372	34	39,023
Total	12	$40,754	14	$27,013	221	$508,784	219	$367,855

Massnick-Phipps Gets Wahl Plant

Perkins Motor Manufacturer Will Increase Force to 500 Men—Plans Output of 100 Motors a Day

DETROIT, MICH., March 13—The business of the Massnick-Phipps Mfg. Co., East Lafayette boulevard, manufacturer of the Perkins four- and eight-cylinder motors, has been increasing so rapidly of late that greater production facilities had to be found. This is now an accomplished fact, as the company has secured the plant of the former Wahl Motor Co., on East Congress street, thus providing 30,000 square feet of additional floor space and making the total more than 65,000 square feet. The working force will be increased to total 500 men, of which 200 will be employed at the Congress street plant where the motors will be assembled and tested. It is the plan of the company to increase its output to 100 motors a day. At the present time fifty are being made daily.

Paige Sales Gain Nearly 70%

DETROIT, MICH., March 13—There are now from 700 to 800 men working at the plant of the Paige-Detroit Motor Car Co., and the production will soon be 1,000 cars a month. Actual sales up to the end of the first week of March were nearly 70 per cent. greater than at the same time in 1914. The production is being increased as rapidly as possible in order to meet the increasing sales. Reports received from Paige dealers from every section of the country are said to be better as to the future outlook of business than at any other time in the concern's history.

DETROIT, MICH., March 12—Up to the middle of February, the General Motors Co. had produced and sold 20 per cent. more cars than it had manufactured in the same period of the 1913-14 fiscal year. Sales up to March 1 were 75 per cent. as large as for all the late fiscal 12 months and the 4 months of largest sales are still ahead of the company.

The company has $13,500,000 cash in the treasury, which is 40 per cent. more than a year ago.

Overland Action on Extra Dividend in April

PASADENA, CAL., March 12—John N. Willys, president of the Willys-Overland Co., states that no action regarding an extra stock dividend will be taken until early in April. No extra cash dividend will be paid at the present time. There was a rumor of a 50 per cent. dividend within 60 days. It is stated, however, that rather than a stock dividend in April, the management will announce that hereafter a more or less regular distribution of stock will be made each year in addition to the regular 6 per cent. cash dividend. In this way the stockholders will gradually receive the $5,000,000 common stock now in the treasury.

This method of distribution of the stock dividend, if followed, would entail but a slightly increasing demand on the earnings for dividends, whereas the issue of the $5,000,000 block of stock at once would add $300,000 per annum to dividend requirements.

TOLEDO, O., March 16—The Willys-Overland Co. has declared the regular quarterly dividend of 1 3-4 per cent. on the preferred stock, payable April 1 to stock of record March 20.

Money Orders Exchange with South America

WASHINGTON, D. C., March 15—Negotiations are in progress for the exchange of money orders between the United States and principal countries of South America. A statement issued by the Postoffice Dept. said negotiations were well under way and probably would be consummated soon.

The department also announced that foreign exchange conditions had improved so much recently that it had been possible to remove the $100 limit on money orders for all countries except Austria, Belgium, Egypt and Portugal.

The Federal Reserve Board recently took up for consideration a request from the National City Bank of New York for permission to open foreign branches at Havana, Cuba, and at San Juan, Porto Rico. Branches have already been established at Buenos Aires and Rio de Janeiro.

Conditions in the United States are improving, especially in the Northwest, where the farmers are very optimistic over the crop outlook. Bank deposits have increased, $218,000,000 has been deposited in the banks of St. Paul and Minneapolis, Minn., showing a gain of $16,000,000 since December, and a gain of $26,000,000 since last March. Bankers of the two cities declared that never in the history of the Northwest were conditions so favorable at this season of the year.

NEW BRUNSWICK, N. J., March 16—The annual meeting of the stockholders of the United States Rubber Co. was held here today. M. S. Burrill, of New York City, and S. N. Nicholson of Providence, R. I., were elected directors to succeed D. L. McGibbon and H. S. Hastings, resigned. The other retiring directors were re-elected as follows: W. S. Ballou, J. C. Brady, N. F. Brady, M. Bun, S. P. Colt, H. E. Conzerse, J. Geshler, J. B. Ford, F. L. Hine, H. L. Hotchkiss, A. L. Kelley, Lester Leland, S. N. Nicholson, R. B. Price, H. E. Sawyer, W. H. Truesdale, T. N. Bail, J. W. Derneule and E. S. Williams.

The board of directors will meet in New York City on March 18 and organize by re-electing the present officers.

Canadian Rubber to Issue 10,000 Shares Pfd.

MONTREAL, QUE., March 8—At a meeting of the stockholders of the Canadian Consolidated Rubber Co., Ltd., today, the directors were authorized to issue 10,000 shares of additional preferred stock to be allotted to present shareholders at par. The directors were also authorized to issue 200 shares of preferred stock now held in the treasury. The company manufactures all kinds of rubber goods, including automobile tires.

The proceeds of the $1,000,000 additional preferred stock which is to be issued by the company will be used for working capital and not for any specific purpose. The terms under which the new stock is to be issued stipulate that the United States Rubber Co., which owns more than a majority of the present stock outstanding, will take whatever part may not be subscribed for by minority stockholders, in addition to taking its pro rata share.

Until this last action of the directors, the authorized capital stock of the company consisted of $3,000,000 common and $2,000,000 7 per cent. non-cumulative preferred. There was outstanding on January 1 last, $2,804,120 of the common and $1,976,780 preferred.

CHICAGO, ILL., March 17—*Special Telegram*—Editor THE AUTOMOBILE:—The announcement made in newspapers that the Stewart-Warner Speedometer Corp., has been awarded the equipment contract on Ford cars is not based on fact. No such order has been placed although negotiations for partial equipment are under way, but nothing definite has been done.—Stewart-Warner Speedometer Corp.

Perrin Joins Continental Engineering Dept.

DETROIT, MICH., March 17—*Special Telegram*—J. G. Perrin, formerly chief engineer of the Lozier company, is now identified with the engineering department of the Continental Motor Mfg. Co. He first became associated with the Lozier interests when Lozier made bicycles. Later, he designed the first Lozier automobile and remained as chief engineer until the company became insolvent.

Owen Joins Forces with Houpt

NEW YORK CITY, March 12—Announcement is made today that Ray M. Owen, one of the pioneer sales organizers in the automobile industry, has joined forces with Harry S. Houpt through the purchase of a substantial interest in the Harry S. Houpt company. The latter concern is eastern distributor for the Mitchell car and will continue to act as such, in addition to which the Owen magnetic car will be marketed. While in New York City the Owen magnetic car will be handled independently, it will be the policy of Harry S. Houpt, Inc., to market both cars together at other distributing points.

MILWAUKEE, WIS., March 12—Prices for Stegeman motor trucks have been reduced from $200 to $350 on the different models, the 1 1-2-tonner being reduced from $2,100 to $1,900; the 2 1-2-tonner from $2,800 to $2,500; and the 3 1-2-tonner from $3,350 to $3,000.

Jeffery Has Order for 750 Trucks

French Government Orders 3-4-Ton Type to Be Delivered in 60 Days—Involves $1,000,000

KENOSHA, WIS., March 13—One of the largest orders for motor trucks to be granted an American manufacturer as an outgrowth of the European war is the requisition booked by the Thomas B. Jeffery Co., Kenosha, Wis., last week. The order is from the French government and calls for the delivery of 750 Jeffery 3-4-ton trucks within 60 days. The contract involves about $1,000,000 and was procured by H. C. Hill, who went to Paris several months ago to seek war business for the Jeffery company. Several hundred additional operatives were employed last week and it is the intention of the company to reach a daily production of thirty cars a day on this order alone.

NEW YORK CITY, March 15—Word was received here today that forty trucks had been sold to the government of Portugal by I. M. Lewis of the Bessemer Motor Truck Co., Grove City, Pa. Mr. Lewis secured the order in London.

TROY, O., March 13—The Troy Wagon Works Co. has secured contracts aggregating $500,000 for motor truck trailers to be used hy the warring nations of Europe. These contracts are in addition to the regular business which is showing a good increase.

SYRACUSE, N. Y., March 13—At a recent meeting of the directors of the Chase Motor Truck Co., this city, it was decided that this company would not accept any future business for motor trucks to be shipped to the warring nations.

DETROIT, MICH., March 13—The Federal Motor Truck Co., which is now employing 150 to 175 men, is operating to full capacity and reports increase of business of 20 per cent. during the first 2 months of this year as compared with January and February, 1914.

Market Reports for the Week

NEW YORK CITY, March 17—Changes in this week's market prices were few, but in several of them they were important, for instance, in the case of linseed oil, which has remained at 60 cents for a number of weeks, there was an increase of $0.02; in Pennsylvania petroleum, there was a loss of $0.05; in lead, which there was an advance of $3.00 per ton; and in tin which closed at $52.00 per 100 pounds, there was a gain of $8.00. The markets for the above products were strong and steady. The scarcity of tin and the irregularity at London, were responsible for its rise. Business in electrolytic copper, as well as in standard, was small. Antimony is held firm at 21 cents. No change occurred in Fine Up-River Para.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.20	.21	.21	.21	.21	.21	+.01
Beams & Channels, 100 lbs.	1.26	1.26	1.26	1.26	1.26	1.26	......
Bessemer Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	......
Copper, Elec., lb.	.14⅝	.14⅝	.14 13/20	.14 13/20	.14 13/20	.14 15/20	+.00 3/20
Copper, Lake, lb.	.14⅝	.14⅝	.14⅝	.14⅝	.14⅝	.14⅝	......
Cottonseed Oil, bbl.	6.70	6.05	6.74	6.70	6.70	6.70	......
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	.92	......
Lead, 100 lbs.	3.95	3.95	3.95	3.95	3.95	4.10	+.15
Linseed Oil	.60	.60	.60	.60	.62	.62	+.02
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans. crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa. crude	1.50	1.50	1.50	1.50	1.45	1.45	—.05
Rapeseed Oil, refined	.75	.75	.75	.75	.75	.75	......
Rubber, Fine Up-River, Para	.58	.58	.58	.58	.58	.58	......
Silk, raw, Ital.	..	3.90	..	..	3.90	3.85	—.05
Silk, raw, Japan	..	3.47½	..	..	3.50	3.45	—.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	..
Tin, 100 lbs.	44.00	46.00	49.00	49.00	51.00	52.00	+ 8.00
Tire Scrap	.05	.05	.05	.05	.05	.05	......

Automobile Securities Quotations

NEW YORK CITY, March 17—Changes in this week's securities quotations were considerably larger than last week's. There was a quick advance in the automobile stocks. An evidence of this is made when these stocks are compared with last week's and the low prices in January: Maxwell Motors first preferred, 74 today; 67 1-4 last week; and 43 1-4 in January; General Motors common, 97 today; 91 1-2 last week; and 82 in January; and General Motors preferred, 96 today; 94 last week; and 89 in January. The two other stocks of Maxwell Motors also made gains, the common being 3 points and the second preferred, 4 points. It is now being rumored that the Maxwell company will earn in the neighborhood of $3,000,000 for the fiscal year ending in July. If the company does earn $3,000,000 and the management decided to pay every cent of it in dividends, there will be less than $250,000 available for the common, which would figure at slightly less than 2 per cent. The first preferred, by the end of the fiscal year, will have accumulated 17 1-2 per cent., equal in money to approximately $2,150,000. The second preferred claiming 6 per cent., would require more than $600,000, leaving less than $250,000 for common General Motors established a new high record, having crossed par at 101 for March 15. A year ago this stock was listed at 37 3-8. Willys-Overland common gained 10 1-2 points.

	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com.	200	..	250	..	..
Ajax-Grieb Rubber Co. pfd.	99	102	100	..	..
Aluminum Castings pfd.	98	100	98	100	..
J. I. Case pfd.	..	..	75	80	—1
Chalmers Motor Co. com.	82	85	..	82	..
Chalmers Motor Co. pfd.	92½	94½	91½	93½	+1½
Electric Storage Battery Co.	..	..	48½	49½	..
Firestone Tire & Rubber Co. com.	288	292	400	405	+5
Firestone Tire & Rubber Co. pfd.	109	110	108	109½	..
Garford Co. pfd.	..	..	..	..	..
General Motors Co. com.	77	78	97	98	+5½
General Motors Co. pfd.	92	93	96	97	+2
B. F. Goodrich Co. com.	22½	23½	34	35	+3½
B. F. Goodrich Co. pfd.	87	90	98½	99½	+2½
Goodyear Tire & Rubber Co. com.	155	†165	192	194	+1
Goodyear Tire & Rubber Co. pfd.	92	†93½	104½	105½	+1½
Gray & Davis, Inc., pfd.	90	97	..	..	..
International Motor Co. com.	.	5	..	.	..
International Motor Co. pfd.	..	15	..	..	..
Kelly-Springfield Tire Co. com.	57	59	111	112	.
Kelly-Springfield Tire Co. 1st pfd.	130	140	83½	84½	+ ½
Kelly-Springfield Tire Co. 2d pfd.	..	..	118	125	+2
Maxwell Motor Co. com.	6	6½	30½	31½	+3
Maxwell Motor Co. 1st pfd.	29	30	74	75	+7½
Maxwell Motor Co. 2d pfd.	10¾	11¼	30½	31½	+4
Miller Rubber Co. com.	..	..	165	170	+5
Miller Rubber Co. pfd.	.	.	101	103	..
New Departure Mfg. Co. com.	..	..	125	126	+1
New Departure Mfg. Co. pfd.	..	..	105½	108	+ ½
Packard Motor Car Co. com.	101	116	..	97½	..
Packard Motor Car Co. pfd.	95	98	94	97	—1
Peerless Motor Car Co. com.	20	30	20	21	..
Peerless Motor Car Co. pfd.	..	80	..	55	..
Portage Rubber Co. com.	..	35	34	36	..
Portage Rubber Co. pfd.	..	90	85	95	..
*Reo Motor Truck Co.	8	8¼	11½	12¼	+ ¼
*Reo Motor Car Co.	18¼	19	28¾	29¼	+1¼
Stewart-Warner Speed. Corp. com.	56	57	57	59	+7
Stewart-Warner Speed. Corp. pfd.	99	101	101½	..	..
Studebaker Corp. com.	24½	26	47	48	+ ½
Studebaker Corp. pfd.	80½	82½	94	95	+1
Swinehart Tire & Rubber Co.	69½	70½	74½	76	+1½
Texas Company	..	..	131¼	132½	—2½
U. S. Rubber Co. com.	61¾	62¼	55	56	—1½
U. S. Rubber Co. pfd.	102½	102¾	102	103	—1
Vacuum Oil Co.	..	..	180	183	..
White Co. pfd.	107	110	103	108	..
Willys-Overland Co. com.	63	68	109	110	+10½
Willys-Overland Co. pfd.	92	96	99	100	+2½

*Par value $10; all others $100 par value

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid 1914	Asked 1914	Bid 1915	Asked 1915	Net Ch'ges
Chalmers Motor Co. com.	..	83	..	82	—1
Chalmers Motor Co. pfd.	92	94	91½	93½	+1½
General Motors Co. com.	76½	78	99	100½	+7½
General Motors Co. pfd.	92¼	93¼	96	97	+1
Maxwell Motor Co. com.	6½	7½	31	33	+4
Maxwell Motor Co. 1st pfd.	32	34	74¾	76½	+7½
Maxwell Motor Co. 2d pfd.	11½	12½	31	32½	+5½
Packard Motor Car Co. com.	161	116	..	97½	..
Packard Motor Car Co. pfd.	95	98	93¾	97½	+ ¼
*Reo Motor Car Co.	19	20	28½	29½	+1
*Reo Motor Truck Co.	7½	8½	11½	12⅛	+ ⅛
Studebaker Corp. com.	..	..	47	49	+1½
Studebaker Corp. pfd.	..	..	94	96	+1½
Continental Motor Co. com.	..	165	170	185	+5
Continental Motor Co. pfd.	..	75	80	85	..

INACTIVE STOCKS

	Bid 1914	Asked 1914	Bid 1915	Asked 1915	Net Ch'ges
*Atlas Drop Forge Co.	..	21	25	..	..
Ford Motor Co. of Canada	540	560	525	..	..
Kelsey Wheel Co.	190	200	195	..	..
*W. K. Prudden Co.	..	21	19	20½	+ ½
Regal Motor Car Co. pfd.	.	50	..	25	+3

*Par value $10; all others $100 par value

N. Y. Motorists Protest on Bills

Delegates from State Associations Center Broad Attack on Hewitt Measure—Legal News

NEW YORK CITY, March 13—Characterizing the present motor vehicle law as unconstitutional, Charles Thaddeus Terry, together with delegates from New York and Brooklyn dealers' associations and from all of the larger state automobile bodies, appeared before the Joint Committee on Internal Affairs at Albany on Wednesday last and entered formal protest against the score or more of bills which are at present pending in the legislature.

The measure upon which fire was centered was the Hewitt bill which, in addition to doubling the fees for the registration of pleasure cars also places a heavy burden on the users of commercial vehicles. In assailing the Hewitt bill, Terry pointed out that there is nothing in the present law which provides for the collection of fees greater than those actually necessary to offset the expense of the registration. In New York State, he said, this amounts to about $2. Hence, he added, the levying of higher fees constitutes a violation of the law which reaches the proportions of confiscation. It is, he added, class legislation, and therefore contrary to all principles of taxation.

Melvin T. Bender, representing the New York State Motor Federation, reiterated what Terry said and added that with all law left out of the question, the Hewitt measure is unfair in that it does not classify all vehicles and tax them in proportion to the amount of damage they do to the roads. Such a measure, he added, would have the support of both users and dealers.

With regard to the other bills, Terry pointed out the fallacy of expecting an examination, such as would be required by one of them, to result in a lessening of accidents. He pointed out that such examinations as are made are little more than farces in any case and added that allowing for 180,000 cars in use, and perhaps four members of each family driving, the necessary examination would require something like 4,000,000 hours, allowing 3 hours each for the written and driving tests. The result, he added, would be obtained in about 1917 or 1918. As for the bill which would require every motorist to supply a bond of $5,000, he could see no benefit in this measure except to the surety companies.

Another measure which was protested was Senate bill No. 1041, which would prohibit the use of non-skid devices of any type, whether chains or merely the usual corrugated rubber tread. Although it was pointed out that it was not the intent of the measure that it apply to passenger vehicles, the bill distinctly includes these. It is understood that the verbiage will be altered to make this provision apply only to heavy traction engines.

Tax on H.P. and Weight in Michigan

Lansing, Mich., March 10—The automobile horsepower and weight tax bill presented by Representative Newel Smith was passed in the House today and will now go to the Senate, where, it is claimed, it will also be passed. The new bill provides a tax of 25 cents per horsepower plus 25 cents for each 100 pounds in weight, for gasoline passenger cars; $1 per horsepower and 25 cents per 100 pounds for electric passenger vehicles; 15 cents per horsepower and 15 cents for each 100 pounds in weight for gasoline and steam trucks; 50 cents per horsepower and 25 cents per each 100 pounds of weight for electric trucks. The tax for motorcycles is 25 cents per horsepower and 25 cents per 100 pounds of weight.

It was provided that 75 per cent of the proceeds will go to the state highway department and 25 per cent to the counties from which the funds came, to be used on highway improvements in the counties.

Approximately $12 will be the average tax per car and truck and on this basis at least $330,000 will be paid by Detroit motor owners, it being estimated that by the end of the year 27,500 passenger cars and trucks will be registered in the city.

Barber Cage-Valve Suit Settled

New York City, March 12—The patent suit which William Barber, a Brooklyn, N. Y., inventor, brought against G. B. Foster, Yonkers, N. Y., Buick dealer, for alleged infringement of patent No. 781,802, issued February 7, 1905, has been settled and the right to use the patent granted the Buick Motor Co. It is understood that several other companies as well have obtained the right to use the construction.

The particular point covered by Barber's patent is the removability of cage-valve construction, the claims stating: "In an explosion motor the combination with an explosion chamber having an inlet orifice provided at one side with means for connecting same with an explosive vapor supply pipe, a normally closed inlet valve located in such inlet orifice, and a removable plug secured in the bushing so as to close the outer end thereof and secure the valve in position in such a manner that the valve may be removed without disturbance of the bushing upon removal of the plug."

Cadillac Wins Wheel Suit Appeal

New York City, March 16—That a manufacturer need not test car materials, if purchased from reputable concerns, except to make a reasonable examination, was the substance of a decision in the United States Circuit Court of Appeals for the second circuit last week. Judge Coxe, however, wrote a dissenting opinion. The case was E. Wells Johnson, of Amsterdam, N. Y., against the Cadillac Motor Car Co., of Detroit, Mich., appellant, and has been before the courts for 6 years.

Judge Ward wrote the opinion of two of the three judges who decided the case in favor of the Cadillac company, reversing the trial court's judgment. The law that guided them was that one who manufactures articles dangerous only if defectively made or installed is not liable to third parties except in the case where wilful injury or fraud is shown. The liability of manufacturers of inherently dangerous commodities, such as powder and poison, was considered, although it was agreed that the automobile is not an inherently dangerous device. A manufacturer is not liable in tort to third persons, even in the case of inherently dangerous articles, when he can prove that he has exercised reasonable care with reference to the manufacture.

The testimony showed that the car of the plaintiff was travelling at the rate of 12 to 15 miles an hour when the wheel collapsed, overturning the car and injuring Johnson. The car had been bought in March, 1909, and was a Cadillac Model 30. A spoke of the wheel, made by the Schwarz Wheel Co., was held to be "dead and dozy," instead of sound second growth hickory.

The Cadillac company contended that it was physically impossible to test completed wheels because the only test would be to bore into a spoke, destroying that particular spoke.

Columbus, O., March 13—The Ohio House of Representatives defeated the bill passed by the Senate, compelling all vehicles at night time to carry lights visible from in front and in the rear. The farmer vote in the House of Representatives opposed the measure on the ground that it was unfair to farming communities. They first tried to amend the bill, excepting farmers, but failing to make it appear constitutional, voted for its defeat.

$5,000,000 Capital for New Lozier

Detroit, Mich., March 13—Before the end of this month final reorganization of the Lozier Motor Co. will be effected and a $5,000,000 concern organized. This is the plan of the purchasers of the assets of the old company, and for that purpose there will probably be issued $3,000,000 common stock and $2,000,000 preferred stock.

There have been many conferences between the Lozier purchasers and bankers and capitalists in New York, Detroit and Chicago and the Detroit Trust Co., trustee. Provided certain agreements made with the latter concern are fulfilled it may be a matter of only a week or 10 days before the announcement of the final organization is made.

Speaking about the matter, General Manager Samuel Frank stated that the various interests who purchased the bankrupt concern have been greatly encouraged to go ahead in their reorganization plans owing to the favorable reports received from many dealers throughout the country.

The Associated Lozier Purchasers, which was organized and incorporated with a capital stock of $24,000 as a temporary working company, will be absorbed by the new concern.

Third Dividend of 10% for R-C-H Creditors

Detroit, Mich., March 15—A third dividend of 10 per cent. is being mailed today by the Security Trust Co., trustee for the R-C-H Corp., to those creditors whose claims arose after October 25, 1912, including deposits of dealers and claims for materials made up or partly made up but not delivered. These creditors will receive, it is estimated by the trustee, between 50 and 55 per cent. of their claims and of this 40 per cent. has been paid them, inclusive of today's dividend.

In its report to the various creditors the trustee explains that he

DETROIT, MICH, March 12.—A large contract has been closed by the Continental Motor Mfg. Co. with W. R. M. Morris, Ltd., of Oxford, England, calling for the delivery of 5,000 Continental motors during the coming year. The illustration shows additions now under construction to the Morris plant. This is the first English factory to attempt the manufacture of small cars on a big scale. Many of the leading American products have been adopted by this pioneer company, whose representatives have made several recent visits to this country, and have been thoroughly imbued with the economies of American manufacture

has paid $208,454.13 of secured claims, including a real estate mortgage of $154,970.70, balance due on land contracts, $32,186.66, delinquent taxes of $7,402.44; vendor's liens on machinery $9,467, and other smaller items.

After the payment of secured claims, liens and expenses the trustee estimates that approximately $210,000 will be available for distribution as detailed above.

To Reopen Nyberg Factory—New Car

ANDERSON, IND., March 13—Arrangements have been completed for reopening the plant of the Nyberg Automobile Co. at Anderson, Ind. The plant has been closed several months, but has now been overhauled and ample capital has been secured. It is reported a light, popular-priced car will be the product.

Walpole Plant Sold for $780,000

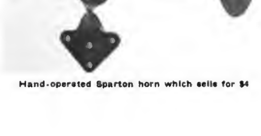
BOSTON, MASS., March 12—With the conditional sale on March 10 of the property and assets of the Walpole Tire & Rubber Co., the affairs of that company appear to be straightening out. Federal Judge Dodge must approve the same, and his decision will not be known until March 22. The property was auctioned at a receiver's sale in Walpole.

There were three bidders, a committee of New York creditors, represented by Morris & Plante; a stockholders' protective committee, and Mr. Kendall, of Walpole, a manufacturer. The bidding started at $600,000 and the property finally went to the New York creditors on a bid of $780,000. The stockholders' highest bid was $775,000.

COLUMBUS, O., March 13—Upon the application of H. C. Park, trustee for a bond issue on the real estate, Judge Kinkead has appointed him receiver for the Dunlap Mfg. Co., manufacturer of automobile parts.

7 Per Cent. Dividend for Abbott Creditors

DETROIT, MICH., March 15—This month the creditors of the former Abbott Motor Co. will receive a 7 per cent. dividend, instead of a 3 per cent. dividend which has been paid them during the preceding 4 months. This will make 19 per cent. thus far. These dividends are available through the sale of Abbott parts, which is taken care of by the Consolidated Car Co., successor to the old Abbott concern.



Hand-operated Sparton horn which sells for $4

SAN FRANCISCO, CAL., March 5—Announcement has been made by C. B. Lewis, of the Lewis Motor Truck Co., Oakland, Cal., that the business of that concern will be discontinued. Mr. Lewis has severed his connection with the concern and opened an office as consulting engineer, Room 406 Board of Trade Bldg., San Francisco, from which office he will attend to repair work and replacement of parts for owners of Lewis vehicles.

N. A. C. C. Trying to Standardize Treads

NEW YORK CITY, March 13—In response to the insistent demand from southern dealers as well as from the manufacturers generally, an effort is now being made by the National Automobile Chamber of Commerce to bring about the standardization of vehicle tracks in this country, which of course will mean lower manufacturing costs and ultimately lower list prices to buyers of cars.

From the manufacturers' standpoint, the making of wide tracks has been a source of trouble and expense, because it necessitated the carrying of large stocks of extra parts, the making of special axles, special fenders, and in some cases, steering gears. Invariably he guessed wrong as to the number of cars to be used in the south, and cars also always came through too late for the southern selling season, besides being a disturbing factor in factory production.

On the other hand, there are some places in the south like southern Florida and southern Georgia where there is still a demand for the 60-inch tread, and this demand is being supplied, although the dealers state that another year or so should see such improvement in road conditions that the standard tread will be in demand.

Working in conjunction with the committee on standard tread, consisting of Messrs. C. W. Nash, General Motors Co., Carl Pelton, Maxwell, J. Walter Drake, Hupmobile, E. R. Benson, Studebaker, and C. S. Jameson, Overland, and the engineers in the Society of Automobile Engineers, Alfred Reeves, general manager of the N. A. C. C. is now arranging to have a conference with the representatives of the National Implement and Vehicle Association and the Carriage Builders National Association, most of whom are also producers of sleighs.

Hand-Operated Sparton Horn for $4

JACKSON, MICH., March 15—Without in the least altering the construction of its model F hand-operated Sparton horn, the Sparks-Withington Co., Jackson, Mich., has reduced its price from $4.25 to $4. At the same time, the horn hereafter will be furnished in either all black satin finish or in black and nickel finish. The horn is supplied with a rigid supporting arm ready to be attached and can be operated by the hand, elbow, foot or knee. A screwdriver is all that is required to make the installation.

"Quantity production is the reason for the reduced price," says Wm. Sparks. "We have hammered costs down to the last notch. Our business is 57 per cent. ahead of this time last year."

Boston Show Sales Larger than 1914

$1,000 to $2,000 Cars Total $15,000 to $50,000—Prospects Plentiful—Large Accessory Business

BOSTON, MASS., March 15—Business done at the Boston show was in accord with the prosperous industrial conditions in New England. Many sales were reported of both cars and accessories, the $1,000 to $2,000 cars selling from twelve to twenty-four, while the total sales in this class were about $15,000 to $50,000. These figures are better than those for 1914, both in individual cases and in the total.

In the higher-priced cars, such as Packard, Pierce-Arrow, and the two foreign cars, Renault and Rolls-Royce, the sales were of course fewer, being as low as two and three in some cases, but the value total is higher and many prospects were secured. In the Cadillac exhibit one salesman said he had—up to Saturday afternoon—secured 250 prospects of his own, not counting those secured by the other salesmen.

In the case of cars which are new in the field or are new in this territory considerable dealer business is transacted. Among the cars new to New England were the Enger, Lewis, Allen and Dodge Bros. All reported good business.

In the accessory division there was more retail business than ordinarily develops at a show which has a national ranking. One tire tool exhibitor shipped 1,000 tools to his exhibit and disposed of the last one early Saturday evening—at $1 each. J. O. Caldwell said Friday that this show brought more business than his accessory house ever had at any preceding show And most of the sales were of small amounts, from $1 to $5.

The attendance was big; the press agent said 300,000 and the figure will probably be somewhere between that and 200,000; Friday night the show building was so congested that it was necessary to close the doors and let people out before more could be admitted; the street was packed in front of the building.

The big social event of the week was the Auto Round-Up Thursday evening at the Copley-Plaza, where 600 tradesmen sat down at 11 o'clock in the evening to a beefsteak dinner and cabaret.

BOSTON, MASS., March 13—The automobile dealers of New England at a meeting held here last Thursday, took steps toward the formation of an association of the dealers of the six New England states. The meeting, which was called by the Boston Automobile Dealers' Assn., by resolution voted to name a committee consisting of the representatives of city, county and state associations to meet later in Boston for the consideration of further plans.

At the meeting were association delegates who represented nearly 600 dealers; thirteen separate organizations appeared through members and the gathering was unanimous in its approval of the plan to bind the trade of the New England states into an offensive and defensive body. The states are Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut.

One of the principal objects of the unifying of the New England dealers is the establishment of a defense against legislation which is aimed promiscuously at the trade.

300 Cars Sold at Indianapolis Opening

INDIANAPOLIS, IND., March 13—If any vindication were required, the spring opening as a producer of business was vindicated last week at the annual spring opening of local dealers. The sales went beyond all expectations, ideal weather throughout the week contributing much to the successful results obtained.

There were thousands of visitors from all parts of the state, and contracts for approximately 300 cars were closed during the week. State distributors also closed many new agencies and altogether the members of the Indianapolis Automobile Trade Assn., under whose auspices the opening was held, were very well satisfied.

The dealers are now looking forward to the fall show, which will be held at the Indiana State Fair in September. This will be staged in a tent, as it was last fall. Indianapolis is practically converted to the idea of two shows a year as a stimulant to business.

The opening gave dealers an excellent opportunity, also, to dispose of used cars that have accumulated since last fall. Used cars were advertised extensively and prices were placed on them to make them move quickly. As a result few of the dealers have any used cars on hand.

There were the usual dinners to agents during the week. Almost every concern that distributes for the state, entertained its state agents in some way or another. The Buick branch gave a dinner to its agents at the Claypool Hotel, Thursday night.

The Hoosier Motor Club gave a luncheon and vaudeville performance at the Claypool Hotel, Wednesday night, which was well attended. The entertainment was furnished largely by performers from vaudeville theatres.

The only other united event was the visit to the new Ford assembling plant, Tuesday afternoon. There was a parade 2 miles long The Ford company alone had 350 cars in line and most of the city dealers had cars in line

Lehigh Valley Show Sells 133 Cars

SOUTH BETHLEHEM, PA., March 13—Dealers in the Lehigh Valley region who were represented at the recent First Annual Lehigh Valley Automobile Show in the Colosseum here are today congratulating themselves that their timidity when the suggestion of exhibiting was first broached was overcome, for more than $200,000 was divided among them directly attributable to the exhibition.

There were 133 cars sold on the floor during Show Week. Kieffer & Steele, of Easton, carried off the honors and also the silver cup donated by the Lehigh Valley Show management to the dealer making the largest number of sales. They handle the Chevrolet and the Haynes, and sold 15 cars. Charles Snyder, of Allentown, the runner-up, sold 11 Saxons. Sales of 107 more cars were distributed among about 50 dealers.

Truck Exhibit at Exposition Opens April 1

SAN FRANCISCO, CAL., March 12—The motor truck manufacturers will have a building erected exclusively for their exhibits at the Panama-Pacific International Exposition. It will be ready for occupancy on March 20 and will be opened on April 1, continuing through the exposition period.

The building is being erected east of Machinery Hall on a five-sided plot of ground and will be one story in height and will have a total floor area of 71,000 square feet. The space which will be available for exhibits is 54,650 square feet.

A large testing laboratory will be installed in connection with the truck exhibits. A series of exhaustive tests covering every portion of manufacturing processes, the testing of the various steels and alloys in chassis and motor construction and the standardization of the parts which enter into the makeup of the modern machine, will be carried out.

NEW YORK CITY, March 16—It has been decided that the motor truck convention, which, as announced in THE AUTOMOBILE for March 11, will be held May 5 and 6 in Detroit by the National Automobile Chamber of Commerce, will be held in the banquet hall of the new Statler Hotel.

Members of the Commercial Vehicle Committee of the N. A. C. C. are at work on the program. The list of papers to be prepared has not yet been decided upon, but it will embrace subjects of uppermost interest to manufacturers, such as service to be rendered to users by the makers and dealers, standardization of capacity rating, shows and demonstrations, and so forth.

Developments in the Jitney Field

PHILADELPHIA, PA., March 10—City Solicitor Michael J. Ryan yesterday issued an announcement advocating the establishment of motor bus lines all over the city as a solution of the transportation problem, at the same time declaring that no legal obstacles barred the way. With the exception of the ordinances and regulations governing horse cabs and taxicabs, there is nothing to prevent independent jitney bus owners working over regular routes all over the city, and that is just what is about to happen. Fortified with the city solicitor's opinion on the subject, it is expected that another week will see the city honeycombed with the motor bus. Jitney cars are already beginning operation.

ROCK ISLAND, ILL., March 15—The first union of jitney bus drivers has been organized at Rock Island, and includes the twenty-two drivers in charge of cars running between Rock Island, Moline and Davenport. The union will come under the jurisdiction of the International Teamsters, Chauffeurs, and Stablemen's union. The following officers were elected: President, Chester Staup; recording secretary, William Dickman; financial secretary, L. S. Massick, and treasurer, William Gable. The buses are all reporting a thriving patronage and are cutting heavily into the street railway receipts.

ALBANY, N. Y., March 12—A charter has been granted to the White Star Jitney Line of Rochester, with a capital of $50,000. The incorporators are Wm. Cross, W. J. Dever, G. V. Kondoff, all of Rochester.

HARRISBURG, PA., March 13—Starting on April 1, the Jitney Bus Co., of Harrisburg, will begin the operation of fifty automobiles on the streets of Harrisburg to compete with the traction interests. The Jitney bus craze is spreading throughout interior Pennsylvania and companies have recently been organized in Williamsport, Altoona, York, Lancaster, and other cities to carry on the rapid automobile transit business.

ST. LOUIS, MO., March 16—After 2 weeks of operation without any specific regulations the jitney buses in St. Louis will have to follow a specially prepared set of rules of traffic laid down by the city this week. No longer will fifteen persons be squeezed into a five-passenger car, that is if one of the new rules is enforced. The new set of regulations in brief follows:

Cars must be examined every two weeks to ascertain whether they are safe for the carriage of passengers.

All chauffeurs must be licensed by the state and each must carry his badge certifying as much.

To prevent overloading standard touring cars and limousines shall carry not more than two persons over the number named by the manufacturer as its capacity. Other cars shall carry no more persons than can be seated comfortably.

No person shall be permitted in any car except in the body thereof.

No car shall receive or discharge passengers except at sidewalk curbs and then only when at a standstill.

No car shall pass another for the purpose of securing a passenger.

NEW YORK CITY, March 15—Walter C. Allen has been elected president of the Yale & Towne Co., succeeding H. R. Towne, who was made chairman of the board.

The stockholders of the company, upon the recommendation of the directors, have authorized the issue of $500,000 additional capital stock. The present stock is $3,000,000. Substantially all of the stockholders have waived their right of subscription thereto in order thereby to place the stock so surrendered in the hands of the directors, and thus enabling the latter to arrange for its acquisition in proper proportions and on equitable terms, at not less than par, by officers and employees of the company upon whom will rest the responsibility of the further development of the business.

TACOMA, WASH., March 12—George D. Dunn, secretary of the Tacoma Speedway Association, has signed up Eddie Pullen, Guy Ruckstell, Earl Cooper, Dave Lewis, Bob Burman and Jim Parsons for the Tacoma speedway races this year, and Oldfield. D. Resta and Ralph de Palma will shortly sign contracts. New cars which will be seen by Northwest fans this year are the Buggatti, which will be driven by the French driver, J. B. Marquis.

Whelan Heads Detroit Speedway

DETROIT, MICH., March 13—Officers and directors have been chosen for the Detroit Motor Speedway which has succeeded the Detroit Speedway Club. Only a few of the officials from the old organization are with the new one. All are well known in business and private circles of the city.

The President is John B. Whelan, United States collector of customs in this district. S. D. Maddux, contractor of Indianapolis, Ind., is vice-president; Albert Hardenstine is treasurer and R. R. Swart is secretary.

The board of directors includes C. C. Starkweather, president of the Detroit Automobile Dealers Assn.; Philip Breitmeyer, vice-president of the German-American Bank; Otto Mich, contractor and builder; Ralph M. Tate, lawyer; George Fullwell, proprietor of the Normandie and Oriental hotels; James Q. Goudie, general manager of the Pennsylvania Rubber Co., and J. B. Haggerty.

$20,000 Prize for Race in Omaha

OMAHA, NEB., March 13—A purse of $20,000 is being raised in this city for the 300-mile race to be held here July 5. It is expected that the leading drivers in the Grand Prix and Vanderbilt cup races will participate. It is stated that Ralph De Palma and Barney Oldfield have agreed to come to this city.

Oldfield Winner in Venice Race

Covers 300 Miles in Maxwell at 68.8 m.p.h.—Carlson, Maxwell, Second and Ruckstall, Mercer, Third

VENICE, CAL., RACE COURSE, March 17—*Special Telegram*—Barney Oldfield, in a Maxwell, today won the first annual Venice grand prix, covering the 300-mile course in 4:24:9 2-5, or 68.8 miles per hour. His team-mate, Billy Carlson, sent his Maxwell over the line for second place in 4:24:43 2-5, while Ruckstall's Mercer took third money in 4:27:27 1-5. Dave Lewis's Stutz had practically won the race when, on the next to the last lap, engine trouble put it out of the running. Fourth place went to Marquis, in the Bugatti, his time being 4:31:39, and Hearne's Case, which ran a consistent race throughout, was fifth in 4:44:51.

With the thermometer registering 85 degrees in the shade, 75,000 spectators watched the race, which was filled with unexpected thrills.

The start of the race was delayed 17 minutes, Chairman Kennerdell, of the A. A. A., demanding a certified check for the $8,000 prize money, which the race treasurer had at a local bank. On the starting line Nikrent and Hughes were ruled out by Mr. Kennerdell over Referee Weise. Pullen, in the Mercer, stripped his gears at the tape and was unable to get away.

From the first to the twentieth lap, Rickenbacher, in a Maxwell, was in the lead with Ruckstall's Mercer second and Klein's Puento Pronto third. At the end of the twentieth lap Rickenbacher's lead was two laps.

On the ninth lap the scoreboard fell with twenty men. Two were injured and taken to the hospital. Another unexpected diversion occurred when Caleb Bragg drove Glen Martin's aeroplane down from Los Angeles and circled the course three times, the passengers being Martin and Engineer Kliesrath of the Bosch company.

On the fifty-fifth lap Ruckstall was leading with Hearne's Case second, Lewis's Stutz third and Oldfield fourth, the average speed for the lap being 71 miles per hour. On this lap Marquis, in the Bugatti, hit a spectator and mangled his limbs.

By lap 70 the order was Lewis, Hearne, Carlson and Oldfield, the speed being 71 miles per hour.

On the eightieth lap the drivers maintained the same positions, but the average speed went up to 71.5 miles an hour. Chairman Kennerdell appointed Fred Wagner emergency representative of the A. A. A.

Lap 90 saw the drivers still circling the track in the same order, but the speed had jumped to 72 miles per hour. The closing laps of the race saw several changes. Oldfield working his way to first from fourth place and Carlson pushing past the disabled Lewis and Hearne to finish second.

The Napier, entered and driven by Orville Jonas, was wrecked last night in a practice run. The opening practice on the Venice course on March 11 was also featured by an accident. Jonas, entrant and driver of the wrecked Napier, went into one of the boarded banked turns at high speed and climbed out over the outside. Lamkin, who was riding with Jonas, was severely injured. Newhouse, driving the DeLage, made the fastest time on the course, completing the circuit at an average of 75 m.p.h. Marquis, on the German Bugatti, made a lap at 72 m.p.h.

Cooper withdrew from the race on account of tonsilitis, Harry Grant taking his place. Louis Nikrent at the last moment decided to enter the Californian, which is a special Mercer

A. C. S. C. Severs Connection with A. A. A.

LOS ANGELES, CAL., March 16—*Special Telegram*—Don Lee resigned as referee of the Venice race when the directors of the Automobile Club of Southern California passed resolutions severing all connections with the American Automobile Assn. on account of the action of Chairman Richard Kennerdell in removing the local contest committee of ten automobile club members who formerly served as official representatives of the A. A. A. John Weise today assumed the position of referee. Chairman Kennerdell, who is in complete charge of the race, requires a statement from Mayor Garety of Venice, assuming all responsibility for the race on account of the dangerous character of the course.

Factory Miscellany

STEEL Products Completes Addition—The Electric Welding Co., Cleveland, O., which recently changed its name to the Steel Products Co., and which increased its capital from $250,000 to $1,000,000, has just completed an addition to its main plant. Contracts have been given for three additional units to be 125 by 45 feet each. The officers of the company are: C. E. Thompson, president and general manager; W. D. Bartlett, vice-president and superintendent; J. A. Krider, secretary and sales manager, and G. H. Brown, treasurer. The chief business of the Steel Products Co. is the manufacture of gas engine valve stems or poppet valves, also spring shackle bolts. A branch office has been opened in Detroit, Mich., at 1515 Ford Building, which is in charge of Frank DeWitt, who has been the Michigan representative for some time.

Victor Rubber to Enlarge—The Victor Rubber Co., Springfield, O., will erect an addition to its plant.

Amplex to Resume—The Amplex Auto Works, Mishawaka, Ind., sold by a receiver to Adolph Kamm, Sr., will resume operations.

Falls Rubber to Build—The Falls Rubber Co., Cuyahoga Falls, O., has purchased a site at Main and Broad streets, upon which will be erected a new factory.

Regal Increases Berlin Plant—The Regal Automobile Co., Detroit, will make an addition to its factory at Berlin, Ont., and will require machinery. Mr. Nyberg is branch manager.

Accessory Plant for Ont.—The Rolls-Royce, Ltd., will establish a factory in Ontario for the manufacture of automobile accessories. James C. Royce, Davenport Road, Toronto, Ont., is representative.

To Move Plant—C. E. Miller and A. C. George, of Lima, O., and F. M. McGraw, of Auburn, Ind., are preparing to move a factory now turning out light delivery wagons, located at Auburn, to Lima. The plant will be located on West Spring street.

Red Arrow to Build—The Red Arrow Automobile Co., Orange, Mass., has awarded the contract for a fireproof factory which will be used for the manufacture of automobiles. The company states that it will be in the market for air compressor, pump, boiler, tank and machinery, details of the requirements for which are not stated.

U. S. Wheel to Erect Plant—The United States Wheel & Tire Co., Rockton, Wis., will erect a plant, 100 by 110 feet, 2½ stories, of brick, steel and concrete construction, to be equipped for the manufacture of elastic wheels for automobiles and motor trucks. The company is capitalized at $300,000. E. S. Gleasman is president.

Canadian Truck Factories Busy—Maisonneuve motor trucks are now being produced by the Oxford Motor Cars & Foundries, Ltd., of Montreal, Que. The plant is being operated day and night. A. J. Lavoie has recently been appointed manager. At Walkerville, Ont., the Dominion Motors, Ltd., is manufacturing the Dominion motor truck.

West Bend Aluminum Busy—The West Bend Aluminum Co., West Bend, Wis., which erected a new factory during last year, is again becoming crowded for room and contemplates the erection of additions during 1915. The company has recently made a voluntary increase of 10 to 20 cents a day in the pay of employees, the increase being graduated by the term of service.

Maxwell Shipments Increase 131 Per Cent.—During November, December and January the Maxwell Motor Co., Detroit, Mich., shipped 6,829 cars, as against 2,950 last season, an increase of 131 per cent.; in February, 3,691 cars, against 794 in February, 1914, an increase of 377 per cent. In January, 1915, the company had on its payroll 6,633 men, against 3,788 in January, 1914, an increase of 75 per cent.

Elbert Plant at Sunnyvale—Negotiations were completed last week by the Elbert Motor Car Co. whereby that concern comes into possession of a completely equipped factory at Sunnyvale, Cal., 38 miles south of San Francisco, where the Seattle-designed Elbert cars will be built. The plant consists of 20 acres of land, on which are six buildings giving a total floor space of 40,000 square feet. The assembling plant will be maintained for supplying the Northwest trade in Seattle.

Bergstrom Plant at Rockford—Bergstrom Bros., Rockford, Ill., manufacturers of the Bergie national spark plug, have organized a stock company and received articles of incorporation this week, capital stock being fixed at $5,000. The incorporators are Andrew, Adolph and Arthur Bergstrom, all of Rockford. The company has been operating a factory at Belvidere, but recently decided to remove to Rockford, Ill., owing to the necessity for extending the field and where more advantageous shipping facilities could be secured.

J. I. C. Warehouse in Madison—The J. I. Case T. M. Co., Racine, Wis., is preparing to erect a large warehouse and office building for its factory branch in Madison, Wis. The building will be 100 by 140 feet in size, two stories high, of solid brick construction and cost about $35,000. Because of the increasing importance of its motor car business the company will make ample provision for garage and service station in the new building. The Madison branch was one of the first to be established by the Racine concern.

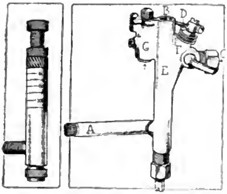
Fire Damages Detroit Plant—Fire destroyed the greater part of the three-story plant of the Detroit Foundry Co., at Fordyce and Marston avenues and Morrow street, Detroit, Mich., on March 12. The total loss to the foundry concern is estimated at about $75,000 and that of the Farmer Mfg. Co., which occupied the third floor of the building, at $25,000. The foundry company's business will not be very strongly affected, according to officials of the company, as the production facilities of the second plant of the company, on Hastings street, will be at once increased to take care of the business for the two plants. The rebuilding of the burned structure will be started as soon as possible. Officials of the Farmer company, which made the Farmer automobile motors, could not be reached to find out about the future plans of that concern.

The Automobile Calendar

Mar. 13-20	Harrisburg, Pa., Show Arena. Harrisburg Dealers Association.
Mar. 17-20	Elgin, Ill., Show, W. H. Tidmarsh, Mgr.
Mar. 22-27	Bangor, Me., Show, Bangor Auditorium.
Mar. 22-27	Newark, O., Show, Arcade Bldg
Mar. 24-27	Oil City, Pa., Show, New Armory.
Mar. 25-27	Mason City, Ia., Show, New Armory.
Mar. 30-April 2	Johnstown, Pa., Show, The Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
April 5-10	DuBois, Pa., Show, Moose Hall.
April 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
April 20-22	Oklahoma City, Okla Road Race, S W. Auto Racing Assn.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 19	Chicago, Ill., 500 - Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4-5	Tacoma, Wash., Road Race.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.: 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.

ACCESSORIES

LOW-SPEED Carbureter—From the modern automatic carbureter it is possible to obtain easy starting and very slow idling speed, but with older instruments it is often difficult or impossible to make adjustments to suit the full range. Actually in effect the modern carbureter when the throttle is closed for idling becomes a smaller size, and in many cases the supplementary jet brought into action is the equivalent of a miniature carbureter which is used for idling only and goes out of action as soon as the throttle is opened.

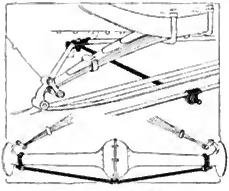


Left—Regulating pressure gauge. Right—Stokes low speed carbureter

The device here described is a miniature carbureter complete in every particular, except that it has no float chamber, and it can be attached to any car whatever. It is necessary to drill and tap a hole in the side of the float chamber of the old carbureter to suit the threaded end of the pipe A, and from B a short length of small-bore copper tube is connected to any convenient point in the intake manifold. From C another small pipe is taken to either the cowl board or the front of the car, according to whether there is a self-starter or not, and a wire ending in a thumb ring is led alongside this pipe from the lever D.

Gasoline entering through the pipe A flows upward through the main part of the device, and at E there is a constriction which makes a kind of jet. Below E a piece of hexagonal brass an inch or two in length and with a rounded upper end lies, so that if the suction becomes very strong this is lifted and partially closes the jet. In the branch passage F there is a second tiny jet controlled as to size by a pin which can be regulated by the lever D, while inside the part G is a small air valve with a spring adjustable as to tension by the screw seen above it. Air also enters through the pipe C and flows across the little jet F.

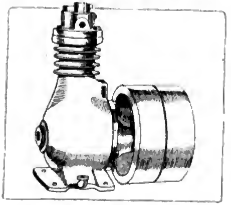
Usually the end of pipe C is fitted with a tiny muffler to prevent any hissing noise from the entering air, and the tap shown is not intended to be used once it has been set to suit the particular motor in question. When the motor is cranked gasoline is drawn in from both jets, and if the speed rises the main jet goes out of action automatically. The convergence of the air streams causes great turbulence and reduces the fuel to a condition of extreme subdivision—so much so, in fact, that it is claimed to be possible to start a motor on kerosene. Since it is very simple and most inexpensive the invention should find a great many supporters, and there is no question but that it enables any motor to be run at very low speed indeed. A point in connection with it that is particularly interesting is that it will allow adjustment to suit a motor in which wear on the valve stems permits a continuous air leak, this being difficult of accomplishment even with the best of carbureters.—Stokes Carbureter Co., Detroit, Mich.



Axle attachments for Fords

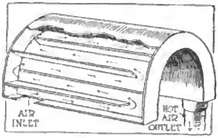
Air-Pressure Regulator—There is nothing new in the pocket tire gauge to show the air pressure accurately, but this apparatus works in a different way. It is set by hand to the pressure desired and then inserted in the pipe line by attaching it to the valve and then screwing the pump or air line to the side of the gauge. As soon as the desired pressure is reached the gauge will blow off with a pop, and any further supply will simply escape to the atmosphere.—American Sanitary Lock Co., Indianapolis, Ind.

Small Air Compressor—A small compressor for use in a private garage is a luxury that most car owners would like to possess if price was not a consideration, and the little Gardner "Midget" pump has been produced with the idea that it will appeal to this class of user. The makers are producers of air pumps in a variety of sizes and patterns, so they have plenty of experience in the manufacture of this kind of machine. The "Midget" is good for a steady output at 125 pounds per square inch, so it is well capable of taking care of the largest automobile tires. It can, of course, be driven from any convenient source of power.—Gardner Governor Co., Quincy, Ill.



Compressor for private garages

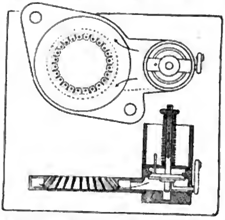
Ford Car Axle Strengthening—Two novelties for attachment to Ford axles have for their purpose the strengthening of the rear axle against road shocks and the steadying of the front axle against twisting in a springy way when traveling over rough ground. It is not supposed that the rear axles of newer model Fords are deficient in strength, but it is a fact that the axle case has been stiffened lately, so a simple tie rod has been devised to fit on old Fords. This can be attached with a spanner only, and in a very few minutes, while the rod is really two long bolts, so that there is a flexibility at the center part where the heads of the bolts socket into the pad under the differential case.



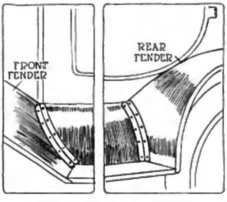
Exhaust muff for carbureter air heater

The front axle attachment consists of a brace to tie together the middle of the axle and the apex of the radius rods or stays, the idea being that the latter being springy in nature allows the axle to twist on its center line when meeting a bump on the road. Both these attachments are extremely cheap, and the least mechanical of persons could put them on correctly.—Auto Parts Co., Providence, R. I.

Carburetion Improver—This is a device designed to overcome the trouble caused by gasoline condensing and collecting upon the interior of the manifold, and operates by directing a stream of heated air along the inside walls of the manifold. A metal drum or muff is clipped to the exhaust pipe, and this has inside it a series of baffles, so that a small



Flange inserted in induction pipe to distribute hot air over walls

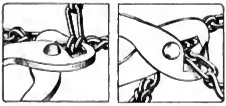


Anti-Rattle strips for Ford fenders

quantity of air admitted at a small orifice is compelled to travel up and down many times before it reaches the outlet. Thence it is taken to the "remixer," first passing a valve which is opened and closed by the interconnected carbureter throttle lever.

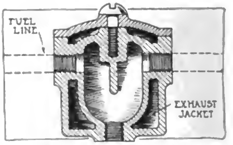
The valve is located on the edge of a flange which has to be inserted between the carbureter and the manifold, and the flange is hollow, being pierced on the inside with a number of small holes shown in the sketch. Through these holes the heated air is drawn, and it naturally rushes along the cold walls of the manifold, raising their temperature and so reducing tendency to condensation of gasoline. It is to be noticed that this device does not impose any restriction upon the manifold or in any way obstruct the passage of the gas to the motor.—Universal Shock Eliminator Co., New York City.

Eliminating Rattle—Often on an old car squeaks or rattles develop in the fenders, and when this happens it is usually difficult to effect a cure, owing to the springy nature of the parts in question. Often the best way to deal with the trouble is to have small strips of angle riveted or bolted in the corners where the fenders are attached to the other sheet-metal parts. To effect this repair on Ford cars with the least possible trouble specially shaped angle pieces are sold made from heavy pressed steel and enameled to match the fenders.—New Era Spring Specialty Co., Detroit, Mich.



Special pliers for Weed chain repairing

Weed Chain Pliers—However carefully one may handle tire chains the day will come when some repairs are necessary, when some new cross links have to be put in. The average man is not very fond of the job, and really it requires some skill properly to open and close odd links in a chain for the insertion of fresh lengths. The special pliers illustrated on this page have been devised by the Weed chain makers to render the job of replacing parts of Weed chains as simple as possible, since they will firstly open the hook on a cross-chain end to allow the old one to be detached, and they can then be employed for closing the hook on the new piece which has been put in place. The sketch shows how different parts of the plier jaws are used for these two operations.—Weed Chain Tire Grip Co., Bridgeport, Conn.



R. O. C. gasoline warmer

Gasoline Preheater—One of the simplest of devices for warming the fuel on its way to the carbureter is that illustrated here, and the design is such that the fitting also acts as a trap for dirt. Gasoline passes through the center bowl, which is surrounded by an exhaust jacket, a flexible pipe serving to make connection with the manifold. It is recommended that the preheater be mounted as close as possible to the carbureter. At the bottom of the fuel bowl a tap is screwed in so that water or dirt which settles can be drawn off, and the top of the jacket is removable so that any carbon or gummy deposits can be removed from the jacket. At the outlet from the jacket there is a second cock so that the heat can be turned off, if desired, in very hot weather. R. O. C. Sales Co., New York City.

Catalogue and Pamphlet Review

Clocks—A recent addition to the Johns-Manville line is a well-made clock supplied with two styles of mounting for the cowl board, either flush or projecting. It is handsome in appearance and guaranteed an accurate timekeeper.—H. W. Johns-Manville Co., New York City.

Radiometer—This is a new type of car heater, which uses instead of coal, exhaust gas, etc., a special chemical compound which is contained in a polished metallic case. The case is immersed in boiling water, and after removal the chemicals are said to retain heat for from 8 to 10 hours, depending upon the size of the heater. All forms and sizes are offered, and when once purchased no additional material is needed, the chemicals being said to last indefinitely.—Radiometer Co., Chicago.

Garage Turntables—An attractively illustrated booklet describes a great variety of Universal turntables for garage use and emphasizes their value to the dealer and to private owners with large garages of their own. Full instructions for fitting a Universal table are given, and the case for the device is put in a manner which is very convincing. It is, of course, undeniable that a turntable is of value to any garage, and this book besides pointing the argument shows that the installation is neither costly nor troublesome.—Canton Foundry & Machine Co., Canton, O.

Tire-Tube Protector—There are a variety of inner liners for tires on the market, but special claims are made for the Interlock, which encircles the tube completely and thus prevents it from blowing out, whatever the condition of the outer casing. It appears easy to fit and is dealt with tersely but fully in a handy little catalogue.—Double Fabric Tire Co., Auburn, Ind.

Zenith Carbureter—Some people have a little trouble in comprehending the action of the compound jet used in the Zenith carbureter, and in order to make its function clear to the least scientific motorist a book has been printed with ample diagrammatic illustration. It is written in simple language and is brief enough to cover the subject thoroughly without any waste of words.—Zenith Carbureter Co., Detroit, Mich.

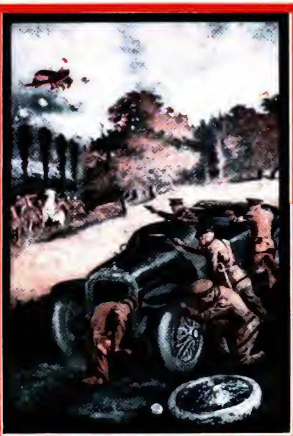
Steel Stud Tread—The Armor tread is made of chrome leather and fits over the tire casing like a glove, protecting it completely from all puncturing substances and adding to its strength. The tread itself is furnished with a number of hardened steel studs, which cause it to give a good grip in the heaviest mud, and a lining of softer leather prevents the rivet heads from coming in contact with the rubber of the tire. Since there are no attachments such as buckles or straps the fitting is claimed to be easy, and it is obvious that great care is taken to make the leather a really good fit on the tire by using sufficient seams and insuring their neatness and strength.—Armor Tread Co., Hartford, Conn.

Special Gears for Fords—The Detroit Radiator & Specialty Co., Detroit, Mich., is offering differential driving gears with special ratios of 3 to 1 which will give a speed of 55 miles per hour and 2 4-7 to 1 which will give a speed of 60 miles per hour, it is said. The price is $15.

Tire Cases—A good tire case for the spare shoes carried on an automobile is well worth its cost by the protection that it gives to the rubber—there is more in it than the mere difference made to the appearance of the car, though this is also important to any man who values his vehicle. Nothing looks worse than a half used, dirty tire tied on a smart, new car. Several varieties of tire covers and some other useful things, such as a pressure gauge for pocket or cowl cupboard and a neat radiator cover for cold weather are dealt with.—Allen Auto Specialty Co., New York City.

Automobile Battery Charging is the title of a handbook of very small size, which deals fully with the use of a rectifier outfit in connection with an alternating current service. The particular apparatus it is designed to expound is the Cooper-Hewitt, prepared especially to suit the needs of owners of electric vehicles. A leaflet coming with this book deals with the other system of rectification by using a motor generator instead of a chemical process to convert the alternating current to the direct, which is necessary for battery charging. Both plants are made by the same great firm.—Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.

A Set of Wire Wheels Free!



Write a little story —your version of this picture, a hundred words or more.

A set of five wire wheels and hubs complete for any car desired is the prize.

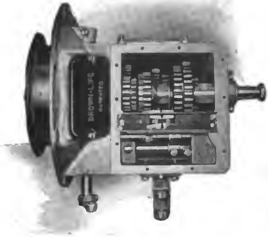
THIS is the picture we had painted for us by a famous artist. This is the picture we have reproduced on canvas, full size (22x32) for presentation to a few clubs and individuals. This is the picture about which you should write your little story. Must be received before July 4th and will be fairly compared by competent judges. We want imagination, not literature. The prize, one full set of five HOUK WHEELS, will be awarded for the story of about 100 words which, in the opinion of the judges, best describes the incident the picture illustrates.

HOUK
DETACHABLE
WIRE WHEELS

The tremendous strength of the HOUK WHEEL, as well as the quickness with which it can be detached and attached for almost instantaneous tire changes, has made it a military necessity. You will find HOUK WHEELS on most of the vehicles sent abroad for military use.

The days of wood as a material for automobile construction have almost passed. Look your car over and see. Wood as a material is unreliable and the fact that it is used in the part of the car where a large factor of safety should be required only proves that the car maker is willing to furnish inferior equipment until the public rebels. You may have wire wheels on your next car. Or you should get them for your old one

HOUK MANUFACTURING COMPANY
1700 Elmwood Avenue **BUFFALO, N. Y.**
1483



Superior S[illegible]l
to begin with!

In Brown-Lipe transmissions the drive shafts are made from chrome nickel steel—with a tensile strength of 140,000 pounds.

Cheap practice, as represented quite generally in products selling at low prices, is to use ordinary carbon steel in the drive shaft—at 1-4 the cost of Brown-Lipe chrome nickel. This cheaper steel represents on an average only about 80,000 to 90,000 pounds tensile strength.

The inference is obvious—if you don't want a compromise in your transmissions use Brown-Lipe.

BROWN-LIPE G[illegible] Co
TRANSMISSIO[illegible]
SYRACUSE · · NEW YORK
NEW YORK · CHICAGO · DETROIT
Thos J. Wetzel · K. Franklin Peterson · L. D. Bolton
29 W. 42nd St. · 132 So. Michigan Av. · 2215 Dime Savings Bk. Bldg
DIFFERENTIALS
BROWN-LIPE-CHAPIN Co

RCH 25,1915 Bul.

10¢ A COPY

Glenville Branch
3-25-15
a.m.h.

The AUTOMOBILE

Automotive Industries

MAGAZINE LOAN COLLECTION

Cleveland Public Library
MAGAZINE LOAN COLLECTION
Date when due marked below
C.P.L. Form 1218 Reading

TO THE TRADE

Very often we receive letters from our subscribers requesting the names of manufacturers making cars, parts and accessories.

Automobile,

239 West 39th St., New York City

Gentlemen,

I am in the market for a seven-passenger car somewhere between $1200 and $1800; shall buy within the next ten days. Perhaps you would like to suggest this to some of your prominent advertisers.

Very truly yours,

(Signed) Name on request.

These letters will be published from time to time and the name and address of the inquirer will be mailed on request.

This letter from the manager of a large mercantile house. Do you make a car listing between $1200 and $1800? Maybe you have a Dealer in his city—or want one. He will do business within 10 days—name furnished on request.

Are You Interested?

ADDRESS ADVERTISING DEPARTMENT

THE CLASS JOURNAL COMPANY

239 West 39th Street **New York City**

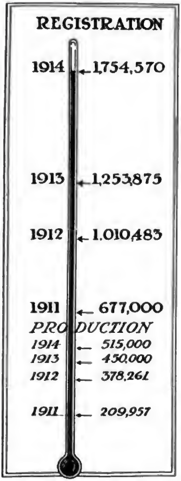
VOL. XXXII NEW YORK—THURSDAY, MARCH 25, 1915—CHICAGO No. 12

The AUTOMOBILE

United States Has 1,754,570 Cars

1914 Registrations Show Gain of 500,695 Over 1913—Increase of 1,077,570 in 4 Years

By Donald McLeod Lay



Comparison of registration and production for the last 4 years

OVER half a million cars and trucks were added to the number in operation in the United States during the year 1914. According to the most accurate statistics it is possible to obtain from state registration officials and other authentic sources, the total number of cars and trucks in the United States at the end of 1914 was 1,754,570, all duplicate registrations, dealers, etc., being deducted where such figures were separately listed. This represents a gain of 500,695 over the total at the end of 1913. An idea of the steady increase in registrations may be gained from the statistics on July 1 and October 1. On July 1 the total was 1,548,350 cars and trucks, an increase of 294,475 since the first of the year and by October 1 these figures had grown to a total of 1,735,369 cars and trucks, a gain of 203,503 over the statistics reported at the beginning of July.

1,077,570 Gained in 4 Years

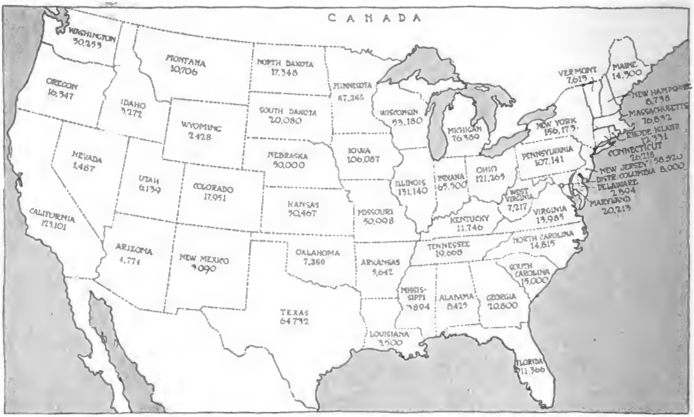
Very few people realize that since 1911 the number of cars and trucks in the United States have increased from 677,000 to 1,754,570 at the beginning of 1915, a gain of 1,077,570. In 1912 the total had increased to 1,010,483 and in 1913 to 1,253,875.

Naturally, production has increased by leaps and bounds from year to year to keep pace with the phenomenal car-buying evidenced by the swelling registration statistics. From a total of 209,957 cars and trucks manufactured in 1911 our factories have steadily increased their outputs, 378,261 vehicles leaving their doors in 1912 and 450,000 in 1913, while the figure of 515,000 given by the National Automobile Chamber of Commerce is so conservative that it is from 5,000 to 15,000 below the actual production total. The estimate for the number of trucks built last year is 30,000, which is a marked advance as compared with previous years.

In compiling the information contained in the table on page 527, every effort was made to secure the most accurate information possible as will be noted by the sepa-

New York	156,173
Illinois	131,140
California	123,101
Ohio	121,265
Pennsylvania	107,141
Iowa	106,087
Massachusetts	76,832
Michigan	76,389
Minnesota	67,365
Indiana	65,500
Texas	64,732
New Jersey	58,820
Wisconsin	53,180
Missouri	50,998
Kansas	50,467
Nebraska	50,000
Washington	30,253
Connecticut	26,218
Georgia	20,800
Maryland	20,218
South Dakota	20,080
Tennessee	19,668
Colorado	17,951
North Dakota	17,348
Oregon	16,347
South Carolina	15,000
North Carolina	14,815
Maine	14,300
Virginia	13,985
Rhode Island	12,331
Kentucky	11,746
Florida	11,366
Montana	10,706
New Hampshire	8,738
Alabama	8,425
Dist. of Columbia	8,000
Vermont	7,613
Oklahoma	7,360
West Virginia	7,217
Utah	6,139
Arkansas	5,642
Arizona	4,774
Mississippi	3,894
Louisiana	3,500
Idaho	3,272
New Mexico	3,090
Delaware	2,894
Wyoming	2,438
Nevada	1,487
Total	1,754,570

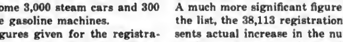
States in order of registrations with duplicates deducted



Map showing total registration of automobiles and motor trucks in the various states with duplicate registrations excluded

rate columns for non-resident registrations, re-registrations due to transfers of ownership, etc., and number of dealers' registrations. In order to get as nearly as possible to the exact number of cars and trucks in use, the totals of these three columns 7,523, 30,856 and 11,180 respectively, were deducted from the gross total of 1,785,613 registrations which included everything of this kind. Tennessee includes motorcycles with its car and truck registrations, the total number probably being less than 2,000 of the 19,668 given for that state. There are also some 3,000 steam cars and 300 steam trucks included among the gasoline machines.

It was found that previous figures given for the registration in the District of Columbia were far too high. H. M. Woodward, Secretary of the Automobile Board of the District, states that as registration, which is perennial there, was begun in 1907, transfers of ownership, etc., have so complicated the records that it is impossible to give even an estimate of the correct statistics. The Auto Directories Co., of New York City, having analyzed the registration lists, gives a total of 8,000 vehicles for the district. The same company gives 3,500 for Louisiana, which has local registration, like Texas, for which the Dallas Chamber of Commerce gives 64,732 registrations. G. R. Lamson, Librarian of the Firestone Tire & Rubber Co., and C. D. Ensign, of the B. F. Goodrich Co., agree in giving Mississippi a total of 3,894, this state being still without an automobile license law, the statute formerly in effect having been declared unconstitutional some time ago.



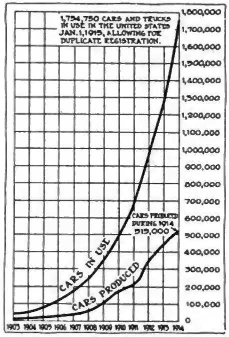
Ten states had gains of over 20,000 machines in 1914

When we come to analyze the gains made by the various states over their respective totals for 1913, we find that California is apparently at the head of the list with a gain of 63,101. This, however, is misleading, inasmuch as when the statistics were compiled at the end of 1913 only 60,000 cars and trucks were registered in the Golden state under the new law which had just gone into effect. This, of course, was far from the actual total of cars and trucks in the state at that time, so the actual gain is probably less than 25,000. A much more significant figure is that which stands second on the list, the 38,113 registrations gained by Iowa. This represents actual increase in the number of cars and trucks added to the equipment of the residents of that prosperous state. Illinois is a close second to Iowa with 37,682 more machines than it registered in 1913, while New York comes next with 37,302, the three states forming a remarkable example of parallel gains. Ohio, with a gain of 36,348 has a good lead over Pennsylvania whose increase was 32,676, while Minnesota follows with 29,565 more than it had last year. Massachusetts is the only other state to record an increase of over 25,000 registrations, having 254 over that figure. Michigan and Indiana both have gains of over 20,000, Michigan having 22,023 and Indiana 20,762. Incidentally, Michigan's secretary of state anticipates a registration in 1915 of over 100,000 of cars and trucks. Wisconsin falls short of the 20,000 mark by only 264, having 19,736 added registrations, while Kansas has 16,101, Missouri 13,793 and Texas 10,369. The main reason for the tremendous car-buying indicated by these increases is that the farmers are beginning to realize that the automobile is here to stay, that it is a necessity and not a luxury, and they are finding it of everyday use for both work and pleasure. Practically all of the states show gains in registration from the 677 increase in Delaware to the 38,113 in Iowa. The only instances in which no increase is recorded are District of Columbia and Louisiana, for which previous figures were too high, and in Georgia and Oklahoma. In Georgia the new law is responsible for the apparent decrease, while in Oklahoma the registration law runs from July to June instead of throughout the calendar year as in most of the other states.

Changes in Standing

A number of changes have occurred in the standing of the various states in respect to the total number of car and truck registrations. Comparing the position tables for 1913 and 1914, of states having over 50,000 registrations, we find that California, which was seventh last year, is now in third place, this being due, of course, to incomplete registration under the new law. Ohio, which was third, is thus thrown into fourth place and so on down through the list. Minnesota, which was fourteenth last year, is now in ninth place, and Indiana has moved one notch into tenth position. Wisconsin was fifteenth and is now thirteenth, having displaced Missouri, which is now fourteenth. Kansas has gained one place, being now in fifteenth position. Nebraska has dropped from tenth to sixteenth.

Perennial registration still reigns in the District of Columbia, Florida, Utah and Texas, registration in the latter state being also of a local character. New laws, since the beginning of 1914, have affected the registration in California and Georgia. Local registration, besides being the rule in Texas, is found in Louisiana and South Carolina, while Minnesota is unique in having triennial state registration, that is, registration is required once every 3 years. The general tendency in automobile registration may be characterized as toward sane and reasonable measures, although the freak bills containing idiotic and objectionable regulations are still plentiful.



Registration and production since 1902

Car and Truck Registration in Each State to January 1, 1915, with Duplications Indicated

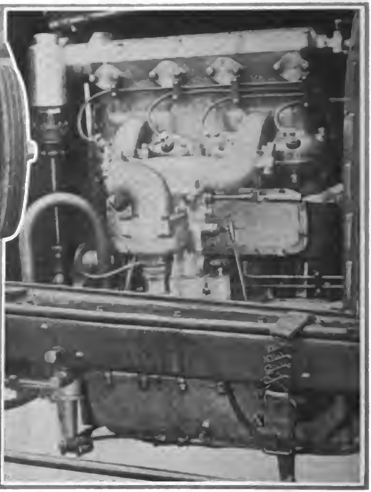
State or Territory	Total Registration	New Registration	Registration up to Jan. 1, 1914	Gasoline-Passenger Cars in Use	Gasoline Commercial Cars in Use	Electric Passenger Cars in Use	Electric Commercial Cars in Use	Non-Resident Registration*	Re-Registered**	Chauffeurs Registered	Total Fees	Dealers Registered	Remarks
Alabama	8,500	3,000	5,500	7,957	500	37	6	None	75	1,000	$116,000 00	...	
Arizona	5,040	1,457	3,583	4,757	266	17	***	***	266	1,160	34,077 50	...	
Arkansas	5,642	2,642	3,000	***	***	***	***	***	***	***	***		
California	123,101	63,101	60,000	***	***	***	***	***	***	18,601	1,338,785 25	...	New law. Previous reg. incomp.
Colorado	18,433	5,433	13,000	***	***	***	***	***	482	2,058	80,047 00		
Connecticut	29,305	6,042	23,263	24,270	4,395	430	220	***	3,895	36,623	406,623 34	192	
Delaware	3,050	677	2,373	***	***	14	7	***	***	***	***	156	
Dist. of Col.††	8,000	...	16,625	6,243	432	1,035	290	***	***	***	***	...	Perennial reg.
Florida	11,366	1,994	9,372	***	***	***	***	***	***	***	***	..	Perennial reg.
Georgia†	20,910	...	22,000	***	20,000	430	100	50	60	***	100,950 00	...	New law
Idaho	3,272	1,099	2,173	3,192	80	***	***	***	***	***	58,579.75		
Illinois	132,338	37,682	94,656	***	***	3,360	810	***	***	17,827	699,725.30	1,196	
Indiana	65,500	20,762	44,738	***	***	310	12	***	***	2,960	427,800 00		
Iowa	108,407	38,113	70,294	***	***	285	15	***	***	***	1,040,135 54	2,330	
Kansas	50,467	16,101	34,366	***	***	***	***	***	***	***	252,335 00		
Kentucky	11,746	3,536	7,210	***	***	325	80	***	***	2,004	104,008 00		
Louisiana††	3,500	...	7,200	3,302	178	***	20	***	***	***	***		Local reg.
Maine	15,700	5,130	10,570	15,061	635	5	1	700	700	18,428	36,856 00		
Maryland	20,213	5,959	14,254	***	1,044	175	140	***	***	***	***		
Massachusetts	87,000	25,254	61,746	77,093	8,236	923	748	1 500	7,150	***	922,460 75	1,518	
Michigan	76,389	22,023	54,366	***	***	1,150	225	***	***	4,783	183,169 30	.....	
Minnesota	67,365	29,565	37,800	***	***	803	142	***	***	***	***	....	Perennial reg
Mississippi†††	3,894	894	3,000	3,867	24	***	3	***	***	***	***	.	Law invalid.
Missouri	51,933	13,793	38,140	***	***	1,314	219	***	***	6,581	235,873 50	935	
Montana	10,706	5,020	5,686	***	***	***	***	***	***	***	***		
Nebraska	50,000	2,626	47,274	***	***	***	***	***	***	***	***		
Nevada	1,487	356	1,131	1,477	***	10	***	***	***	***	4,337.08		
New Hampshire	10,596	3,160	7,436	9,220	1,298	60	20	1,160	698	2,199	200,002 50		
New Jersey	60,247	8,887	51,360	***	***	96	164	None	1,427	70,313	814,575 30		
New Mexico	3,192	1,471	1,721	***	***	***	***	***	***	***	19,663 23	102	
New York	169,966	37,302	132,664	145,186	14,864	7,455	2,461	2,377	11,416	66,636	1,529,852 36	1,743	
North Carolina	14,615	4,815	10,000	***	***	***	***	***	***	***	99,000 00		
North Dakota	17,348	4,273	13,075	***	***	15	***	***	***	***	52,044 00		
Ohio	122,504	36,348	86,156	118,071	***	3,877	***	83	***	11,276	685,457.25	1,156	
Oklahoma §	7,360	...	7,934	***	***	150	***	***	***	***	***		
Oregon	16,347	2,390	13,957	14,797	1,482	30	38	***	***	***	***		
Pennsylvania	112,854	32,676	80,178	101,401	5,453	5,000	1,000	1,000	4,712	28,264	1,185,039.50		
Rhode Island	12,331	3,149	10,182	10,973	1,298	28	32	***	***	17,695	157,020 00		
South Carolina	15,000	3,500	11 500	***	***	5	***	***	***	***	***		Local reg.
South Dakota	21,420	6,842	14,578	***	***	***	***	***	849	***	***	491	
Tennessee	19,668	5,565	14,103	***	***	80	4	***	***	***	11,130 00		Motorcycles incl.
Texas §§	64,732	10,369	54,363	63,738	717	125	3	***	***	***	***		Loc. & per. reg.
Utah	6,274	2,253	4,021	6,022	129	119	3	10	25	580	5,444 00		Perennial reg.
Vermont	8,256	2,338	5,918	8,033	214	4	5	643	***	10,337	154,266 91		
Virginia	14,152	5,130	9,022	***	***	21	25	***	***	1,209	125,000 00	167	
Washington	30,253	6,075	24,178	***	***	***	***	***	***	***	60,506 00		
West Virginia	8,224	3,136	5,088	***	***	***	***	***	***	1,007	67,000 00		
Wisconsin	54,382	19,736	34,646	***	***	***	***	***	***	***	277,830 00	1,202	
Wyoming	2,428	844	1,584	***	***	***	***	***	***	***	12,140 00	.	
Total	1,785,613	511,818	1,287,784	624,660	62,143	27,516	6,793	7,523	30,856	321,241	$11,497,678 36	11,180	

NOTE.—3,300 steam passenger cars and 300 steam trucks included. *Number of cars belonging to residents of other states. **Number cars re-registered owing to change of ownership, etc. ***Not listed separately by registration officials. †Registrations low under new law. ††Figures from Auto Directories Co., N. Y. †††G. R. Lamson, Librarian, Firestone Tire & Rubber Co., gives 2,777 for Louisiana, with 22 counties not included. He is the authority for the Mississippi figure 3,894. C. D. Ensign, B. F. Goodrich Co., also records 2,777 Louisiana registrations. He is the authority for the number of trucks in District of Columbia and his Mississippi figures correspond with those of Mr. Lamson. §Registration law runs from July to June. §§Statistics by Dallas Chamber of Commerce. Electric car and truck statistics, where not given by registration officials, are from incomplete returns compiled by the Electric Vehicle Assn. of America.

Maxwells Designed for 105 M.P.H.

Aluminum Alloys in Chassis Minimize Weight in Cars for 500-Mile Race

Front view of the new 298.2-cubic-inch Maxwell racer now being tried out at the Indianapolis Speedway



Intake side of motor on Maxwell racer, showing overhead valve drive and mounting of carbureter and intake manifold. Note exterior air intake

COINCIDENT with the double victory of the Maxwell racing cars with Oldfield and Carlson at the wheels at Venice, Cal., last week, Ray Harroun, chief engineer of the Maxwell company and designer of the cars, comes forward with the details of construction of the three new Maxwells which will contend for honors at the annual 500-mile race at Indianapolis this year.

Generally speaking, the new chassis are of more elaborate design than the three that made up the Maxwell racing team which have been so successful all over the country this year. Much hand work is being put on them, and five Belgians are working in the racing car department with the other mechanics to make the cars as good for their purpose as Harroun knows how to make them. The Belgians are a new and interesting part of Harroun's domain. They are expert mechanics, careful, accurate and painstaking. One of them, expertly polishing a bearing, explained proudly that he had been in the battle at Liege, and due to a wound on his head was incapacitated for further war service. Somehow or other he got to this country and he is now working for Maxwell.

But to get back to the cars, they are similar in appearance, on the whole, to the past season's contenders, but have been altered here and there. To bring them within the 300 cubic inch piston displacement limit, the bore and stroke have necessarily been reduced, though the general motor design is much the same. The bore has been cut down from 4.2 inches to 3 3-4 inches, and the stroke has been lessened from 8 inches to 6 3-4 inches. These dimensions bring the displacement to just within the limit: to be exact, it is 298.2 cubic inches, as compared with the 445 cubic inches of the old cars.

75 M.P.H. for 200 Miles

Harroun has the first of the new cars running and it is being put through its preliminary paces at Indianapolis now, having been driven down about a week ago. On Saturday, the thirteenth, Harroun did some testing on his own account at Indianapolis, driving the car at an average of over 75 miles an hour for 200 miles. He expects 95 miles an hour out of these new cars, and believes he may get 105.

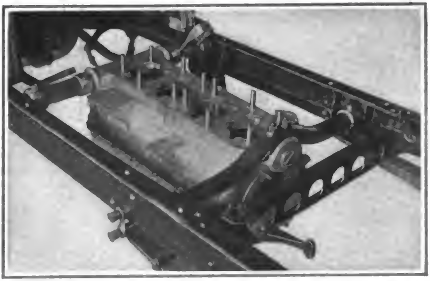
Motor Follows Maxwell Practice

The motor is still the offset overhead valve design which was used in the other cars. The camshaft is overhead, and the offsetting of the valves is made necessary in order to get both sets of cams on the one shaft. Drive for the camshaft is by a vertical shaft at the front end which has spiral gear connection with both the camshaft and the crankshaft. Those who have followed the design of these cars will remember the construction.

The most unusual feature of the engine is the crankshaft which this year, while preserving the counterbalanced design, is made in two halves, as shown in the illustration. No flywheel is used, but its effect is obtained by counterbalancing the shaft opposite to the throws; a feature that has been used in the old cars with a shaft of single piece design. The center bearing of the old shaft had to be a plain type, for it was impossible to get a ball bearing into place.

In the new design, instead of having only ball bearings at either end of the shaft as in the old type, splitting the shaft into two parts has made it possible to have a ball center bearing as well. Naturally many will say that it is objectionable to split the shaft, as it would be next to impossible to make a solid joint of the two parts, but this has been provided for by using a telescoping construction whereby one part slips within the other. Accurately to position these with respect to each other, there are four No. 8 Morse tapers to key the two parts together and then through the center is passed a 3-4 inch bolt which has a large head to cover the ends of the four tapers.

This makes a very accurate and solid connection, and effectively eliminates any bearing trouble here: the center bearing is a Fafnir No. 6,215.



Method of supporting the crankcase in the chassis. Note the integral rear arm through which the rear cross member passes, and the hanging of the front and

In further explanation of the counterbalanced crankshaft, it might be explained that the flywheel function is distributed along the entire length of the crankshaft and is conducive of fine engine balance. The counterbalance weight opposite each rod bearing is equal to the weight of the lower part of the rod and its bearing, thus the active forces are balanced with respect to the center of gravity and the centers of masses revolve in the same or parallel planes, vibration being reduced materially thereby.

The cylinders are cast in a block and the head carrying the valves, their rockers and the camshaft is detachable. Intake and exhaust passages are on opposite sides of the casting and they are large and free, so that the least possible interference with the passage of the gases to the manifolds is obtained.

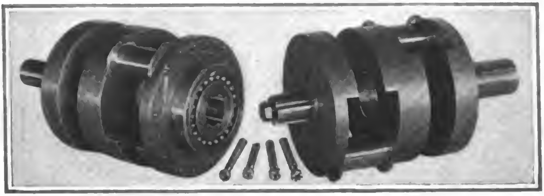
Lubrication Rearranged

The oiling system has been entirely redesigned, so that instead of pumping oil out of the bearings, the cars are now fitted with a system which, though possessing many special features, moves in the conventional direction as it is a combination splash and force feed arrangement. Oil is pumped to each bearing by a McCord six-feed oiler with dash sight for each of these feeds. Three introduce the oil to the main crankshaft bearings, one goes to the camshaft and so on. This is the main system, and there is an auxiliary which works entirely by splash, the lubricant being pumped by hand to the splash troughs through a by-pass within reach of the mechanic. This latter is only for emergency in case the oiler fails to work. In ordinary operation, the oil is pumped to the reservoir of this oiler by the hand pump and is then forced to the points of use, but the by-pass offers a commendable means of sending the oil to the crankcase direct if needed.

In addition to this double arrangement, a separate pump alongside the main one is used to force oil to the rear end of the hollow camshaft. It goes through this and out by holes drilled in the cams, lubricating the rocker contact points. Surplus oil running out at the other end of the shaft and then to the gearcase, which has no connection whatever with the crankcase, a felt washer being placed between the two parts so that there will be no possibility of the oil of the different systems mixing. Of course, in driving, the lubricating of the camshaft requires only a stroke of the pump occasionally and it, being alongside the main supply pump, is no trouble to operate. Harroun backs up the new oiling arrangements with a guarantee against smoking and says that the cars will use less than 3 gallons of oil in 500 miles; only castor oil is favored.

In lubricating the connecting-rod bearings, a unique method has been devised. Screwed to each counterweight is a disk, the function of which is to direct oil to the bearing by centrifugal force. The oil, coming under pressure to the three main bearings overflows from them and is caught by these disks which have a passage all the way around for the purpose. This passage widens at the hole drilled through the

Left—Piston and connecting-rod. Note oil scoop for emergency lubrication. Right—The counterbalanced crankshaft is split into two parts so that a ball bearing can be put in the center. The two halves are held together by four Morse tapers which accurately position them with respect to one another. In addition there is a 3-4-inch center bolt



Control features of Maxwell racer. Note isinglass windshield, a new idea in racing cars

Ray Harroun sending the new car over the Speedway at 90 miles per hour with his hands off the wheel to show ease and steadiness of steering with yoked spindle construction

counterweight to the rod bearing, and the effect when the shaft is rotating is for the oil to be thrown to this wider point, from which it escapes through the drilled hole into the bearing. The construction may readily be seen by referring to the illustration of the two-piece crankshaft: the disk is in position on the counterweight and behind the ball bearing. A similar one would be placed on the opposite counterweight so that the center bearing would take care of the two adjoining rod bearings. The other two oil disks would attach to either end weight and each would care for the adjacent rod bearing with the ball bearing of that end as the source of supply. Even at high speeds it is claimed that lubrication is ample.

Changes in Construction

Of course this change in the oiling system has necessitated some changes in the head construction as well as the crankcase, but in the main they are the same. Connecting-rods are still made of chrome-vanadium steel and have been subjected to accurate machining all over. The I-beam section is further strengthened by forging webs on either end of the section, making a very sturdy rod. The use of magnalium pistons is continued, magnalium being an exceedingly light and strong alloy which would no doubt find general use in motor car construction were it not for the expense. The piston heads are domed to give them strength, and each has five rings. There are two diagonally-split rings in each of the upper grooves and one wider ring below which is used as a retainer for the wristpin. The use of magnalium reduces the piston weight from over 2 pounds, the weight of a similar cast-iron piston, to about 15 ounces.

Cars Weigh Only 2,075 Pounds

The new cars are actually about 290 pounds lighter than their predecessors: that is, the weight has been cut from 2,365 to 2,075 pounds. Several things are responsible for this: light alloy parts have been substituted for steel or iron wherever possible, the motor is smaller and lighter, and the front axle weight has been cut considerably.

In fact, the use of macadamite, which is a very strong and light aluminum alloy, has been quite extensive throughout the chassis. Roughly, about half the weight of a part is saved by using this material instead of steel, and it is nearly as strong. For instance, the brake drum spiders are now macadamite instead of steel, and thereby they are 5-pound parts as against an old weight of 10 pounds. The rear axle bevel gear carrier is macadamite—the cars use no differential gears. Among the other parts also made of macadamite this year are the housing for the front spiral camshaft drive, the fuel tank lid, the water pump, certain other parts of the rear axle and the water manifolds.

Windshield Reduces Eye Strain

The use of a windshield is also a new thing to racing cars. a shield with isinglass windows is attached to the top of the body cowl, and seems to have given excellent results, taking away much of the terrific eye strain which the racing driver knows so well. In trial, the shield has apparently made no difference in the car's speed, and in all probability will be used in the races. It has the advantage of allowing conversation between the driver and his mechanic.

Among other points of interest is the adoption of the Lemoine type of front axle, which design has principally to do with the method of mounting the spindle. Instead of the yoke end with a mounting for the spindle in the upper and lower arms of this yoke as in conventional practice, the horizontal steering spindle itself is yoked, and the end of the axle fits between, which is lighter and very strong. At the same time the swivel has been so positioned that the balance will be conducive to the utmost ease in steering.

A group of the macadamite parts of the new Maxwell racing cars which are a material factor in the reduction of the weight of the cars. Macadamite is an aluminum alloy of great strength

New South Wales' 1914 Imports $2,893,830

Increase of $231,455 Over 1913—United States Makes Large Gains—Is Only $4,200 Behind Great Britain in the Number of Chassis —Business Conditions in Australia Improving

THE import of automobiles into New South Wales has not been materially affected by the European war, according to the latest statistics from the Motor Traders' Assn. of N. S. W. The total value of motor vehicles imported in that state in 1914 was $2,893,830 compared with $2,662,375 in 1913, a gain of $231,455. The United States showed tremendous gains, the value of the American cars in 1914 amounting to $797,675 as against $663,760 in 1913, a gain of $133,915. Were it not for the war, these figures would have been even greater, as this country is the first to give delivery of the new year's models. It is easy to predict that many of the 1915 cars would have been in that state in December, and in that case, the United States would have shown the greatest amount of business.

Business Is Improving

Trade this year has improved to a wonderful extent. Wool is beginning to find a market and unless further restrictions are put on it there will be a fair sale for the same. Unfortunately the Government recently saw reason to prohibit the export of wool to the United States for the time being. However, this will not have any material effect on the popularity of the American makes of cars.

Some interesting figures are given in the accompanying table, showing the country of import and the country of origin. There was a decrease in 1914 of United Kingdom cars, that is, in the country of import column, but in the country of origin column there was an increase. The total value of cars imported from the United Kingdom in 1914 was $987,050, while the value of the British cars was $801,875, a difference of $185,175. The difference between the value of cars imported directly from the United States and the total value of American cars imported is $241,945, showing that a great number of the American cars came through the United Kingdom. Though the United Kingdom led the other countries in the value of chassis imported, the United States was a close second, being only $4,200 under the British imports, which were valued at $801,875, the American value being $797,675.

United States First in Bodies

The United States led in the imports of bodies, the value being $192,620, Great Britain being second with $147,415. The United States also showed a greater increase than the United Kingdom, the increase over 1913 being $21,895 as against the British increase of $8,820. The total value of bodies imported into New South Wales in 1914 was $444,205 as against $386,560 in 1913. The figures again show that many American bodies came through England.

New South Wales is one of the leading Australian states in the purchasing of automobiles, especially low-priced cars. The largest sales are made in the country districts where farming and pasturage constitute the chief occupations. With this class of population purchasing practically 80 per cent. of the cars, it is not surprising that the low-powered and medium-powered cars should lead.

Throughout Australia, with the exception of South Australia, the automobile trade is improving; stock values have recovered greatly since the reopening of the Exchange and, though the position is by no means the same as previous to the war, still people are beginning to spend money once more.

The demand for high-priced cars is small because of the new taxation which lately came into force, taxing individuals more highly. Added to general taxes that have the effect of raising the cost of living, there are special automobile imposts varying from $10 to $50 according to size. In the truck field things are particularly bright, since the large number of users who have lost their vehicles to the government will buy anything capable of doing the work.

Imports of Chassis and Bodies into New South Wales in 1914

Chassis

Country of Import.	1913	1914	Country of Origin.	1913	1914
United Kingdom	$1,011,330	$987,050	United Kingdom	$789,495	$801,875
Canada	286,885	528,055	Canada	220,325	338,480
Ceylon	......	1,020	New Zealand	......	50
Fiji	......	10	Austria	1,700	1,210
India	......	3,045	Belgium	49,115	58,185
New Zealand	11,800	35,980	France	240,105	184,790
South African Union	385	......	Germany	148,225	156,875
Straits Settlements	95	......	Italy	143,395	110,575
Austria	1,700	......	Netherlands	2,200	......
Belgium	142,770	124,020	Sweden	3,545	......
France	45,245	20,670	Switzerland	3,950	......
Germany	127,730	104,550	U. S. A.	663,760	797,675
Hawaiian Islands	2,400	......			
Italy	108,525	89,495			
Sweden	1,700	......			
U. S. A	525,250	555,730			
Totals	$2,265,815	$2,449,625	Totals	$2,265,815	$2,449,625

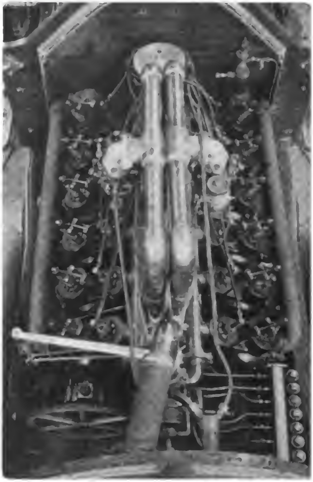
Bodies

United Kingdom	$151,305	$151,100	Commonwealth	$825	....
Canada	62,570	127,030	United Kingdom	138,695	$147,415
Ceylon	....	140	Canada	48,150	75,660
Fiji	....	4,410	New Zealand	275	225
New Zealand	3,075	7,530	Austria	....	....
South African Union	85	....	Belgium	140	1,135
Belgium	11,830	5,780	France	17,960	6,950
France	1,670	570	Germany	7,595	11,955
Germany	6,975	8,565	Italy	1,740	8,245
Hawaiian Islands	400	....	Netherlands	455	....
Italy	1,215	6,695	U. S. A.	170,725	192,620
U. S. A.	147,435	132,385			
Totale	$386,560	$444,205	Totals	$386,560	$444,205

Schebler Has Veteran Twelve-Cylinder

Motor Constructed in 1908 Has Carried Old Chassis Over 30,000 Miles—Unusual Connecting-Rod Design

IN 1908 when many of our manufacturers were experimenting with sixes and building successful fours, George Schebler of Wheeler & Schebler, Indianapolis, Ind., maker of Schebler carbureters, designed and successfully built a twelve-cylinder V-type valve in the head motor with cylinders set at 45 degrees. Since the time of its construction, which was done under Mr. Schebler's direction by Philip Schmoll of the engineering staff of the company, the motor has pulled an antiquated automobile chassis over 30,000 miles. Mr. Schebler has many hobbies, and this twelve-cylinder motor which is still giving service is one of them.



Plan view of V-type, 45-degree, twelve-cylinder motor mounted on old chassis

But this twelve can very conveniently be transformed into a double six, operating on either the right set of six cylinders or the left set, causing the machine to run little different from an ordinary six-cylinder. Thus, at will, the driver can use either one of two six-cylinder motors, or both, so making it a twelve-cylinder power plant. Two carbureters, Scheblers of course, are used, and these may be controlled independently or together. Mr. Schebler in using the machine employs six cylinders when the roads are good and no difficulties are met with and twelve when a sand pit is encountered or when the car is required to pull through deep mud.

Unusual Connecting Rods

In these days when the eight-cylinder motor is attracting a great deal of attention, some of the mechanical details of the Schebler twelve should command the consideration of the motor enthusiasts. This will be especially true in the matter of connecting-rod design, since the engine is of the V-type. In our present eights two type of rods are used, the yoked and the side-by-side, but the Schebler twelve uses neither. Instead, one long rod is employed and a shorter one attached to it on the bearing cap, by means of a steel pin, as shown in the illustration herewith. This means that the large rod is almost the same as the conventional type except that on one side and near the I-beam section there is provision for coupling a forked rod by means of a steel pin, which forms the bearing for the small rod. The present motor uses rods made of bronze, the larger 9 3-16 inches long and the smaller 7 1-2 inches.

The crankshaft is not startling in design, being similar to that of a six-cylinder shaft using seven main bearings. These are 2 inches long and 1.75 inches in diameter. The crank pin bearings, plain like the main bushes, are 1.5 inches in diameter and 2 1-2 inches long. Directly above the crankshaft is a camshaft with twenty-four cams, each operating a roller push rod directly, and these push rods are extended angularly to operate rocker arms. However, between the valve tappet and the valve stem is a finger, such as is used on a few valve-in-the-head motors, to allow the valve stem to take a direct thrust instead of one at an angle.

Flat Valves Best

During the early stages of the development of this motor 45-degree valves were used, in accordance with convention, but because of excessive valve trouble due to warpage the designer turned to flat heated valves and while a little valve trouble was encountered for a while, it has recently been slight.

The Schebler twelve has a bore and stroke of 3 1-4 by 5 and up to this time no dynamometer test has been made of its power output. On the road exceptional power and speed is shown and, according to Mr. Schmoll, no one has had the courage to keep both throttles wide open for any length of time.

Ignition of this motor is by a Mea magneto of the six-cylinder type fitted with a Schebler-made twelve contact distributer, while the armature is, of course, operated at three times crankshaft speed. There is nothing unusual in the timing, it being just like a six-cylinder motor firing 1, 4, 3, 6, 2, 5.

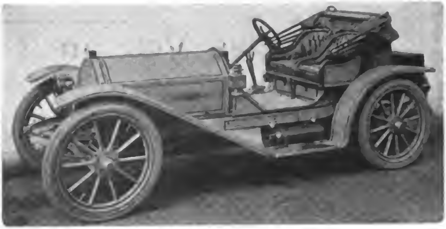
Novel Oiling System

There is a slight deviation from common practice in the oiling system, as a large plunger pump operated from an auxiliary shaft forces oil through pipes to the main bearings, and directly to the cylinder walls which are drilled for the purpose. These holes are drilled so low that they are never uncovered by the pistons. Besides the force feed, splash is used for the rod bearings, etc., there being six troughs the overflow from which falls to a sump whence it is again picked up by the pump and recirculated.

Nothing unusual is seen in the cooling system, a centrifugal pump being used.

As one would expect this twelve-cylinder engine has a very light flywheel, its weight being between 30 and 35 pounds; the rapidity of firing being such that a heavier flywheel is not needed. The motor weight is greater than that of a six but its length is only 40 inches overall.

At present there is being designed another twelve-cylinder motor somewhat similar to that now in use, but this new one will be a 3 3-4 by 5 1-2 and will have the valve push rods vertical, instead of at an angle of 45 degrees as in the present type.



George Schebler's twelve-cylinder car. For ordinary running six cylinders suffice, but under difficult road conditions the other six are called into service

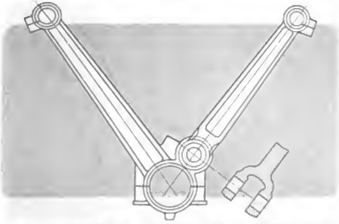
A Winton Twelve

The Winton company at one time made up a special twelve-cylinder job for a motor boat. It was composed of three four-cylinder motors of the same size and style as those used in the old model A Winton in 1905. The cylinders had a bore of 5.25 inches and a stroke of 6 inches. The motors were practically independent, each having its own flywheel and magneto but only one water circulating pump was used for the entire battery of motors. The crankshafts were connected by Oldham couplings. All other features of the motors were the same as those used on the Winton cars.

Two Improvements Devised for Motor Spirit Process

TWO improvements have recently been suggested by chemists of the Standard Oil Co. of Indiana in the equipment for running the Burton process for producing motor spirit. One of these introduces two long leaves of steel running the length of the still on either side and hinged to the wall at the center. These leaves form a bridge across the lower part but can be swung up against the top of the still when it is to be cleaned. The reason for its use is to catch the free carbon in the distillation of the oil. This carbon heretofore has been deposited on the bottom of the still, forming a heat insulation layer, thus causing the apparatus to be burned out in a short time. When the steel leaves are covered with carbon they can be swung to the top and readily cleaned.

This improvement has been suggested by Robert E. Humphrey, of Whiting, Ind., and in his patent application Mr. Humphrey states that, "In commercially practicing the Burton process on a large scale wherein the capacity of the still and the quantity of the material treated is several thousand gallons, it is found that the accumulation of carbon on the still bottom precludes conducting the run long enough to convert into gasoline more than about one-third of the material contained in the still. This is because the carbon, being a good insulator of heat, becomes red hot, and, if the run were continued, would soon burn through the bottom of the still. Beside the destruction of the still itself the layer of carbon heat insulation at the bottom also tends to retard the progress of the distillation. A primary object of the invention is to prolong the run to an extent that will enable two-thirds of the still contents to be converted into gasoline without incurring the objectionable consequence referred to."



Novel connecting-rod construction used in Schebler twelve-cylinder motor. The large rod is almost the same as the conventional design except that on one side and near the I-beam section there is provision for coupling a forked rod by means of a steel pin, which forms the bearing for the small rod. The rods are made of bronze in the Schebler motor, the larger being 9 3-16 and the smaller 7 1-2 inches

A Mechanical Pressure Regulator

The second improvement suggested for the Burton process in the patents applied for by Francis M. Rogers, and Thomas S. Cook, both of Whiting, Ind., and assignors to the Standard Oil Co. of Indiana, consists of a mechanical regulator which will govern the high pressure maintained in the still. This pressure is around 80 pounds and the contrivance is so devised as to feed to, or release from, the still, a sufficient amount of gas to keep the pressure even.

As explained in the patent papers, "It is now understood that in the manufacture of commercial gasoline from high boiling point hydrocarbons, such as the product commonly known to the trade as fuel oil, it is of the utmost importance to maintain perfectly constant and uniform conditions, particularly in matters of pressure. Since variation will produce changes in the character of the distillate produced with consequent undesirable irregularities in output, the present device is particularly designed to maintain this pressure absolutely constant. Tests have shown it to be thoroughly satisfactory for the purpose."

It will readily be seen that in order to secure anything like uniform results from the volatile and complicated gases in the still approximately uniform pressure must be maintained throughout the process of distillation.

Detroit Adopts Traffic Signal

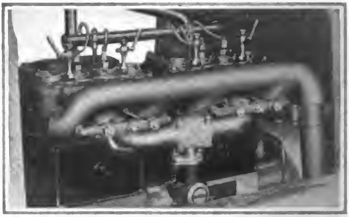
DETROIT, MICH., March 20—The police department has adopted definitely the traffic signaling device which was invented by secretary Walters of that department and tried out for the last 3 weeks. The device, as described in THE AUTOMOBILE for March 4, consists of removable posts surmounted by two metal cross plates, one with a red background and the other with a green background. Upon the former is the word Stop and upon the latter the word Go, both in white. At night an oil lamp surmounts the top of the post and throws either a red or a green light according to whether traffic should stop or go. A handle connects with the two cross-plates and thus the traffic man can regulate traffic very easily. These posts cost only $4.

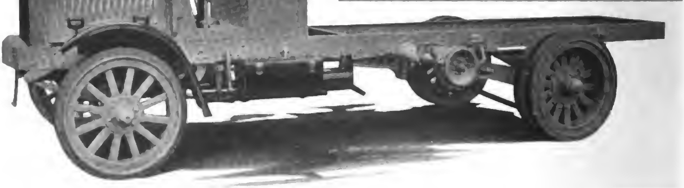
Four New United Motor Truck Models

2 and 3 1-2-Ton Are Worm-Driven and 3 and 5-Ton Use Chains

Right—Side view of Continental motor used in United trucks, showing manifold design

Below—The new 3-ton, chain-driven United truck





PRELIMINARY announcement of the formation of the United Motor Truck Co. in Grand Rapids, Mich., was made about the first of February, but the specifications of its commercial cars were not available at that time. There are four models in the new company's list. These are a 2-ton worm drive, a 3-ton chain drive, 3 1-2-ton worm design and 5-ton chain type. So far as possible the designers have endeavored to standardize the four models so that parts are interchangeable throughout the line. This has a tendency to make the smaller model slightly heavy for its rating, but that is rather to be looked upon as a desirable feature since the company claims no extravagant use of tires or fuel as a result.

The trucks are assembled from parts of well-known makers. Motors are Continentals, axles are of Timken make, the worm final drives are from the Timken-David Brown factory, Brown-Lipe gearsets and clutch units are fitted, Perfection springs, Mayo radiators, Gemmer steering gears, Spicer universals, Whitney chains and Hayes body parts are all used in the make-up of the United trucks.

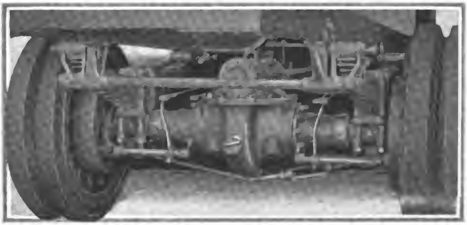
The price of the 2-ton is $2,050; of the 3-ton, $2,750; of the 3 1-2-ton, $2,950; and the 5-ton is offered at $3,400. These figures are exclusive of body but with driver's cab fitted.

The 2-ton model uses the 4 1-8 by 5 1-4 size of Continental engine. This is a conventional L-head type provided with three-point chassis suspension and carrying an S. A. E. horsepower rating of 27.23. It is cooled by centrifugal pump, has Eisemann fixed spark ignition, splash oiling and Stromberg truck type of carbureter. All of the other models use the 4 1-2 by 5 1-2 Continental which is also an L-head design, features of which are similar to those enumerated for the other engine. The spark advance is automatic, however.

The 2-ton model follows standard design throughout. The gearset, in unit with the engine, gives three forward speeds and reverse and provides center gearshift. The gears and shafts are nickel steel, and Timken bearings carry them. Then back of this unit, the power is transmitted through one of the two Spicer universals to a 2 1-2-inch tubular shaft which in turn gives its power to the worm rear axle through the intermediary of the second universal.

The rear axle is floating and has the overhead form of worm gearing. The reduction from motor to wheels on high gear is 9 1-4 to 1. Springs are half elliptics of regular truck form. The front pair measure 44 inches long and are 2 1-4 inches wide, while the rears are 3 inches wide and 56 inches in length. The rear spring shackle bolts are 1 inch in diameter and the spring eyes have bronze

Front view, showing swiveled crank bracket



Rear view of 3 1-2-ton United truck, showing worm-driven axle and rear spring construction

bushings to bear against these bolts.

The wheelbase of the 2-ton is 148 inches while front tread is 56 inches and rear 58. The tires are 34 by 4 in front and 36 by 4 dual in rear. To give an idea of the loading space, the length of frame back of the seat is 120 inches and the clear space between the rear wheels is 52 inches. A governor is fitted, and may be adjusted for maximum speed of either 10, 12 or 15 miles an hour.

The same general construction is adhered to for the other worm drives as for the 2-ton briefly described above, and the chain types employ the familiar construction whereby the drive shaft from the engine runs back to a jackshaft with a differential as a part of it. From this point the delivery to the wheels is through the Whitney chains on the sides, the rear axle being a dead type.

On the 3 1-2 ton worm model, the Timken-David Brown axle has a gear ratio of 10 1-3 to 1. In this model as well as in the 2-ton, the drive and torque is taken by the springs. The springs are so designed as to be flat under rated load, thus driving in line. At this time, the drive shafting from motor to back axle is in one plane, making for efficient power transmission. The brake rods then are also in line.

The 3-ton chain and 3 1-2-ton worm models have 36 by 5 tires, dual in the rear. The tread is 72 inches rear and 65 inches front. There are several wheelbase and body space options to meet the requirements of different service. The standard is 144 inches, but 120, 168, 192 and 216-inch lengths are available, the first two of these costing $50 more than list and the last two $100 more.

Although the 5-ton has 36 by 5 front tires, its dual rears are 40 by 6. However, the wheelbases are the same as the two just mentioned, with 120-inch as the standard. Its general design, though heavier, follows that of the other models.

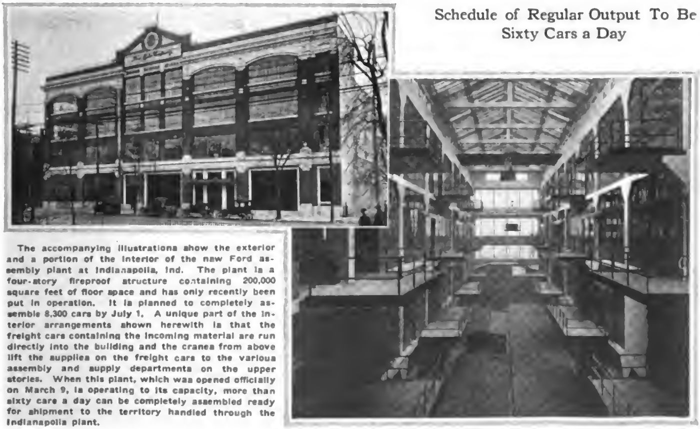
Concern Has $200,000 Capital

The concern is a Michigan corporation with a capital stock of $200,000, and has for its head F. T. Hulswit, president of the local railway and light company, while E. M. Elliott, who for several years has been connected with the industry is the secretary and general manager.

The concern is now getting under way; is placing dealer agencies and is said to be progressing at a lively rate.

New Ford Assembly Plant in Indianapolis

Schedule of Regular Output To Be Sixty Cars a Day



The accompanying illustrations show the exterior and a portion of the interior of the new Ford assembly plant at Indianapolis, Ind. The plant is a four-story fireproof structure containing 200,000 square feet of floor space and has only recently been put in operation. It is planned to completely assemble 8,300 cars by July 1. A unique part of the interior arrangements shown herewith is that the freight cars containing the incoming material are run directly into the building and the cranes from above lift the supplies on the freight cars to the various assembly and supply departments on the upper stories. When this plant, which was opened officially on March 9, is operating to its capacity, more than sixty cars a day can be completely assembled ready for shipment to the territory handled through the Indianapolis plant.

Automobile section of an aviation squadron. New motors, propellors, etc., were taken to the front by 3-ton trucks with canvas bodies

Cars and Trucks Behind the Lines

Wide Range of Usefulness—Searchlight Cars, Transport and Supply Convoys and 45 Vehicle Tractor Trains—Cooking in Traveling Truck—All Painted Battleship Gray—Novel Equipments

By W. F. Bradley

Special Representative of THE AUTOMOBILE *with the Allied Armies in France*

PARIS, March 5—The town was not within sight of the trenches and not even within sound of rifle fire. It worked by day and it slept by night to the dull boom of the cannon, and so highly developed had become the ears of the inhabitants that they could not only forecast but supplement the official war reports with considerable accuracy. But this town was more than a public long distance telephone to the battle front. Being on the main line of communications, all the automobile traffic to the front passed through it, and by examining that traffic a better idea could be obtained of the general situation than was possible in the front line of trenches. At the front everything is hidden and secretive; men and officers obey orders without knowing or seeking to know the why and the wherefore of them. Nobody asks questions for there is nobody willing to reply to them.

Searchlights on Eight-Cylinder Chassis

It is impossible to stay in this town without realizing the diversified nature of the work done by the automobile. Even the extensive user of automobiles is apt to fall short of his conception of the range of work undertaken by mechanical traction. A fleet of automobile searchlights, manned by marines, paid us a visit. Six vehicles formed a working section. While the chassis were alike, all of them being eight-cylinder De Dion Boutons, with cylinders of 75 by 130 millimeter bore and stroke, their equipment varied. Originated in France, the eight-cylinder motor has not met with the general approval of French manufacturers or the European public. De Dion Bouton is the only firm making this type of motor as a stock touring car proposition and it is only being used in the army for touring car work and these special automobile searchlights.

The leading vehicle in the convoy is fitted with a platform body covered with a green canvas top. It has aboard the officer in command of the section, half a dozen men, and a reserve supply of food and ammunition. In addition to its acetylene headlights and its oil side lamps, it has a very powerful electric searchlight pivoted on the dashboard. This is the only use of electricity for the automobiles themselves. Most of the night driving has to be done in complete darkness, for the showing of any light might be an important indication to the enemy. An easily controlled electric light at the disposal of each driver might result in it being used at undesirable moments; thus one powerful light at the head of the column is all that is required for general safety. The duty of the driver on the road at night is merely to follow the outline of the car ahead.

The rear vehicle has also a closed canvas body and forms a workshop and general stores for the section. The tools are sufficient to enable all ordinary repairs to be carried out in the field, whether those repairs be to the mechanical or electrical part of the outfit. The four electric searchlights are of an entirely new type. In addition to the eight-cylinder motor driving the car, there is a separate four-cylinder motor direct coupled to a dynamo, and mounted under a bonnet on the car platform. The radiator is at the rear, and is one of the circular coil tube type as used on the Paris motor buses. Naturally its capacity is proportionally greater than that of a car radiator, for its position gives it no direct current of air, even with the automobile under way.

Back of the driver's seat, and between him and the gasoline-electric group, is the electric searchlight mounted on a forked pivot so that it can be swiveled in any direction. The searchlight is not intended to be taken off the automobile, and in consequence is raised a sufficient height for it to cast its rays above the heads of the crew and over such natural obstacles as wayside hedges. Four men are carried aboard each automobile. They comprise the driver and a companion sitting by his side, also two men sitting one on each side of the gasoline-electric group, facing forward, with their seat practically over the rear mudguard. Every inch of space is used to the best advantage, so that while the six must operate together to do the most useful work, no vehicle is likely to be stranded if left alone to work itself out of a difficult situation. Gasoline is carried under the seat. The kit of each of the four men has to be carried on the car. This comprises the regulation knapsack, sleeping blanket, new pair of boots, and 2 days' reserve rations. The whole forms a compact bundle which can be slung on a man's back at a moment's notice, if it becomes necessary for him to leave the car, but it is sufficiently big to take up an appreciable amount of space on an automobile.

Complete Tool Equipment

Spare gasoline, oil, tubes, tools and automobile parts, as well as carbide for the side lamps and headlights, are contained in lockers around the body of the automobile. The gasoline for the small motor is in a separate tank built into and forming a part of the bonnet covering the small four-cylinder motor. On a sloping board at the rear of the automobile, and just below the second radiator are leather cases to hold respectively a saw, hammer, shovel, and pick. A coil of rope is also attached to the rear. These tools have their handles projecting from the cases so that they can be picked up without the loss of a second. It would fall to the lot of the soldiers on the side of the car to make use of them first if obstacles had to be cleared away, or if the automobile became bogged. The position of these men makes it possible for them to jump down and seize the tools with the fewest possible motions.

Invisibility is secured by painting every part of the automobile and its equipment a grayish green, including the waterproof cover over the searchlight. The canvas cover over the bodies of the first and the last vehicles are also of green. This is found to be much less visible than the khaki tint adopted by the British army; indeed, in the English motor service khaki is giving way to battleship gray. Single pneumatics are used in front and twins in the rear. No armor plating is used on the cars.

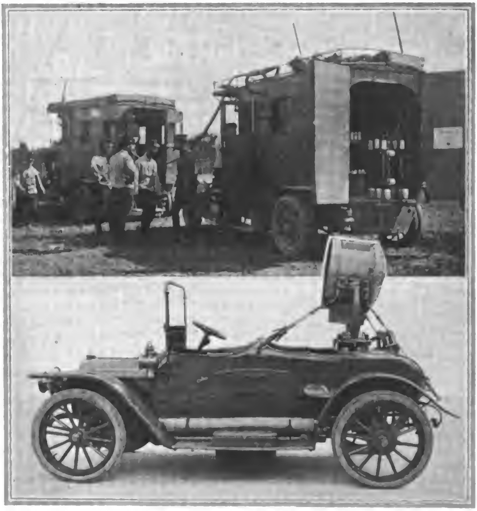
More automobile searchlights appeared. Only one of these was of a new type. It had a light steel telescopic tower normally lying horizontally on the top of the platform body, the latter being provided with rails to enable the tower to be placed on the ground with great rapidity and opened out by steel cables and pulleys. The searchlight was permanently attached to the topmost section of the tower, and thus went up with it, or could be used direct from the top of the car. This outfit enabled the searchlight to be hoisted to a height of 40 feet from the ground in about as many seconds and to be brought back and placed in position on the automobile in about the same length of time. The feature of the design lay in the rapidity of operation with the use of only two men for the searchlight and two for the automobile—a crew of four in all. Taken to a height of 40 feet, most natural obstacles could be cleared, cottages, trees, bushes, etc., while at the same time the observers could remain in a zone of safety. Electric long distance controls enabled the searchlight to be manipulated at the top of its tower with the same degree of accuracy as on the automobile platform. A single motor was made use of on this type of machine, this being a four-cylinder model carried under the driver's feet.

The most commonly employed automobile searchlight is one having a four-cylinder motor for both the dynamo and the propulsion of the car, and a searchlight mounted on a light steel frame with pneumatic tired wheels. This can be used from the top of the automobile or run down steel rails, normally carried under the platform, placed in the desired position, and operated from a distance.

A convoy of American trucks—3-ton Whites—passed through town. They were being used for taking fresh men from the depots in the rear, setting them down within half a mile of the trenches, and taking back the unshaved, mud-stained soldiers who had completed their period at the front line. All this work had to be done at night and without a single light being shown. In an hour men who had been living amid mud and water for a week could be in some town 10 miles away where a bath, good and regular food and clean straw beds could be obtained for all. In 2 hours they could be 20 to 24 miles from the actual scene of fighting, and it was not an uncommon thing for the men to be brought back this distance in order to relieve the somewhat congested villages just to the rear of the firing line. Canvas camps are unknown to the French army. The men are housed in all kinds of buildings, varying according to circumstances from comfortable bedrooms to partially wrecked sheds.

American Trucks Behind Firing Line

Before the American trucks went into service many of them were slightly modified. The yellow canvas tops of some makes were far too visible for work in the military zone. Thus they were painted a dull gray throughout. The



Upper—Wireless telegraphy outfit as carried on a special motor truck for the use of the French army. Lower—One type of large automobile searchlight for military purposes, the Sautter-Harlé extension top over the driver did not always afford sufficient shelter. This has been brought further forward, lower, and has been completed by canvas sides. In many convoys a higher dash has been fitted so as to completely cover in the steering column and wheel. This is easily done by a steel tube frame over which canvas is laced. Most of the trucks now have a partition back of the driver's seat. Without this the driver as well as the soldiers who are being transported are placed in a strong current of air. An airtight partition, with a mica window in its center, placed behind the driver, makes a remarkable difference to a truck both from the standpoint of the driver and his passengers.

Individual Equipment a Feature

A convoy of twenty-two Delahaye trucks came into town. They had been in service for several months, and consequently had lost much of their original smartness, but this was more than compensated for by the practical and ingenious fittings the individual men had worked out for themselves. Just as a touring car coming direct from the maker is very rarely equipped in a way to suit the experienced motorist doing a lot of cross-country work, the average truck designed to work in town or from a fixed depot is lacking in a score of little things necessary to follow an army in the field.

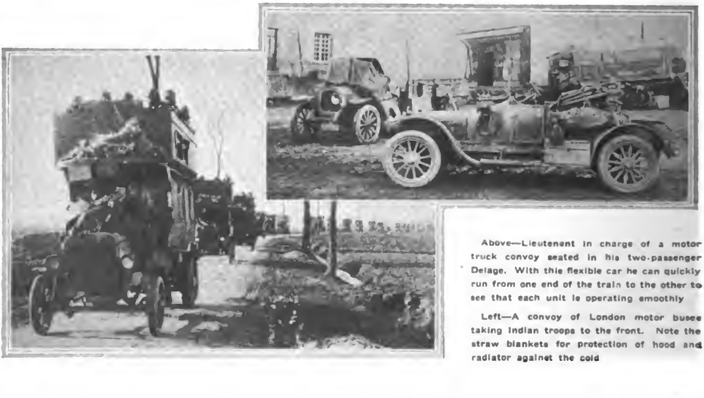
As an example, these Delahayes had gone out with the standard French army type body, which is a platform with movable sides and top and separate top for the driver and his companion. They were told off to carry fodder for horses; this meant a 20-mile trip from a railroad depot to the town where the cavalry were quartered, and a return the same day. The bodies had to be modified for this work. The canvas tops were taken off, although the hoops were left in position, and the wood sides were raised a couple of feet. Here the advantage of a separate hood for the driver made itself felt, for with this latter, whether the truck was used open or closed, the driver always had protection. However, the protection afforded was rarely sufficient for winter work. The men got over this by lowering the tops so that there was but a small amount of head clearance when they were seated. Although the dash on the Delahaye is much higher than the bonnet, it is not sufficient protection. The men got over this by fitting either a canvas or a wood extension. Side doors made out of packing cases or any other available wood were also fitted. The most suitable arrangement would be canvas extension for the dash and canvas side doors mounted on steel tubes, thus rolling away in small space when not required.

No Protection from Cold

Very few trucks afford sufficient space for tools and spares. The regulations stipulate that there must be big capacity lockers placed under the overhanging portion of each side of the body. These, however, were not always fitted, or not in sufficient number and size, and were supplemented by lockers made by the men. A ladder is a very useful equipment for a truck. It is conveniently carried fastened along the side of the body. Protection of the bonnet and radiator against cold is never thought of by the manufacturer, although it is an important consideration in active service. The men in this convoy had overcome the difficulty by the use of straw blankets commonly used by gardeners. One blanket made to the correct size completely covered the bonnet and was held down by a couple of straps or two pieces of rope. A second was shaped to fit over the front of the radiator. These blankets cost little to make, they were obtainable almost anywhere in the country and could be replaced readily. While they were not always required for running, they were convenient as a protection at night. When the frost was particularly severe water was drained out of the radiator, gasoline pipe disconnected and float chamber drained, then a small spirit lamp placed under the bonnet. With the straw covering over everything, a motor treated in this way could be started up easily in the morning. The use of the lamp and straw blankets in many cases made it unnecessary to empty the radiator.

The best way of carrying spare gasoline is in one of the 5-gallon galvanized iron cans used by gasoline refiners. One of these is attached under the rear of the body by two flexible steel bands, with nuts for tightening them. They are readily changeable for a full can, and as there is a plug near the base and in the head, air is conveniently admitted to facilitate drawing off gasoline. One repair shop traveled with the convoy and was capable of keeping the entire fleet in running order. Externally this vehicle did not differ from the others, except that it always had its canvas cover in position. Inside it had a stout workbench, vise, portable forge drills, a good assortment of hand tools, and all the spares likely to be needed.

In charge of the convoy was a lieutenant aboard a 12-horsepower two-seater Delage car. This was an ordinary



Above—Lieutenant in charge of a motor truck convoy seated in his two-passenger Delage. With this flexible car he can quickly run from one end of the train to the other to see that each unit is operating smoothly

Left—A convoy of London motor buses taking Indian troops to the front. Note the straw blankets for protection of hood and radiator against the cold machine except for the equipment: big capacity tool boxes on the running boards, plenty of spare tires, gasoline and oil, a sleeping bag fastened on one side and a coil of rope hung on one of the lamp brackets. The officer was assisted by a motorcyclist, known to his companions as the hyphen, for his duties were to keep in touch with each unit of the convoy, explore the road ahead in case of danger, and report, stand by, and bring in any laggard.

Two Contrasting Truck Crews

There is a general impression, unfortunately too prevalent among army officers without technical knowledge, that any man who has had a few days instruction behind a steering wheel is fit for service on trucks. Thus, in many cases young men who are specially fitted for this class of work are being taken off the trucks to serve in the trenches and their places are taken by older reservists with little or no automobile experience. Skilled mechanics and professional chauffeurs who are serving in the ranks are treated as shirkers if they make application for a transfer to the automobile service. In giving way to the popular impression that automobile driving is a soft job which ought to be reserved for the old men unfit for service with the first line troops, the authorities appear to have made a mistake. We had a remarkable example of it in this convoy and one we met the following day. The Delahayes were in charge of an ex-aviator who knew as much as any officer need know about automobiles. His motorcyclist was a professional road racing cyclist acquainted with every highway in France. The man in charge of the repair truck was a professional tester who had seen service in French and American factories; several of the drivers were chassis testers; there was not a green man among them. As a consequence the men of the convoy were a self-satisfied family; they never missed a journey and nothing short of an enemy's shell would hold a truck back.

Theory Vs. Experience

The contrast was a convoy of twenty-three Aries trucks. The officer in charge had doubtless passed the theoretical examination in brilliant style, but his ordinary business was not connected with automobiles, and he had little practical experience. The next in rank was a sub-officer who handled a Paris taxicab in civil life and who counterbalanced his lack of technical knowledge by his severity towards the men. Most of the professional automobile drivers had been transferred to the active army and their places taken by painters, grocers, and others of small practical experience. The only man capable of taking up a connecting-rod bearing on the road was sore because of a threatened transfer to a line regiment. Although this convoy delivered the goods according to schedule, the number of trucks under repair was always larger than desirable.

Cooks Meals as Trucks Travel

Of the twenty-three trucks in this convoy twenty-two were 3-ton models and one a 5-tonner. This latter carried the same useful load as the others, and in addition took charge of the convoy's spare parts and spare equipment. It was useful, too, in taking charge of a broken-down truck, or pulling a bogged automobile out of the mud. The cook in the party had fitted up the rear of his truck to receive a big stew pan, the stovepipe of which projected through the rear and passed up above the canvas roof. He prepared meat and vegetables while on the road and was able to serve out soup and boiled beef as soon as the convoy had taken up its position on the street or market place selected for the night. In this way he was able to serve hot meals at regular hours irrespective of the movement of his section.

One of the most interesting sights was a convoy of fifteen all-drive tractors attached to an artillery regiment and employed in taking ammunition from the depot to the batteries in the field. These were among the best equipped and the most efficient of the heavy motor brigade. Each tractor hauled two trailers with a couple of men on each for brake service. The personal interest which each man took in his tractor, the pride he had in maintaining it in the best running order and in keeping up to schedule was manifest in conversation with them. They displayed it, too, in adopting names for their vehicles, such titles as "Pourquoi Pas," "Quand Meme," "La France," etc., being painted on the bonnet of each truck. The ease with which these fifteen tractors, representing in all forty-five vehicles, negotiated narrow, winding roads, obeying the signals given to them by whistle, was really remarkable. They possessed the regularity of a train with all the mobility of individual automobiles.

Army automobiles crossing the river Marne on a floating bridge

The Aviation Supply Trucks

The flying corps figured prominently on that route to the front. New motors, landing chassis, spare propellers and other parts were taken out on 3-ton trucks with closed canvas body. On nearly every occasion a truck going to the front took in tow a complete but dismounted aeroplane on a two wheel carriage with a canvas cover on steel hoops. In addition to avoiding packing in a wood case, this method of transport is quicker than the train. A truck can leave the aeroplane factories around Paris in the morning and deliver the machine to the flying brigade 100 miles away the same evening. By train the same journey would average 48 hours.

Automobile Transportation Gains

It is evident that the allies are paying more and more attention to the question of the transportation of troops by automobile. In addition to the many American trucks used almost exclusively for carrying men, London has supplied hundreds of motorbuses for this work, many of the Paris buses are handling troops and new Paris bus chassis have been specially fitted up for this service. For service at the front the all-wood single deck body with which the Paris buses were fitted when in city service is not really necessary. Weight can be reduced by fitting a stake body with canvas hood mounted on steel hoops received in sockets. There is little difference in the comfort of a body of this type and the regulation all-wood type, while the advantages are lower weight and ability to transform the bus into a truck within an hour. Some of the London buses have had their upper deck removed, thus getting rid of a lot of weight. With the upper deck gone the passenger capacity is cut in half, but the vehicles become more useful for general service. The two decker is not an altogether satisfactory proposition near the firing line; it is too visible a mark, and occasionally it is found that the buses cannot pass under railroad bridges.

Eliminating the Gearset Problem

Lower Gears Do Not Operate Most Efficiently Except on Exact Grades for which Each Was Designed

WHAT is it that gives the average driver most trouble in driving? What is it that causes the novice most concern? What is it that keeps many women from learning to drive? What is it that makes most noise in a chassis? Emphatically the gearset.

When the automobile was a new thing it was really essential to understand it thoroughly before one could hope to drive it. Skill of a fairly high order was needed to control the motor, to shift the spark lever to and fro, constantly to adjust a throttle lever and an air lever, while gear shifting had to be done every few minutes, since the motors had no sort of flexibility whatever.

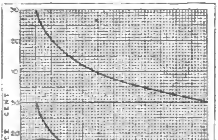
Gradually these things were eliminated and first of all the air lever vanished, or became a thing which needed to be touched only occasionally. Next the magneto made it unnecessary to shift the spark so often: automatic carbureters improved flexibility and the motor needed very little skill to make it work at its best. The difficulty of shifting gears was lessened by reason of motor improvement, and detail alterations in design caused the gears to mesh more easily, while the coming of the direct top speed did away with a deal of noise in the transmission.

Having found that improving the motor satisfied the driver, manufacturers have left the gearset practically alone and have thus encouraged the motorist to demand greater and greater top speed ability. Everyone dislikes dropping into a lower gear because of the trouble of changing the gears and because of the increased noise of the lower ratios. Big motors mean higher gasoline consumption, greater weight, shorter life of tires and greater first cost; it is only on rare occasions that the full power is used when running on level ground and less power on a lower gear ratio would give just as great a speed on grades as is to be obtained from the big motor running slowly on top gear.

The mechanical crudity of the sliding gear appalled engineers in the early days, and this led to the prolonged endeavor to popularize the epicyclic gear, which is still used on the Ford. But this gear is costly to make, except in the two-speed form, and it is complicated to an extreme degree if three or four speeds are demanded, while it is also not perfectly quiet.

Before considering the mechanical alternatives to the sliding gearset it will be well to examine the whole question of gear ratios and to do so properly it is best to come right back to first principles.

With a steam car power is obtained on grades by increasing the amount or the pressure of the steam admitted, and as the speed falls we can keep the power output the same by increasing the average steam pressure throughout the stroke. Thus we can figure on a constant power throughout a wide range of engine speeds and can calculate the car speed on any grade on the basis of constant power. With a gasoline motor we have to take the power curve of the motor as a basis, and this will give us a definite power for definite crankshaft speeds only. Knowing the gear ratios, we can calculate the grades that the car will climb and the speed of climbing for any one gear or, taking the grades required to be climbed on any particular gear, we can figure the necessary ratio.



Figs. 1 to 5 reading from top to bottom. 1 shows diagrammatically the effect on speed of car on rising grade if power available at road wheels was constant. 2 represents power at road wheels obtainable from gasoline motor on one gear which touches ideal curve at 15 miles an hour and 15 per cent grade. 3 shows range of car speeds obtainable with two gears. 4 range with three speeds and 5 with four gears. In last three diagrams the black part shows the periods where the actual performance differs from the ideal performance shown in 1

Effect of Gears on Speed

If the motor were to give constant power whatever the speed of the crankshaft and we take a piece of squared paper to plot the car speed in miles against the grade per cent. we should get a curve of the shape shown in Fig. 1. This curve would vary according to the weight of the car, the resistance of the air at differing speeds, and so on, but with the average car it would be of the characteristic shape shown. Now, with our gasoline motor that cannot give the same power over anything like so wide a range, we must introduce gearing so as to get the needed power by letting the crankshaft speed rise as the car speed falls.

If we had a gear with an infinite number of steps, like friction gearing, we should be able to get exactly the same power for each car speed within the limits set by the diagram, Fig. 1. But having a definite power curve for the motor and definite gear ratios separated fairly wide apart, there will be only one particular grade to which each gear ratio is suited exactly. If we take Fig. 1 and choose a gear ratio that will exactly suit a grade of 15 per cent. we can then determine the speed of the car as the grade increases or decreases while the gear ratio remains unchanged, and we shall find that the curve of actual performance varies from the ideal curve to an increasing extent as we go in either direction away from the point where the two curves touch. It is to be noticed that the curve of real performance lies always to the left of the ideal, which means that, if the gradient eases, the power increases more rapidly than need be—in other words, power is being thrown away and the car is not traveling as fast as it ought for the motor output. If we go the other way, and increase the grade, the motor power falls off and the speed therefore falls off too, faster than it would if the motor output was constant. This means that with a three-speed gearset there are only three definite miles-per-hour road speeds at which the motor is exactly suited to the work it has to do.

Effect of Number of Gears

Figs. 3, 4 and 5 show the same ideal curve of constant power, and the effect of using two, three or four gear ratios: the black parts show the degree of difference between real and ideal. Thus we can see that the four-speed gearset gives a very close approximation to the ideal indeed; so close that if we tried five or six speeds the approximation would be improved only imperceptibly.

In Europe, where drivers have less objection to gear shifting than they have here, four speeds have become the rule, but motorists only accept the task of hand manipulation of the changing lever because they have been offered no substitute. They prefer the four-speed gearset to the three because it gives faster hill climbing and they are prepared to go to the trouble of using the gear lever in order to get the speed. As a consequence of this habitual use of the indirect ratios there is continuous complaint concerning the noise of the gears, and manufacturers are put to great expense in order to get the third speed, which is the most used, as quiet as skilled hand work on the gears can make it.

So far the only alternatives have been the small motor with a gearset that is meant to be used, and the big engine with a gearset intended only for emergency, that is if we except the two or three electric transmissions and hydraulic gears which have been subjects of experiment from time to time. Nothing is likely to be done that really counts until some of the big manufacturers take up the subject and give us a car that will automatically vary the gear to suit the road resistance; what has kept them from it is absence of a public demand. Let it be remembered, however, that there was no outcry for the electric starter till some of the large concerns had offered it, and that the originators of the starter reaped a fairly rich harvest. Imagine what would happen if one of our important firms were to bring out a model that eliminated the gear lever and changed the ratios without conscious separate effort on the driver's part.

Alternative Transmissions

So far the only promising scheme is the electrical transmission or the combined electric and mechanical system, for it is in these only that noise is eliminated from the lower gears, and it is well known that there is great difficulty in obtaining a good efficiency from an electric transmission without adding considerably to the weight of the chassis. It cannot be doubted, however, that this is a matter for research, and any determined effort to put the electrical transmission into form on a large scale practical would be bound to bring about its very great improvement. The diagrams showing how closely four speeds serve to fill the requirements of the case may be useful in drawing attention to the lack of need for a complicated switch gear control to give an almost infinite number of speeds, because it seems reasonable to suppose control would be simplified by using a small number of steps.

Extended Venturi in New Schebler

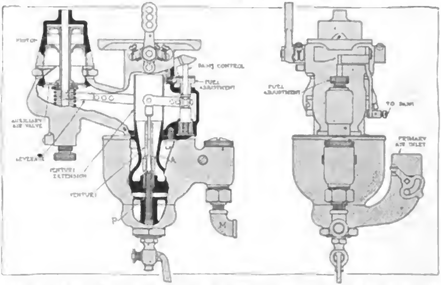
THE model R Schebler carbureter is to be superseded by a new design which, while following all the principles identified with Schebler practice, is none the less considerably different in detail. The new carbureter is shown in the accompanying illustration and it will be noticed that it is inverted, by comparison with the model R; that is to say, the metering pin or needle opens the jet by depression instead of by lifting, and the air valve opens downward instead of upward.

The long end of the leverage is connected to the air valve and the short arm to the needle, so that the latter travels a much less distance than the former. For setting the amount of fuel passed—the size of the jet oriffice—for running with the air valve closed, there is a screw which raises or lowers the fulcrum of the lever and there is also a dash control having the same effect by pushing down the fulcrum against a small spring. The long extension to the venturi, not hitherto a characteristic of Schebler construction, is present in a most pronounced form and the venturi is very narrow round the jet orifices, which are horizontal and shown at A in the drawing. Fuel enters through the union M and the spring P holds the metering pin upwards against the restraining action of the lever.

For setting the air valve there is an easily accessible knurled screw shown in the drawing, and fluttering is restrained by the piston dashpot located in the chamber above the valve. Primary air enters beneath the jet passage, and there is a little throttle in the intake to increase the depression for starting purposes. A feature that should prove useful is the little cock at the bottom of the jet passage, since this would enable the jet to be cleared of dirt without taking apart any portion of the carbureter under ordinary conditions of clogging by small particles.

Judging simply from the design it appears that the new Schebler should be easy to adjust and the greatly narrowed venturi ought to give facile starting; the horizontal arrangement of the jets ought to encourage proper atomization of the fuel and the long venturi should prevent any interference with the functioning of the jets which might otherwise be caused by the opening of the air valve.

The carbureter is adapted for the use of a hot-air flexible tubing to be operated in conjunction with a stove on the exhaust manifold, and it is recommended that such a fitting be applied. The lever which controls by a valve the supply of air through the primary air intake is so arranged that if desired it can be connected with a linkage to the dash.



Section and end view of new Schebler carbureter in which the metering pin is inverted and the fuel jets are horizontal

The Rostrum

Installing a Generator

EDITOR THE AUTOMOBILE:—Would you kindly tell me if a Willard storage battery could be installed in my 1913 Studebaker 25, and also a dynamo? If so, where could they be placed and how much would it cost?

Pembina, N. Dak. JACK CHISHOLM.

—Both a storage battery and a dynamo can be installed on your car. The installation of the storage battery can be made by yourself by simply arranging a cradle for the battery in a convenient position on a car and will cost you nothing beyond the price of a battery. A 60-ampere hour battery will be sufficient for all purposes and even a 40-ampere hour size will be large enough for your lighting system. The installation of the generator and position upon the motor in which it is placed will depend altogether on the make of the generator and the manner in which it is driven. If it is possible to make a simple belt or friction contact off the flywheel installation it will cost about $10.

Wants to Eliminate Piston Slap

Editor THE AUTOMOBILE:—I have a 1913 Model T Ford touring car and have run it about 15,000 miles. The pistons have some side slap which causes them to knock. I had some new rings put in but it did not remedy the difficulty. Do you think that by putting in a patent ring it would help any?

Plainville, Ill. A. D. ANDERSON.

—It is possible that you can buy oversized pistons for the Ford car which would help or as you suggest, some make of patent ring which would provide an extra amount of bearing surface and thus take up the side lash in the piston. The surest method is to have the cylinders rebored and new pistons and rings fitted, but if you do not desire to go to this trouble the slight expense of the piston ring renders it well worth trying.

Mitchell Transmissions Made in Racine

Editor THE AUTOMOBILE:—Please inform me who made the transmissions for the 1912 model Mitchell car.

Bridgeport, Conn. LAUREL GARAGE.

—These were made by the Mitchell Lewis Co., Racine, Wis.

Stevens X a 1911 Model

Editor THE AUTOMOBILE:—1—What year is the Stevens Duryea model X? Is it an early 1911 or a late 1910 model?

2—What is the bore and stroke?

Elmhurst, N. Y. GEO. W. GAY.

—1—The Stevens Duryea model X was put on the market for 1911 and is therefore a 1911 car.

2—The bore is 4.75 inches and the stroke 4.5. This is one of the few cars which has a stroke that is less than the bore.

Wants to Install Magneto Ignition

Editor THE AUTOMOBILE:—Will you kindly explain in the Rostrum a practical method of attaching a Bosch high-tension magneto to a Chalmers model 26 B. Could this be satisfactorily accomplished by leaving the present battery system as it is and installing a new set of spark plugs for the magneto, thus giving double ignition? It would seem in this type of T-head motor that considerable power and higher efficiency would be gained if the above can be accomplished.

Springfield, Mass. W. T. G.

—If you desire to go to the expense entailed it will be possible to put a Bosch magneto on this car. It is simply a question of machine work, as a bracket would have to be made and the magneto driven by bevel gears. The present battery system can be left in place and a new set of spark plugs installed, giving a double system, but it must be remembered that this will not be a two-point system with synchronized sparks.

The bracket is mounted on the side of the crankcase in the form of a shelf and the bevel drive can be taken off the shaft that is now utilized for the battery distributer.

Tight Rings Prevent Carbon Trouble

Editor THE AUTOMOBILE:—I am writing to inquire as to the advisability of installing in my National car, series VI roadster, a patent piston ring. This ring is made by a local concern and is designed to hold compression.

My motor is 4 7-8 by 6 and I have been told that the compression will be so high that it will tend to loosen the bearings. The ring manufacturer claims that it will increase the compression 10 pounds to each cylinder. Will this give me more power on the hills? The car is geared 2 1-2 to 1 and I have difficulty in climbing hills on high gear.

2—Should not this ring do away with carbon trouble?

Albany, N. Y. JAMES B. LYON, JR.

—The use of a patent ring to hold compression is a good idea where the ring is of such a kind that it tightly seals the cylinder without adding an undue amount to the friction. You need have no worry about the compression being made so high as to loosen your bearings, as when the motor was new there is no doubt the rings that you have in the motor did not leak. A piston ring cannot increase compression where there has been no leakage beforehand. It can only hold compression by preventing leakage. If you have no leaks in your present rings, no ring that you could add will increase the compression. The compression is determined by the ratio of the piston displacement to the compression space.

If your present rings are leaky, the addition of rings which do not leak will give you more power on hills. If the car is geared 2.5 to 1 it is natural to expect that very hilly country will trouble you on high gear as this is a small reduction.

2—If you have carbon trouble due to the leakage of lubricating oil past the rings the use of tight rings will prevent this trouble.

Differential Adjustment on Hupmobile

Editor THE AUTOMOBILE:—Kindly advise me if the Hupmobile company ever made a car that has no adjustment for differential pinion and bevel gear.

Philadelphia, Pa. J. B. G.

—All Hupmobiles have been made with an adjustment between the bevel drive pinion and the bevel gear. However, on the Hupmobile 20 this adjustment was accomplished by the use of shims or washers placed behind the differential bearings. Several of these shims were also provided between the housing which carries the drive pinion and the bevel gear housing. On the model 32, and the model K cars, this adjustment is made by threaded differential and drive pinion carriers and of course on these later cars the adjustment is much simpler, since the gears can be lined up properly without removing any part.

Believes in Use of External Treads

Editor THE AUTOMOBILE:—I have recently seen an article in some magazine telling how to keep extra or spare tires soft; or, how to prevent them from becoming hard and brittle from non-use. If a car is equipped with demountable rims, it strikes me that a better way would be to change one wheel weekly, thereby giving each tire four weeks' continual use and 1 week rest. By going around the car the first week, right rear; second week, right front; third week, left front and fourth week, left rear, it would also give each tire a change of position, from right to left, and from driving to steering, thereby equalizing the wear.

The makers of patent treads claim that four sets of treads will give four times the life to the rubber shoes. Their cost is about two-thirds that of rubber shoes. That would seem to make them economical, but I doubt if there is any saving in that way. The extra weight on the periphery of each wheel takes more power. I kept careful tabs on a Ford, and estimate that it took about 20 per cent. more gasoline to drive the car with, than without them.

They are not as resilient as bare shoes. Hob nail leather boots are stiffer than rubber, so that I go more slowly over pavements, or rough places. Abrasions, to say nothing of punctures, are just as apt to occur within one rod of the garage door, as in any other single rod of a 1,000-mile trip. Consequently, it behooves all to critaclly examine their shoes every time the car goes out. It may be running all right, but little stones imbedded in the rubber will fester, like a splinter in the hand, unless removed and salve applied. About the only things that need watching on the patent treads are the springs that hold them in place. When one is found broken, it should be replaced at an early convenience. A puncture or blow-out needs heroic treatment on the spot; but a broken spring on those treads can wait for a leisure hour, though the sooner it is replaced the better. Any material damage would show without microscopical inspection; at the same time it is well to go over them occasionally to make sure that some tack, or nail, has not become imbedded. The treads are not warranted puncture proof. It is merely claimed that they materially reduce the chances.

In nearly 2 years' use, no punctures, no skidding, no tire troubles or anxieties, no extra tires to lug around and care for, are worth a great deal, which cannot be computed in dollars.

Boston, Mass. W. G. R.

To Install Stewart Vacuum System

Editor THE AUTOMOBILE:—I have a Reo 1914 model to which I have been thinking of attaching a Stewart vacuum system.

1—Will it reduce the gas consumption?

2—If so, about what will the increase in mileage be per gallon of gas?

3—If you think advisable, give diagram showing how to install same

Jamestown, Mo. F. A. HEYSSEL.

—1—Since the Reo car 1914 model was equipped with gravity feed, the installation of the vacuum feed will not reduce the gasoline consumption because the final feed to the carbureter on this system as well as that you employ is by gravity.

2—This is answered under question 1.

3—Inasmuch as you are considering vacuum feed it must be that the gravity feed you are employing does not give you good results when ascending fairly steep grades. Under these circumstances the Stewart vacuum tank should be located on the engine side of the dash under the hood as high as possible.

The method of connection of this system is as follows: Three points must be borne in mind on making the tank installation.

A—The top of the Stewart Vacuum tank must be above the level of the gasoline in the main supply reservoir when full, even when the car is descending steep grades.

B—The bottom of the Stewart Vacuum tank must be not less than 3 inches above the carbureter.

C—The tank should not be installed near the exhaust of the motor, nor directly over any wiring or electrical instruments that could be harmed by a possible leakage of gasoline.

Supplied with the Stewart system when you purchase it, there will be the vacuum gasoline tank complete, Fig. 1; a coil of 8 feet of 5-16-inch brass tubing; a Lavigne ball solderless coupling, three Lavigne ball solderless elbows and four straps and screws for holding the tubing in place. The coil of brass tubing is sufficient to cut up into lengths to supply the vacuum connection between the tank and the intake manifold, the connection from the bottom of the tank to the carbureter and the gasoline connection from the top of the vacuum tank to the point where it must be connected with the old pipe from the gasoline storage tank. Beyond this point you can secure detailed directions from the instructions furnished with the vacuum feed system.

Dry Cells on Starting Ignition

Editor THE AUTOMOBILE:—Is it possible to use the storage cells on a 1913 Abbott-Detroit 34-40 for starting ignition purposes ? As it is now, three dry cells in series are used and after the motor is turning under its own power, a magneto is used for ignition.

Lincoln, Neb. C. J. F.

—The Abbott 34-40 is equipped with a storage battery which is used in connection with the cranking motor to turn the engine over. Dry cells are used as means of ignition for starting the car and, although a number of Abbott owners are using the storage battery as a means of ignition with very satisfactory results, this practice is not recommended for the reason that the spark derived from the storage has a tendency to burn out the points on the coil.

Automobile Engine in Motor Boat

Editor THE AUTOMOBILE:—Will an automobile engine give the same service as a marine engine in a motor boat?

2—What difference is there in their construction, if any?

I have been told by some parties that automobile engines would not give satisfaction in motor boat work. Others have told me that the fastest motor boat they ever saw had the engine from a Ford car. I am thinking of using a Ford or Flanders automobile engine in a 30-foot launch. If you can give me advice on the above matter and tell me the speed of crankshaft on a Ford motor when the automobile is making

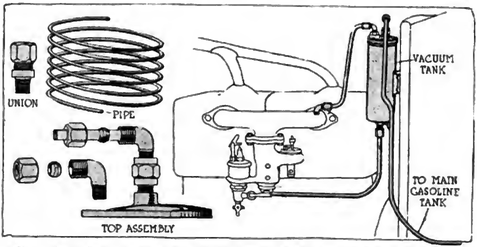


Fig. 1—Left—Parts supplied with Stewart vacuum feed. Right—Assembly of Stewart vacuum feed

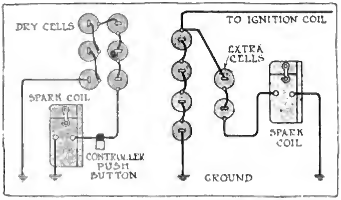


Fig. 2—Wiring diagrams of primary circuits with six and four ignition cells for lighting device for acetylene lamps

about 20 miles per hour, I would greatly appreciate it. Probably some of your subscribers have tried the above and can give me some valuable information.

Walnut Ridge, Ark. W. J. Chamberlain.

—The only motor boat which can properly use an automobile engine is one of a very high-speed type. The light racing boat can use the same engine as is employed in an automobile with good results. The reason for this is altogether a question of propeller design. It would not be correct to use a light, high-speed motor with a propeller designed for this purpose in a heavy-duty boat as the efficiency would be very poor.

2—The difference in the construction is altogether in the expressions, high speed and heavy duty. The light high-speed engine is designed to run at a higher r.p.m. with a great reduction and the heavy duty engine is supposed to run at a low speed with small reduction.

When the Ford car is making 20 miles per hour the rear wheels, being 30 inches in diameter, are turning 224.1 times per minute. With a gear ratio of 3.6 to 1 the motor would be turning over 806 r.p.m.

Loose Set Screw Causes Knock

Editor The Automobile:—I noticed in The Rostrum of The Automobile that one of your subscribers had a knock in the motor. I may say that I had the same trouble and took the motor down three times before I found it. Each time I tightened up the set screws that hold the wristpin but the knock would soon come back. The last time I found that the trouble was not with the wristpin but that the bushing in the upper end of connecting-rod had become loose, allowing about 1-32-inch play every time the motor made a revolution. This amount of play together with the stress put on the connecting-rod at each turn caused the lower bearing to wear and loosen so that each time the knock became so bad that it was unbearable and I was compelled to take the motor down, when I found the set that holds the wristpin screws loose also, while all the time the trouble took its origin in the loose bushing. When I asked several motorists about this knock when I first heard it they all told me to leave it alone. But my lesson from experience is to stop a knock as soon as possible for my nerves' sake if nothing else.

Wachapreague, Pa. A Subscriber.

Horsepower Formulas Give Different Sizes

Editor The Automobile:—Referring to The Automobile for January 21, 1915, in which appears an article showing the horsepower formulas for gasoline engines used in various countries for purposes of taxation, it is noted that the horsepower for the same engine when calculated by the various formulas varies between wide limits. I should very much like to know whether this is due to the fact that these formulas give the horsepower for purposes of taxation only, or whether there is any effort made to indicate the actual horsepower. It does not appear at all possible that cars of foreign make could develop a horsepower so much greater than those of American manufacture.

Washington, D. C. J. B. Rose.

—The mere fact that the actual b.h.p. of motors of the same size varies within such wide limits would be sufficient to indicate that the horsepower formulæ which are calculated to approximate the b.h.p. outputs should themselves vary. As a matter of fact, however, our foreign contemporaries are securing a slightly higher b.h.p. per unit of piston displacement than we are in America. This is due to the use of longer stroke motors running at higher rotative speeds.

Cleaning Slip Covers for Seats

Editor The Automobile:—What is the proper way to clean top slip covers?

2—Is it necessary to remove them?

Newark, N. J. W. F. S.

—To take the dust out, the vacuum cleaner is probably better than any other method, although a vigorous brushing will probably suffice if the vacuum cleaner is not available. To take spots out, the proper solution to use will depend on the nature of the spots as different stains or materials that cause stains are soluble in different liquids. For all ordinary purposes, warm water and castile soap will do the work very well.

2—To do a thorough job, it is better to remove the covers, although for slightly stained goods this will not be necessary.

Explains Theory of Thermo-Syphon

Editor The Automobile:—Regarding the article on The Use of Thermo-Syphon Cooling on page 325 of The Automobile for February 18, your answer is not complete. Primarily the thermo-syphon is used in cooling because in winter time you secure no flow of water until heat from the cylinders has affected the water. Therefore, the maximum speed of water circulation is not obtained until the correct temperature of the cylinder is attained. In summer a radiator is not necessary if you have enough capacity for carrying water. That is why radiators on thermo-syphon cars invariably carry more water than is carried by the cars using a water pump.

The aim of manufacturers to maintain a temperature most suitable to the efficiency of the engine is illustrated in the Cadillac with thermostatic control of water circulation and the Glide, with an abnormally large radiator, giving more cooling surface in summer and a more tardy circulation in winter.

Chicago, Ill. A. Lee Henson.

A. L. A. M. and S. A. E. Formula the Same

Editor The Automobile:—Kindly give me the A. L. A. M formula for horsepower in gas engines. Also the S. A. E. formula.

Philadelphia, Pa. Joseph H. Bromley, Jr.

—The two names you mention are for the same formula. When the A. L. A. M. organization went out of existence the name of the formula was changed by many to Society of Automobile Engineers, or S. A. E. The formula is $\frac{D^2N}{2.5}$ where D is the diameter of the cylinder or bore and N the number of cylinders.

Misses Fire at Low Speeds

Editor The Automobile:—I have a model 19 Buick that will not run slow enough on high. How can this be helped?

2—Will lowering the compression by putting plates under the cylinders help? If so, how thick should they be?

Clay Center, Kan. G. L.

—The probabilities are that the ignition is weak at low speed. Try putting the spark plug points closer together and if this does not work out go over the ignition system thoroughly for possible leaks or losses of current.

2—It is not advisable to lower this compression.

Oversize Tires Often Most Economical

Editor THE AUTOMOBILE:—1—The writer is contemplating buying a six-cylinder car which carries a regular 34 by 4 tire. He has been informed by many that by using oversized tires or a size 35 by 4 1-2, that he would get a great deal easier riding and the life of the tire would be much longer. The difference in the price of a 34 by 4 and a 35 by 4 1-2 is in the neighborhood of 1-3 more. Can you please advise, if consistent, what your views are in regard to this?

2—This car is equipped with cantilever springs. What is your opinion on this type of spring?

St. Louis, Mo. J. S. CARADINE.

—Oversized tires are generally more economical than the ordinary size when the load in the car is greater than the designed load, when the roads are harder on tires and when the speeds are higher than normal. If your car is lightly loaded and you are running at low and medium speeds there will be no advantage in using the oversize as the tires will perish by cutting before they will become worn out.

2—Cantilever springs give a very satisfactory and easy suspension.

Guides Pressed Into Overland Cylinder

Editor THE AUTOMOBILE:—1—Kindly tell me in your magazine the best method to remove the valve stem guides of a model 59 Overland and to replace them with new ones.

2—In the same model, will the camshaft have to be removed to put in new push rod guides?

Lostant, Ill. X. Y. Z.

—In this model the cylinder valve stem guides are pressed into the cylinders under considerable pressure and great difficulty is generally experienced in removing these guards, as they are made of gray iron and are very brittle. Consequently, they are generally broken when they are being driven from the cylinders.

It is very seldom found necessary to install new valve stem guides as the stems of the valves generally wear instead of the guides and consequently any play is taken up when new valves are fitted.

2—In order to install this particular part of the motor on model 59 it is necessary to remove the camshaft as the push rod guides are installed from the inside of the crankshaft.

Liquid Spills from Storage Battery

Editor THE AUTOMOBILE:—I have a model 3 Buick runabout with a Vesta magneto generator and Vesta storage batteries 6-80. The other box rotted so that I had to tear it off; also the tar-like composition covering the three cells. What is this composition and where could I get something new to replace it with as I intend to make a new outer box? Or, would a regular battery box of right size be better to set batteries in, providing the composition was tight around between it and the cells? It seems as though the metal box would not rot away like the wooden one has.

2—Could a starter be put on this car geared to the magneto and pumpshaft, if the starter were a single unit type? If not, what system could be used, and at what expense about could it be installed?

3—Could I use the new tungsten valves in this model?

Phillipburg, N. J. G. H. ZINK.

—The fact that the battery is leaky is sufficient to show that it should be entirely reboxed and a new jar put in. This you should have done by the Vesta Company, the makers of the battery itself. The charge for this is $4.25 but should any of the plates need repairing this will of course be extra. You cannot hope to put a leaky battery into any container, and have that container last, as the acid will destroy anything with which it comes in contact. The most durable substance for resisting its inroads is lead but it would not be worth while for you to go to the expense of securing a lead-lined container when you can have the cause of the trouble removed by having the battery reboxed and a new jar fitted as specified.

2—A single-system of electric starting and lighting can be installed on this car. There are several makes which would be available for the purpose and the expense would, of course, vary with each.

3—You can use the tungsten valves if you desire.

Electric Connections for Gas Lamps

Editor THE AUTOMOBILE:—I saw a diagram a few weeks ago, showing how to wire a car so the gas lamps can be lighted by a jump spark. I have a 1911 Regal car which has a Michigan magneto and a Michigan coil. How can I wire to this coil so that I can get the jump spark by pressing the coil button?

I noted that in your article you stated the regular coil on the car could be used for that purpose.

Springfield, O. GEO. R. BORDEN.

—The method employed in wiring a gas lamp so that it can be ignited by electricity is illustrated in Figs. 2 and 3. The connections shown in Fig. 2 are those used on the primary circuits. In one diagram will be noticed the connection with six dry cells and in the other with two batteries attached to the four cells used in the ignition circuit. The one which fits your case can be used.

Fig. 3 shows the connection of the secondary circuits and these connections will apply regardless of the type coil employed as the wiring diagram shows merely the principles of the connection. The diagrams as furnished are those provided by the Prest-O-Lite company in connection with their electric lighter.

As a general rule it can be remembered that all that it is necessary to do is to borrow a spark from the ignition circuit for use in igniting the gas at the jet of the lamps.

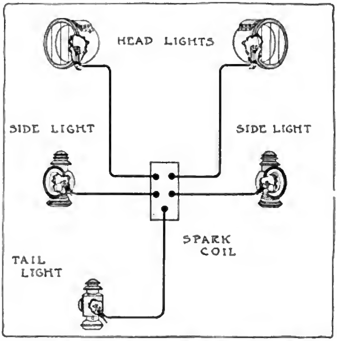


Fig. 3—Wiring diagram of the secondary circuits as used in the Prest-O-Liter device for lighting gas-lamps

Exhaust Heat Cuts Oil Film*

Lubrication Is Least Efficient on Scavenging Stroke—Viscosity of Oil Has Greatest Influence on Friction

By Lieutenant G. S. Bryan
Naval Engineering Experiment Station, Annapolis, Md.

IF an internal-combustion engine, using a certain brand of lubricating oil, runs indefinitely without giving trouble of any kind, we can feel certain of two things; first, that it is a well designed engine, and second, that it is using a good lubricating oil. Otherwise, trouble would occur.

If trouble does occur in an engine, however, we are confronted with several possibilities:

1—The engine and lubrication system may be poorly designed. 2—The oil may be poorly refined. 3—The oil may not be supplied to the cylinders in the right amount. 4—The oil may be of good quality, but may not be suited to that particular engine.

Trouble due to the first case is exceptional. That due to the second case is more frequent, perhaps, but is also exceptional among well known brands of oil. That under the third case depends sometimes on the design of the engine, but more often on the lack of care exercised in maintaining the proper oil level in the crankcase. The remedy for both of these faults is obvious. Trouble encountered under this head may well depend, however, on the fourth case, in that it is necessary to use an oil that is suitable as well as of good quality, or the correct amount will not be supplied the cylinders.

We can assume that most of the engines on the market are correctly designed. From the fact that most of the different varieties of oils on the market work satisfactorily in some engines, we can also safely assume that they are good oils when properly used in the right place. A consideration of the properties of cylinder oils, and an analysis of the conditions under which they lubricate, lead us to the belief that a large majority of the complaints about cylinder oils can be accounted for as due to ignorance regarding the principles governing their use.

Most gasoline motors have their cylinders lubricated by the splash system, the bearings being sometimes lubricated by force feed. In some cases the cylinders are also lubricated by force feed, the oil being injected through small holes in the side of the cylinder that are continually covered by the piston. The general principles governing cylinder lubrication, however, apply to both systems.

Reserve Oil in Crankcase

In the splash system on four-cycle motors the reserve oil is contained in the crankcase and each cylinder is lubricated by the splash of its own crank. A small dipper on the end of the connecting-rod dips into a trough of oil when the crank is at its lowest point, and with the upward stroke of the crank throws the adhering oil violently against the cylinder walls, splashing it in every direction. This oil is then spread evenly on the cylinder walls by the piston as it slides up and down. Every up-stroke of the crank thus gives a new supply of oil, and every up-stroke of the piston smears some of this oil on the upper part of the cylinder where the combustion takes place.

The operation in a four-cycle motor then is as follows:

Suction Stroke.—On the previous up-stroke of the piston oil was spread on the cylinder walls, and this furnishes lubrication as the piston descends on the suction stroke. At the bottom of the stroke the dipper dips into the oil.

Compression Stroke.—The film that has just lubricated the piston on the suction stroke will not be affected by the cool gases entering from the carbureter, and will be left intact to lubricate on the compression stroke. As the piston goes upward it smears a fresh film on the walls. A new supply of oil is also splashed on the lower part of the cylinder by the upward throw of the crank.

Explosion stroke.—The film smeared on the walls on the compression stroke is also sufficient to lubricate the piston on the down stroke. The combustion space on this stroke is exposed to a very high temperature, but the flame only comes into contact with the oil film after the latter has performed its allotted function of lubricating the piston; therefore no difficulty should be encountered. At the bottom of the stroke the dipper again dips into the oil.

Exhaust stroke.—This is the part of the cycle where the most difficulty is encountered with the lubrication. The oil film on the upper part of the cylinder walls has just been exposed to the very high temperature of the ignited gases, and has certainly been damaged to some extent. It still possesses some lubricating value, however, and also the piston itself is now covered with a film which it is about to smear on the walls as it moves upward. The combination of these two factors should be sufficient for the lubrication of this stroke. If trouble is encountered due to faulty lubrication, however, it will show principally on this stroke.

In the two-cycle type conditions are more severe. The oil film is here exposed to the temperature of the explosion every revolution instead of every other revolution as in the four-cycle type. To offset this, however, we have a lower compression and generally slower piston speed. When this is taken into consideration the problem does not appear to be so difficult, and experience has shown that this type can be lubricated efficiently without any particular difficulty.

The three essential requirements of a good motor cylinder oil are: 1—It must lubricate the piston efficiently at the temperatures encountered in the cylinder. 2—It must give a good seal to the piston and rings, keeping them tight and preventing leakage of the oil and condensed gasoline past them. 3—It must burn without forming carbon deposits in the cylinder when an excess of the oil gets into the combustion space.

The first requirement is a general one. If we examine closely into the action of the film of oil we shall see that it is subjected to widely different conditions at different depths. The lubricating value of an oil is due to the fact that when the surfaces of the cylinder and piston are separated by a film of oil the friction of these two metal surfaces is eliminated, and the friction that remains is only that occasioned by the sliding action of the molecules of oil past each other. In other words, it is the same as if two layers of oil are sliding past each other, and the friction that occurs takes place inside the oil film and not on the surface between the film and the metal. In other words we have a dual film—oil working against oil.

---

*A paper published in the Journal of the American Society of Naval Engineers for February, 1915.

Viscosity Measures Friction

The quality of an oil that gives the comparative measure of the friction generated is the viscosity, and this may be defined as its resistance to flow. By oil manufacturers it is generally expressed numerically compared to that of water taken as unity; but as known by the consumer it is only expressed roughly as light, medium, heavy, etc., terms that are more generally understood. The higher the viscosity the less fluid the oil, and the greater the corresponding liquid friction. The viscosity of an oil decreases greatly with an increase of temperature, and at the working temperature in the cylinders even the heavy motor oils have their viscosities reduced to about that of a turbine oil at its working temperature.

Figure 1 will show this graphically. Oils A, B and C represent the heavy, medium and light grades of a well-known brand of Pennsylvania (paraffin base) oil. Oil D represents a heavy[*] oil of asphalt base. It will be noted that the falling off in viscosity with increased temperature is much greater in the case of the heavier grades. Also the viscosities of the Pennsylvania oils are maintained slightly better with increased temperatures.

The deciding factor with regard to viscosity is the condition of the piston and rings. If these are tight, a light oil will give good results. If they are badly worn and loose, a heavy oil becomes necessary. If the oil is too light, too much of it will be drawn past the piston rings on the suction stroke. Likewise on the compression stroke some of the gaseous mixture from the carbureter will leak past the piston rings and condense in the crankcase. As the gasoline which condenses in this way will tend to make the oil still lighter, this effect will be cumulative. Under the conditions of high rubbing speed and small piston-ring pressure that are generally found in motor cylinders, light oils, such as are used in turbines, would probably give the most efficient results if it were not for the high temperatures encountered in the cylinders.

Before discussing the effect of these high temperatures, it will be well to determine just what they are. Recent experiments abroad have shown that the maximum temperature attained in an internal-combustion engine is about 2,700 degrees F. This is the maximum and is obtained only at the top of the explosion stroke. The temperature is successively lowered as the gases expand on the explosion and exhaust strokes, and as the cool carbureter mixture enters the cylinder on the suction stroke. With the compression stroke the temperature begins to rise gradually until ignition takes place and causes it to jump up to 2,700 degrees again at the top of the stroke.

A recording thermometer used in the above investigation showed that the maximum temperature was about 2,700 degrees F., the minimum about 250 degrees F., and the average during a complete cycle about 950 degrees F. These temperatures are those of gases in the cylinders, and are not those of the cylinder walls. There is a great difference between the temperatures of these two.

An elaborate investigation was carried out by the Bureau of Mines in 1912[†] on the transmission of heat in steam boilers, and the successive drops in temperature due to the different media were determined. With the hot moving gases in the boiler at an average temperature of 1,550 degrees F., and the maximum of 2,700 degrees F., and the water in the boiler at 350 degrees F., the following results were obtained:

	Temperature drop, in degrees F.	Percentage of total drop.
Drop in temperature between moving gases and dry surface	1,047	87.3
Drop due to layer of soot on tube	65	5.4
Drop due to thickness of metal	13	1.1
Drop due to layer of scale on water side of tube	65	5.4
Drop between scale and water	10	0.8
Total	1,200	100.0

In an internal-combustion-engine cylinder the conditions are almost identical except that the temperatures are lower, and there is very little scale on the water side of the cylinder. There is no layer of soot if the cylinder is in good condition, but there is a film of oil on the cylinder walls which would have about the same effect. The point which it is desired to emphasize is the great difference in temperature between the moving gases in the cylinder and the cylinder walls, since this has a very important bearing on the lubrication.

Let us assume that the cooling water in the jacket is at a high temperature—say 200 degrees F., just below the boiling point. Using the average temperature found for the moving gases in a complete cycle (950 degrees F.), this gives us a total difference in temperature between these gases and the cooling water of 750 degrees. If we apportion this drop in the same way as for a steam boiler we have:

	Percentage of total drop.	Temperature drop, in degrees F.
Between moving gases and dry surface	87.2	654
Drop due to film of oil, assuming it to be the same as for layer of soot	5.4	40
		694

which would give us the temperature of the inner surface of the cylinder walls as 950 — 694 = 256 degrees F.

Perhaps a more convenient way would be to figure this from the other end, that is, to determine the difference in temperature between the inner surface of the cylindr wall and the circulating water in the jacket. Under the same assumptions as above, this would be 7.4 per cent. of the total drop, which would give a difference of 56 degrees F. If we take the temperature of the circulating water as 150 degrees F., we get a difference of 58 degrees, so we can assume that the temperature of the cylinder walls is about 55 to 60[*] degrees higher than that of the circulating water. As long as the water is not boiling we know that the temperature of the walls is little, if any, higher than 267 degrees F.

In air-cooled motors the temperature would be somewhat

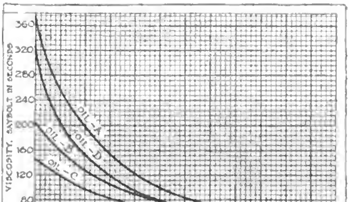


Fig. 1—Oils A, B and C represent the heavy, medium and light grades of a well-known Pennsylvania petroleum base oil. Oil D is a heavy asphalt base production

higher due to the less efficient method of cooling the cylinders. This does not mean that it would become too high, however, as it has been repeatedly demonstrated that properly designed air-cooled motors do not heat up excessively. The lubrication of this type of motors is more difficult at any rate.

---

[*] The viscosities of the light, medium and heavy grades vary with the different brands. Two medium oils, of different brands, for instance, may differ greatly in viscosity.

[†] Bulletin No. 18, of the Bureau of Mines, 1912, "The Transmission of Heat into Steam Boilers.'

[*] Since this was written some actual experiments conducted have given values of only 30 degrees. See "Steam as a By-product of Internal-combustion Engines," by J. B. Merriam, "Practical Engineer," November 15, 1914.

With Diesel engines the maximum temperature is lower than in ordinary gasoline motors. Since ignition is by temperature of compression, the heating effect begins on the compression stroke; and since combustion is at constant pressure, the resulting average temperature in a cycle will be slightly higher. As long as these motors are water cooled, however, the temperature cannot exceed 267 degrees F. without the water boiling.

Difference in Film Temperature

It was mentioned previously that there was a vast difference between the temperature of the hot gases and the cylinder walls. It naturally follows that the inner and outer surfaces of the oil film will be exposed to quite different conditions. The inner surface is exposed to the high temperature of combustion, and without doubt is very greatly damaged thereby. The outer surface is exposed only to the comparatively low temperature of the cylinder walls, and with a film of any appreciable thickness would be protected from the heat due to low conductivity of this film.

We can consider the film as consisting of two layers, the function of one of these being to furnish the lubrication, and of the other being to withstand the destructive action of heat and to protect this lubricating layer. It is well known that an exceedingly thin layer will furnish lubrication, and it is probable that the greater part of the thickness of the film is used up in giving the requisite protective action from the heat. At any rate, the part that we must look to for lubrication is that part having the lowest temperature, which is the very thin layer next to the cylinder walls.

The action of heat on oils is indicated by two properties, the flash point and the fire point. The flash point of an oil is the temperature to which it must be heated in order that the vapors given off will give a slight explosion when a small flame is held immediately over the oil. The fire point is the temperature to which the oil must be heated in order that it will take fire and continue burning when a flame is applied. Roughly, it is about 50 degrees higher than the flash point.

It is important that the flash point shall be higher than the temperature of the inner surface of the cylinder, otherwise the vapor given off by the oil will prevent it from adhering to the walls. We have seen that with the water boiling in the jackets the temperature of the inner surface of the cylinder walls will be about 267 degrees F. The temperature of the layer of oil that is in immediate contact with the cylinder walls, which is the part that regulates the friction, cannot be much higher than this. I do not know of any motor oils that have a flash point lower than 325 degrees F. If the temperature of the cylinder walls gets up as high as this in a water-cooled motor there is something radically wrong, and the remedy is not to get another oil of higher flash point, but to locate the trouble and remove it.

It is an old theory that was never founded on solid facts that a high flash point is a necessity in a motor oil or the oil will burn up without giving any lubrication. The point was overlooked that, when we have a maximum temperature of the gases in the cylinder of 2,700 degrees F. and an average temperature of 950 degrees F., an oil with a flash point of 450 degrees F. will offer but little more resistance to burning than one would of 350 degrees F.

Either oil will burn if kept for any length of time in contact with the hot gas. Lubricating oil does not burn very easily or very fast, however, and the time given for it to burn in a motor cylinder is very short. A thin film of oil smeared on a hot (300 degrees) piece of iron or steel will burn for several seconds if ignited. Few motors ever run at less than 120 revolutions per minute, and at this rate the average point of lubricated surface on the cylinder wall would be exposed to the action of the flame for only one quarter of a second. It is easily seen that there is no danger of all the oil film being burned in that short time, though there is no doubt that some of it is burned, whether the flash point is 300 F. or 500 degrees F. At high speeds the time allowed the oil to burn is so small a fraction of a second that we need not worry at all on this score. It would therefore appear that a flash point of 300 degrees F. would be sufficiently high for almost any water-cooled motor. Air-cooled motors might in some cases require a higher flash point, but 300 degrees F. should be sufficiently high for Diesel engines except in unusual cases.

Silica Found in Carbon

The third requirement brings up the question of carbon in the cylinders. So much misinformation has been published on this subject that it will be well to look into the conditions resulting in its formation. In the first place, what is ordinarily known as carbon in the cylinders nearly always contains something else in greater or less quantity. Rust and small particles of iron are nearly always found. In automobile motors a large percentage of dust (silica) is generally present, and in marine motors and Diesel engines salt is a common constituent. In a case recently investigated at the Naval Engineering Experiment Station of an oil that was considered unsatisfactory on account of the large amount of carbon formed, a chemical analysis of the oil from the crankcase that was supposedly full of carbon gave results about as follows:

	Per Cent.		Per Cent.
Free oil	15	Decomposed oil	2
Water	12	Carbon	1
Rust	11	Foreign matter	1
Salt from sea water	58		

Carbon may exist in a motor oil in two forms: First, as free carbon held in suspension, and, second, in combination with hydrogen forming the numerous hydrocarbon compounds which go to make up the oil. The amount of free carbon in a well-refined oil is very small, and the objectionable carbon deposit is generally due to some other factor.

The conditions attained in the cylinders of internal-combustion engines that result in the formation of carbon are: First, high temperature, and, second, a limited supply of oxygen (air). References have been previously made in this article to the oil "burning." This term has been used rather loosely, as, strictly speaking, "burning" means the combining of the vapors from the oil with the oxygen of the air, and does not include simple vaporization of the oil. Unless air is present in excess of that required for the combustion of the gasoline or fuel oil, and usually it is not, the oil cannot really burn. Under the intense heat, however, the inner surface of the oil film will be vigorously affected, and, in the absence of the air necessary for burning, three things may happen:

Case 1. The compounds may volatilize without decomposition.

Case 2. The compounds may decompose with the formation of free carbon and hydrogen.

Case 3. The compounds may decompose with the formation of other hydrocarbon compounds of a different nature.

The products formed in case 1 give no trouble, as, being gaseous, they are carried out with the exhaust, whether burned or not. Of the products formed under case 2, the hydrogen would pass out of the exhaust, whether burned or not. The carbon may be blown out with the gases, or may remain in the cylinder. Whether or not it remained in the cylinder would depend greatly on the condition of the oil film on the cylinder walls. Some oils form a thick, viscous, gummy, asphalt-like deposit, which retains the carbon formed on its surface and prevents it from being blown out through the exhaust. This gummy deposit gradually gets thicker and harder, eventually forming the hard carbon deposit so well known in cylinders.

This gummy deposit is due to the action of the compounds mentioned in case 3. The free carbon liberated in case 2 is light and fluffy, and of itself would not form the hard deposit. Where the compounds break up into new compounds, however, some of the new compounds are volatile, while others are heavier and more viscous than the original compound. Continued action of the kind mentioned in case 3 will therefore result in the gradual thickening of the film; and the retention and absorption by the film of the carbon that is liberated will increase this effect until, finally, a hard, brittle deposit results.

In the absence of any gummy deposit of this kind to cement the free carbon together, the latter will generally be blown out through the exhaust. The oil that will give the best results, then, is not necessarily the one that will form the least carbon, but the one that will form the least carbon in the cylinders.

Oils made from the Southern-asphalt-base crudes have shown themselves to be much better adapted to motor cylinders, as far as their carbon-forming proclivities are concerned, than are the paraffin-base Pennsylvania oils. The carbon formed from the latter is, as a rule, extremely hard and clings to the metal surfaces, while that from the former is soft and can easily be wiped off any surface that it is deposited on. This would be expected from a consideration of the nature of the hydrocarbons composing the oil, and it has also been demonstrated in practice.

The explanation lies in the fact that the paraffin-base oils are generally composed of the paraffin series of hydrocarbons, while the asphalt-base oils are composed mainly of the ethylene and napthene series. One of the characteristics of the latter two series as compared with the paraffin series is their tendency to distill without decomposition. Consequently no gum will be formed on the cylinder walls, and the carbon liberated will be mostly discharged with the exhaust gases.

Little Difference in Light Oils

In the light grades of motor oils there would probably be very little difference between the two varieties, but in order to get oils with a high viscosity in the paraffin brands it is necessary to compound the light oils with cylinder oil in different proportions. The presence of this cylinder oil is what is responsible for most of the gumming and this explains why the heavy oils give so much more carbon trouble than the light oils. Oils from an asphalt base can be made with viscosities sufficiently high to make it unnecessary to compound them with cylinder stock.

Some oil companies, in their advertising, lay great stress on the color and specific gravity of their oils. The color of an oil has no relation to its lubricating value. About the only information of any value that can be obtained from noting the color is whether or not it is a light oil compounded with a cylinder oil. If such is the case it shows the familiar greenish tinge of the cylinder oil.

The specific gravity is of no practical value to the consumer. The producer uses it to advantage in his refining. It might be used in conjunction with the flash point to determine what particular kind of crude a straight oil is made from, but it would take almost an expert to do this.

It will generally be found the best policy to use a lighter oil in winter than in the summer. There is generally very little difference in the working temperature of the cylinder walls in winter and summer, but the temperature of the crankcase will show very great differences. If the oil is very viscous, due to low temperature, it will not splash very easily and too little oil will be supplied the cylinders. This will be particularly apparent when starting the engine. The cold point, which is the temperature at which the oil freezes, should be sufficiently low to insure that no difficulty will be encountered at the temperatures to which the crankcase will be exposed. Otherwise it is of little value. The asphalt-base oils have a lower cold point than the paraffin oils. The heavy oils are usually the only ones that have cold points that are not sufficiently low.

The amount of oil necessary for the lubrication of motor cylinders depends on so many factors that no data can be given, and it will be necessary to solve the problem for each individual motor. The heavier the oil the less the amount that will be used; also the tighter the piston and rings the less will be used. It is also well to remember that to use more than is necessary for proper lubrication simply aids in the formation of carbon.

Two-cycle motors can be successfully lubricated by mixing the lubricating oil with the gasoline in the gasoline tank. The proportion generally used is about 1 pint of oil to 5 gallons of gasoline. In this method of lubrication the oil must vaporize in the carbureter and be carried with the gasoline vapor into the cylinder, where it will condense on the walls. In choosing an oil for this method of lubrication attention should therefore be paid to the characteristics governing its vaporization.

Gasoline, kerosene, lubricating oil and most all other products obtained from crude oil consist of a large number of different kinds of hydrocarbons, each of which has its own boiling point. When the oil is heated the lighter hydrocarbons will first vaporize, being followed by the others as their boiling point is reached.

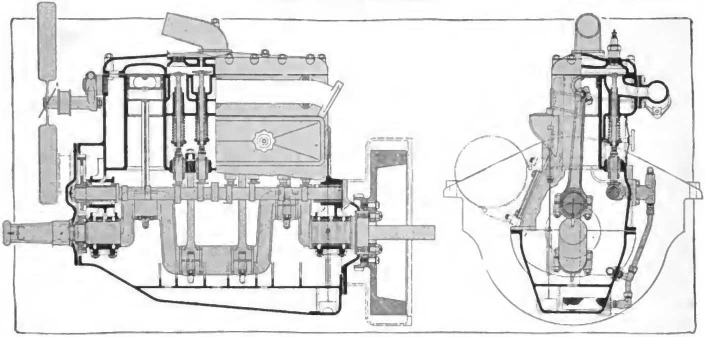
If we take a mixture of gasoline and lubricating oil and heat it so as to cause it to vaporize, the gasoline will be driven off and the oil will remain, unless we select such conditions that the oil will also vaporize without leaving any residue. In the carbureter conditions are made very favorable for vaporization, but it will help appreciably if an oil is selected that has a low flash point and is easily vaporized. The writer has in mind a case that was brought to his attention a few days ago of a motor-boat engine that gave considerable difficulty owing to the oil congealing in the carbureter in cold weather.

The study and application of the foregoing principles to the selection of a motor oil for use in any particular engine should enable anyone to obtain an oil that is suited to that engine. It should also clear up some of the obscurity regarding the reasons why an oil will work well in some engines and will not in others. The writer believes that the formation of carbon in the cylinders of internal-combustion engines is an evil that can be prevented by a little study of its causes.

Oil Changes for Temperature and Wear

THE USE OF OIL of a different grade in summer as compared to the grade used in winter is not now as common as it was a few years ago due to an increased tendency on the part of the car user to merely demand a medium oil from the garage he happens to be passing, dumping that into the crankcase and letting the results take care of themselves. Not a few makers recommend the use of a lighter grade of oil in winter than in summer owing to the fact that the oil has to work at an entirely different temperature due to the increased average temperature of the cooling water.

A tendency which is increasing and which is meritorious is the use of oils with heavier viscosity for worn cylnders. The ability of an oil to maintain the dual oil film—on piston and cylinder is sorely taxed if the viscosity is low and the clearance high. For this reason an engine which in its earlier days of perfect condition was qualified to use a medium or light oil will be better lubricated after wear by a medium or heavy grade.



Longitudinal and transverse sectional views through the new Wisconsin four-cylinder L-head passenger car motor with detachable head

Two Four-Cylinder Wisconsin Motors

New Car Type L-Head Block—Truck, T-Head Pairs

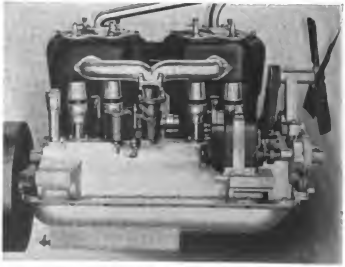
TWO new motors, one a passenger car design with a detachable head and the other a truck motor, have been brought out by the Wisconsin Motor Mfg. Co., Milwaukee, Wis. Both these models are additions to the complete line made by the Wisconsin company but do not differ materially in the methods of construction from the previous designs made by this concern. The passenger car model is known as type Q and has four 3.25 by 5-inch cylinders. The type J truck design has also four cylinders and the dimensions are 5.1 by 5.5.

Referring to the type Q passenger model the four cylinders and upper part of the crankcase are cast in a single block of gray iron. The waterjackets are carried entirely around each cylinder and also, as will be noted from the sectional view, extend well around the valve space, only a small portion of the valve guide surface being unprotected by the waterjacketing. The cylinders are aged after boring to eliminate the internal casting strains before the finish grind is applied. On this model the cylinder head is cast separately in accordance with growing practice, and is held on by large studs. Tightness between the cylinder and head is maintained by a metal gasket. The independent head construction is used by the Wisconsin concern because it is their belief that the cylinder cores can by this method be made more uniform and a percentage of wasted castings greatly reduced. Furthermore, from a user's standpoint the valves, pistons and cylinder heads can be readily cleaned by removing the cylinder head casting.

The lower half of the crankcase is made of a nickel aluminum alloy and is so designed that when removed the crankshaft and connecting-rod bearings are readily accessible.

In piston practice this motor is up-to-date in the use of the multiple ring system. The pistons are made of the same grade of metal as the cylinders and are ground to finish size and fitted with eight narrow steel expansion rings which are ground on both faces and on the outside. In this system of piston rings a careful fit must be made both in the grooves and in the cylinders and this is done by a finish grinding process to extremely small limits. As part of the balance scheme all sets of pistons and connecting-rods intended for the same motor are weighed against one another and balanced when assembled with the connecting-rods.

The piston pins are case-hardened and ground. They are clamped in the ends of the connecting-rods and have their bearings in the piston bosses, this method being chosen because of the greater amount of bearing surface permitted and, according to the Wisconsin company, advantages are also secured in piston pin lubrication. I-beam connecting-rods of .35-.45 per cent. carbon steel drop-forged and heat-treated



Carburater side of the Wisconsin truck motor made in T-head pair cast form transmit the thrust to a 2-inch chrome nickel-steel crankshaft which is also a heat-treated drop-forging and has a tensile strength of 125,000 pounds per square inch. This is a two-bearing design, the lengths of the bearings being liberal to take care of any tendency toward whipping on the part of the shaft. The rear bearing is 3.5 inches long and the front bearing 3.25 inches. The diameters of these bearings are 2 inches. Both the main bearings and the four crankpin bearings are ground to size all being 2 inches in diameter. Running balance of the crankshaft is secured by the use of the Norton running balancing machine.

Cams Tested by Scleroscope

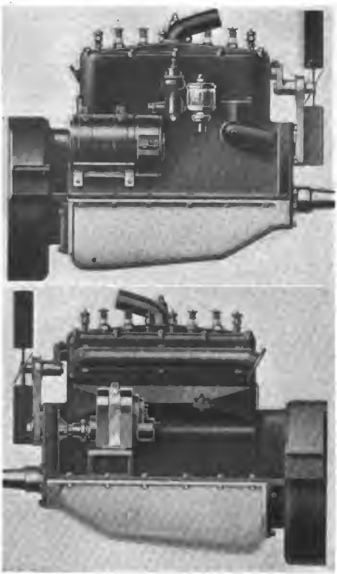
The camshaft is also a drop forging carrying the cams integral on the shaft. The material used for this is a low carbon steel and it is carried in phosphor bronze bearings which contain oil pockets cast directly in the bearing thus taking care of the lubrication of the camshaft. The entire shaft after having been turned to finish size and having the cams rough-machined is carbonized and hardened. It is then finish ground to accurate size on a camshaft grinding machine, the cams then being tested on a scleroscope for hardness. The carbonizing, however, is sufficiently deep as not to be removed by the finish grinding. A feature of this camshaft is the ease with which it may be removed from the motor by taking off the timing gearcase cover and pulling it directly out.

The entire valve mechanism is carried on the left side of the motor, the valves being operated by a single camshaft with the cams bearing directly on flat push rods. The bearing contact between the cam and follower is off center allowing the disk-shaped follower to turn on its axis, spreading the wear over its entire surface. Both intake and exhaust valves are interchangeable, being 1 11-16 inch in diameter and having nickel-steel heads electrically welded to carbon steel stems. The valve stem guides are removable and can be easily replaced in case of wear. They are made softer than the stems so that all the wear will be taken on the cheapest part. The tappet guides are also separate castings and can easily be removed, being held in place by means of a forked forging. By loosening this the complete tappet assembly, including the guide, can be taken out without disturbing other parts. A removable metal plate covers the valves and, being dust-proof, keeps them clean and also renders the action quiet.

Helically-cut timing gears are employed. They are semi-steel against steel and are cut on automatic hobbing machines. The set comprises a crank gear, a cam and a magneto gear. These are all housed in the customary manner at the forward end of the motor.

No intake manifold is used, the carbureter being bolted directly against the side of the cylinder on the opposite side from the valve mechanism. A cored passage leads the gases across the cylinders and allows the gases to become heated by the water which passes around them. The exhaust manifold is located on the opposite side from the intake and is carried some distance out from the motor to insure its freedom from the other parts. The center line of the exhaust manifold is 6.875 inches from the center line of the motor. This does not in any way interfere with its mounting as it falls well within the motor-supporting flanges. The breather pipes are in the valve stem cover plates, allowing the breathing action of the motor to operate through the valve stem housing, thus carrying with it a supply of oil in the form of a vapor which insures the lubrication of the valve stems.

Lubrication is accomplished by a circulating splash system in which the circulating medium is a plunger pump accessibly located on the sides of the motor and driven off the camshaft. This pump takes the oil from the reservoir in the bottom of the crankcase and forces it through a duct to troughs under the connecting-rods. The oil is picked up by the rods and enters the connecting-rod bearings through openings in the lower caps. The rods also throw the oil into pockets over the main bearings and camshaft from which it feeds through drill passages to the bearings. The rods also throw the oil into a pocket in the rear face of the crankshaft gear and in addition oil is fed into this pocket from the front main bearing. From this recess the oil is thrown by centrifugal force through drilled holes directly into the gear teeth. The oil filler is cast integrally with the cylinder and the oil gauge is located on the same side of the motor as the oil filler, that is, on the valve side.


Both sides of the new Wisconsin passenger car motor with detachable cylinder head. Note carbureter mounting

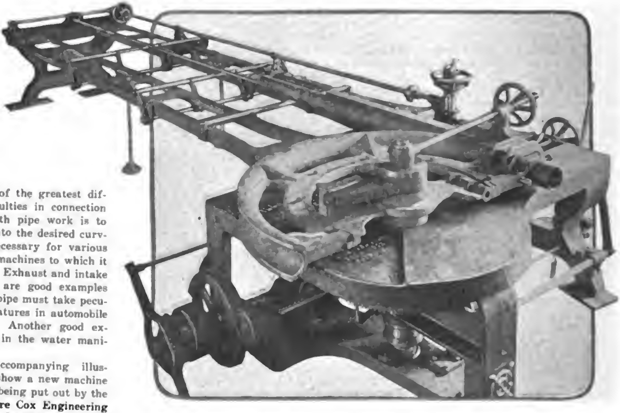
The Truck Motor

In the new truck motor type J the same method of construction is used throughout, although the materials and dimensions differ, naturally, on account of the difference in the type of the motor with its heavy duty construction. In this motor the cylinders are cast in pairs with unit cylinder heads. The pistons are fitted with three rings and are eccentric. The piston pins are of hollow tool steel, ground and hardened and fastened to the connecting-rods by means of bolts, thus providing maximum bearing surface.

The crankshaft is chrome nickel steel and the camshafts, of which there are two, are 40 per cent. carbon steel forgings with the cams integral.

Machine Makes Intricate Pipe Bends

Replaces Men and Inaccurate Methods and Permits of Accuracy in Results—Saves Much Time on Heavy Work



Illustrating the automatic stop, power safety clutch, quick change tool system, etc., which renders this machine a great time saver

ONE of the greatest difficulties in connection with pipe work is to bend it into the desired curvatures necessary for various types of machines to which it is fitted. Exhaust and intake manifold are good examples where a pipe must take peculiar curvatures in automobile practice. Another good example is in the water manifolding.

The accompanying illustrations show a new machine which is being put out by the J. Fillmore Cox Engineering & Tube Bending Co., Bayonne, N. J. This company specializes on the manufacture of pipe-bending machinery and at the present time is putting out twenty-one different types and sizes ranging from a small hand portable bench machine such as an electrician or plumber would use in his daily work to a large motor-driven hydraulic instrument for heavy pipe sizes. The machine herewith described operates on pipe and tube from a 3-inch radius on 1-inch pipe up to a 6-foot radius on 4-inch pipe without any filling.

Bends Tube of Any Size or Shape

The new machine operates on any shaped pipe or tubing, making any shape or style of bend. It handles equally well flats, squares, solids, channel and I-beam sections or angle T and diamond shapes. After being set up the machine can be operated by a boy, and the company claims that where a large amount of pipe work is being handled the machine will do the work of twenty men with little expense. In such work as heavy production in any line or in jobs where a great amount of pipe work is required this machine will be of the greatest value.

A great amount of work is necessary in bending heavy piping and to do this work a reliable source of energy must be secured. In the ordinary installation the Cox company uses a 5.5 horsepower General Electric motor of the variable-speed reversible type. This is used in connection with a drum controller and with this combination the required flexibility of control is secured. In pipe bending the power application is spasmodic and this puts a very difficult load upon the source of energy. One instant the machine will be passing over a section of straight pipe where no work is required for bending and the next instant a quick bend will require a heavy torque.

The old methods in bending pipe, especially in steam installations or on boats, consisted in making templates of the bend necessary and then bending the pipe to fit the template. The pipes would generally be bent hot and after they cooled would be found to be some distance out of shape. With the motor-driven bending machine the pipe is bent cold and the finished job is accurate. Even bent boiler tubes can be reproduced exactly with this instrument.

The finished machine is stated by the manufacturers to be the result of 15 years experimenting and embodies a number of improvements in control. Complete guidance of the machine is had from one position of the operator and in addition the fittings of the instrument include an automatic degree stop, emergency lever, starting lever, safety clutch, clutch control, quick-setting arrangements, reverse stop, quick change of tool system, special duplicating devices and a quick power release.

Some of the particular applications of this machine for automobile work include manifolds, exhaust pipes, fenders, tubular supports, etc. In ship work the steam-heating pipes are a good example.

An idea as to the speed of the machine may be had from the claim that a U bend may be made with threads on both ends on a 4-inch pipe of iron or steel centers 18 inches apart in 1 minute's time. This is a net saving of .5 minute over the previous records made with the belt-driven machine manufactured by the same company. Tests made upon the U bend for accuracy showed that it was correct to within .003 inch. On the same instrument lock-joint steel tubing of 22 gauge has been bent perfect to a 4-inch radius with 2-inch material, and to an 8-inch arc around the curvature of 180 degrees.

With the full attachments as fitted to the machine several different sorts of bend may be made at the same time and when used in connection with the magazine arrangement radial bends are produced automatically, it being only necessary to feed the material in properly cut lengths. Each bend will then be a duplicate of every other.

In the work done on this machine the pipe and tube bending is divided into four general classes. These are conical helices, open and closed coils, radial and die bends. All of these can be produced accurately with the fittings that come with the machine. The bends in the piping shown in the accompanying illustration have all been made cold and without filling. They range from 1 up to 6 inches and consist of various material, and radius from 3 inches up to 3 feet. The time consumed in making these bends is from .5 minute to 2.5 minutes per bend. Some of these bends would ordinarily require the services of from three to four men and then would use considerable gas or fuel of some kind for heating. At the end of 5 or 6 hours the bend would be as close as possible but even at that it could not be perfect under ordinary circumstances. Any shape, style or size bend can be made on machine so it may be put to many general uses and fill many requirements about the factory in a general way besides making the standard parts of cars.

Most of the large bends shown in this photograph are too big for automobile use, but there are a few quite small angles in fairly small pipe to be seen about the middle of the heap. The very wide capacity of the tool makes it typical of a most interesting class of machine that is exercising powerful influence upon the design of all sorts of manufactured articles. Often where castings or forgings would have been employed a year or two ago, we now find tubular or sheet metal parts prepared with much less wastage of material by bending, pressing or spinning machines. In almost every case the new part is better than the old as well as being cheaper to make and considerably lighter in weight

Atwater Kent Igniter Is Interchangeable with Magneto

THERE are many occasions when it is convenient to replace an old magneto by a new timer for working in conjunction with a battery system, and there are many more when it is a great convenience to a manufacturer to be able to fit either kind of ignition without the smallest of changes to the motor.

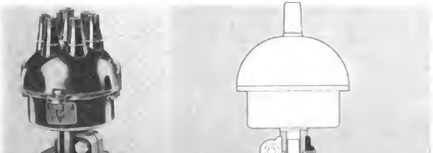
With this idea in mind the Atwater Kent Unisparker is now being made by the Atwater Kent Mfg. Works, Philadelphia, Pa., with a standard magneto base and a horizontal shaft drive which is so proportioned that it can be coupled easily to the magneto driving spindle or shaft. The new fitting is illustrated below, the sectional view showing the bevel driving gears and the construction of the base, while the photographic reproduction gives an idea of the general appearance of the complete unit.

Both a plain pattern of Unisparker and another design with automatic ignition point control are made, but the details of the governing mechanism are in no way different from the ordinary Atwater Kent outfit. The makers inform us that the type with automatic advance and retard weighs 7 1-2 pounds complete, and the other kind with hand advance 5 1-2 pounds; so the apparatus is light enough in either case.

Of course, the coil is a separate unit and has to be mounted separately, the customary place being on or adjacent to the cowl board. All the attachments are simple, however, and no special electrical skill would be necessary to re-equip an old car with the new outfit which, incidentally, is not expensive to buy and easy to install.

In connection with this new style of igniter the usual Atwater Kent features are retained, that is to say the contact maker is the well tried design with single tungsten contact points, while the switch and coil designs are unchanged also. Where cowl board space is limited there is a special pattern of coil provided for mounting beneath the hood.

Of course the demand made upon the battery by adding ignition to its regular duties of lighting and starting is too small to be worthy of the slightest consideration, and even when the battery is partially discharged so that it has not power enough left for heavier work it will continue to operate the ignition without missing fire, even under unfavorable conditions.



Right—Part section through new Atwater Kent igniter. Left—Exterior view

The AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, March 25, 1915 No. 12

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico -One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - -One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

1,754,570 Cars and Trucks

IF the solons of the stock exchange, who recently advocated an investigation into the reason for the phenomenal strength and steady gain in value of automobile and allied securities, had glanced over the registration statistics for 1914 they would have found their answer. A gain of over half a million cars and trucks in 1 year, or 41.7 per cent., means a largely increased output as compared with previous records, production having gained 14.4 per cent. The industrial reports from various sections of the country published in THE AUTOMOBILE during the past 2 months have indicated that in spite of all the hard-time talk people have been buying cars in steadily growing numbers. Our car census is rapidly nearing the 2,000,000 mark, having gained 1,077,570 registrations in 4 years, production having jumped in that time from 209,957 to 515,000. These statistics answer conclusively any question as to why automobile stocks have featured the market during the past few months.

Prosperity Amidst Adversity

THE curves showing the healthy state of the automobile stock market, which appear on page 557, are really far more remarkable than they appear at first glance, because the prosperity they indicate in almost every case has little or nothing to do with warfare. Perhaps the rubber concerns have been steadied by the demands of the armies, but the big passenger car productions are in spite of the war and not by any means because of it. We know that all over the world people are cutting down personal expenses, and that in such a cutting it is the luxuries and pleasures that make the first splash overboard. Just a few years ago this war would have crippled the automobile trade horribly, but now it is demonstrated beyond all doubt that the car is not in the class of personal belonging that can be called luxurious. If it has not become an absolute necessity—and of course it is not this in the majority of cases—it has become one of the things that the man who can afford it is not going to try to do without; rather, one may suspect, he would cut other pleasures and do positively more motoring. To those who helped the automobile through its early days of stress and trouble the present position is extremely gratifying because the new industry for the establishment of which the pioneers labored has now shown its power to keep employed the millions who now depend upon it for their living despite a trade depression in some quarters unparalleled in the history of the world.

Driving a High-Speed Motor

WITH a high speed engine the peak of the power curve is well above 2,000 revolutions and often runs up to nearly 3,000, especially on small motors, so, for equivalent climbing power, the smaller motor must be allowed to revolve more rapidly. Partially this is accomplished by dropping the top speed gear ratio a little so that the peak of power on the direct gear is reached at the same road speed as it used to be with the low speed motor and higher gear ratio, but this does not mean that the new car is thus put upon all fours with the old.

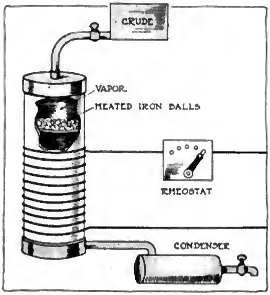
If we let the car slow down from the speed at which the gearing makes the high speed motor the exact equivalent of the low speed, we shall find that the power falls off more rapidly with the smaller engine, because the curve of horsepower flattens out towards the top and, in coming *down* the curve the steeply descending part is sooner reached with the low geared, high speed motor than with the old arrangement. Thus instead of opening up on a hill only after the car speed has dropped greatly, and then letting the motor plug, we ought to keep the speed up at the commencement of the grade. If this is not possible then instead of plugging on top speed it is quicker to drop into second, accelerate till the motor speed is almost at its maximum and then slip back into top quickly. This action will enable many a hill to be climbed on top which, by sticking to each gear till power petered out, would have called for second for the major portion of the ascent, or even for low gear. The high speed motor is intended to have its speed capacity used and this fact should not be overlooked.

In principle it is merely a repetition of the old law of storing up energy by the use of the momentum of rapidly revolving parts and when this energy is placed at our disposal it is a waste not to use it.

Rittman Vaporizes Petroleum in Still

Little Heat Applied to Liquid Itself in Container--Process Perfected Only on Laboratory Scale, But Commercial Requirements Have Been Provided for—To Prevent Monopoly

WASHINGTON, D. C., March 20—A detailed description of his process whereby the product of gasoline from petroleum can be tripled has been given by Dr. Walter F. Rittman, of the federal bureau of mines. "The process has been perfected on a laboratory scale; it has not as yet received the test of operation on a commercial scale," said Dr. Rittman. "But the results have been as carefully checked and every step, every phase of the process has been subject of such minute scrutiny that, even before a single foundation stone has been laid for the first plant that will make use of the new process, it is scientifically safe to say that the process of producing gasoline from petroleum has been revolutionized in at least many particulars.



Diagrammatic illustration of the Rittman process

"In every type of distilling apparatus in use at the present time the same ancient fundamental principles are followed. The body of the still is some form of vessel for containing the liquid to be distilled. Some kind of tube leads from the upper part of the still to the condensing apparatus and heat is applied to the liquid from beneath. In this manner the temperature of the liquid is raised to a point where it becomes partly vaporized, the vapor passing out of the tube, or 'worm' to the condenser. In other words, the liquid itself is distilled. This means that temperature limitations have to be observed or an explosion is likely to occur. Furthermore, the temperature limitations render it impossible, under present methods, to recover all the valuable products.

"In the new process no heat is applied to the liquid itself in the container. The liquid to be distilled, speaking particularly of petroleum, is contained in a feed tank from which it is fed into the still. There it is vaporized and the vapor, not the liquid, is then distilled.

"The new form of still is, generally speaking, cylindrical in shape. An inlet tube leads into the still from the container holding the liquid. This tube is equipped with a cock by means of which the flow of the liquid, petroleum, is regulated. In the upper part of the still is placed a number of small iron balls, which are heated to a temperature sufficiently high to vaporize the oil as it flows over them from the inlet tube. The vapor thus formed is forced down into the lower portion of the still by the continual formation of more vapor above.

Electricity for Heat

"A series of wires conveying a powerful electric current wound about the lower portion of the cylindrical still, with resistance coils, furnishes the heat for distilling this vapor. The heat can be regulated to any desired temperature. The fact that the expansion of vapor under heat is a definitely known equation, whereas nobody ever knows what a mixture of vapor and liquid is going to do, illustrates the value of the safety factor of the new process. The vaporized oil, distilled at the proper temperature, passes into the condensing apparatus—and that is all there is to the new process.

"But when it comes to discussing the possibilities of this new process, that is another thing. By its use we can utilize material that is absolutely wasted under the old process of distillation. We can obtain a larger volume, therefore, of gasoline from a given quantity of oil and we can do it in a third of the time required by the old process and without any of the danger attending the operation of old-fashioned stills through the possibilities of conflagration.

To Prevent Monopoly

Patents covering every phase of the new process have been applied for and these patents, which will absolutely prevent monopolization of the process or any part of it by private interests, are to be vested in the government for the benefit of the whole people of the United States. Companies which desire to avail themselves of the new process may do so only on license from the government or under government supervision. Every safeguard is to surround the granting of such license, so that the development of a monopoly will be impossible.

Already scores of refining companies and individuals have asked upon what terms the government will permit them to build and operate refining plants under the patents covering the new process. As yet no plan has been perfected but it is expected before the middle of the coming summer not one but a dozen or more big refineries will be in process of construction. It may be that one or more such plants will be in actual operation before half the summer has passed.

To Discuss Standard Truck Service Policy

NEW YORK CITY, March 22—At the motor truck convention to be held May 5 and 6 at Detroit by the National Automobile Chamber of Commerce, there will be a paper on, Can Manufacturers Have a Standard Service Policy?, by Alvan Macauley, vice-president and general manager of the Packard Motor Car Co., Detroit, Mich., and also a member of the Commercial Vehicle Committee of the N. A. C. C. This paper will treat of the co-operation of the manufacturer and dealer with the truck user to insure the most satisfactory and economical operation of the vehicles. It is planned to present for discussion a form embodying the provisions of a service policy that has been in successful use by the Packard company during the past year and to have the convention recommend the form, with such modifications as may be agreed upon, for adoption as a standard.

A dozen or fifteen other papers on questions to which the manufacturers of commercial vehicles have been seeking solutions for the last year or two are provided for on the program the Commercial Vehicle Committee is preparing.

Chevrolet Buys 2nd Tarrytown Plant

Will Be Used for Manufacture of $490 Car—Last of Four Maxwell Factories in East To Be Sold

NEW YORK CITY, March 22—The Beekman avenue plant in Tarrytown, N. Y., formerly occupied and owned by the Maxwell-Briscoe Motor Co., has been sold to the Chevrolet Motor Co., of New York City. The plant comprises about 20 acres and the buildings contain about 150,000 square feet of floor space. The property, which was held at $250,000, will be used for the manufacture of the $490 car and will, beginning June 1, produce about 5,000 of this model a month. The company expects to turn out 14,000 of the larger models a month at its three plants in New York City, Tarrytown and Flint, Mich.

The Beekman avenue property was one of the large plants included in the properties of the U. S. Motor Co., which, when liquidated, turned back its holdings into the original companies, so that the Maxwell-Briscoe Motor Co., one of the concerns in the U. S. Motor Co., received this property. This company then offered this plant for sale, together with three other plants here in the East, including one at Providence, R. I., one at Hartford, Conn., and one at Tarrytown.

The sale of the last Tarrytown plant winds up the sale of all the plants of the Maxwell company in the East.

Yale & Towne's 1914 Earnings $663,898

NEW YORK CITY, March 20—The Yale & Towne Mfg. Co., this city, reports net earnings for 1914 of $663,898 as against $713,109 in 1913. After deducting payments on interest and depreciation, amounting to $212,050, the net profits amounted $451,848 as against $522,689 in 1913. The surplus amounted to $136,850 compared with $252,504 in 1913. The company paid out $314,998 in dividends in 1914 as against $270,105 in 1913.

The balance sheet shows cash and receivables of $1,405,786 against $1,368,573 last year, and a profit and loss surplus of $4,436,786 compared with $5,981,110 for the previous year.

The report says that the decrease in volume of business in 1914 was almost wholly due to the influence of the European war on the company's export business.

The company has declared the usual quarterly dividend of 1 3-4 per cent., payable April 1, the books closing March 25 and reopening April 1.

Electric Storage Battery Earns $848,628

PHILADELPHIA, PA., March 18—The Electric Storage Battery Co., this city, earned $848,628 in 1914, as against $1,035,917 in 1913. Gross sales amounted to $1,395,793 as against $1,558,123 in 1913. The total net income was $1,103,237 compared with $1,208,755 in 1913. The total surplus amounted to $3,690,069 as against $3,312,522 in 1913.

LANSING, MICH., March 19—The Reo Motor Car Co., this city, has declared the regular quarterly dividend of 2 1-2 per cent. on the common stock.

DETROIT, MICH., March 22—Since the announcement of the new models, February 1, the Packard Motor Car Co., this city, has received orders for over $1,250,000 in trucks.

NEW YORK CITY, March 18—At a meeting of the directors of the United States Rubber Co., held today, the following officers were elected for the ensuing year: President, S. P. Colt; vice-presidents, J. B. Ford and Lester Leland; vice-president in charge of development work, R. B. Price: vice-president in charge of tire and mechanical department, E. S. Williams; secretary, Samuel Norris; treasurer, W. G. Parsons; assistant treasurer, E. J. Hathorne, and assistant secretary, J. D. Carberry. The executive committee was reelected.

Market Reports for the Week

NEW YORK CITY, March 24—Market prices this week were generally steady with few changes. The scarcity of tin and Great Britain's embargo had a lot to do with the unsettled condition of the local tin market. The embargo caused a flurry resulting chiefly in causing dealers to keep their hands off the product until there are further developments. Tin experienced a sudden drop on Tuesday to $51 a ton, after having risen to $53.50 on Saturday. A further cut of 5 cents was made by Pennsylvania petroleum this week. This reduction to $1.40 a barrel has been anticipated for some time. In some quarters it is regarded as the first of other reductions to follow. Overproduction in the western fields and the disturbed condition of the export trade are the most depressing features. The rubber market this week was quiet with no new developments. A large quantity of plantation rubber from London was reported yesterday, but this had no effect upon the situation. Fine Up-River Para went up to 59 cents and stayed at that price until Tuesday, when it dropped to last week's price, 58 cents.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Changes
Antimony	.21	.21½	.21½	.21½	.21½	.21½	+.00½
Beams & Channels, 100 lbs.	1.26	1.26	1.26	1.26	1.26	1.26	......
Bessemer Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	......
Copper, Elec., lb.	.14⅞	.14⅞	.14⅞	.14⅞	.14¾	.14⅝	—.00¼
Copper, Lake, lb.	.15	.15	.15	.15	.14⅞	.14⅞	—.00⅛
Cottonseed Oil, bbl	6.65	6.70	6.60	6.55	6.55	6.60	—.05
Cyanide Potash, lb	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	.92	......
Lead, 100 lbs.	4.10	4.10	4.10	4.10	4.10	4.10	......
Linseed Oil	.62	.62	.62	.62	.62	.62	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans. crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa. crude	1.45	1.45	1.45	1.45	1.40	1.40	—.05
Rapeseed Oil, refined	.75	.75	.75	.75	.75	.75	......
Rubber, Fine Up-River, Para	.59	.59	.59	.59	.59	.58	—.01
Silk, raw, Ital.	..	3.90	..	..	3.90	3.90	......
Silk, raw, Japan	..	3.50	..	..	3.50	3.50	......
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	53.00	53.00	53.00	53.50	53.00	51.00	—2.00
Tire Scrap	.05	.05	.05	.05	.05	.05	......

N. A. C. C. Protests Tire Freight Increase

NEW YORK CITY, March 19—Efforts of the railroads to increase the rating on pneumatic tires in carloads from third class to second class is meeting with protest on behalf of the automobile manufacturers through the National Automobile Chamber of Commerce.

Following the horizontal increase of 5 per cent. in the rates applicable to these shipments, it is felt that any additional increase would be unfair, especially in view of the decreased value of tires as compared with the conditions when the third class rating was fixed. The increase from third class to second class would mean a substantial increase in the charges for carrying tires.

NEW YORK CITY, March 22—At the regular meeting of the Rubber Control Committee of the Rubber Club of America on March 18, it was reported that since the raising of the English embargo on the shipments of plantation rubber from London to this city and up to March 6, the receipts here amounted to 5,300 tons.

Akron Co. Takes on Tire Manufacture

AKRON, O., March 19—The American Tire & Rubber Co., this city, has started the active manufacture of automobile tires. The company is at present manufacturing only small-sized tires, but expects, however, to get into the larger sizes before the close of the season, and anticipates manufacturing a tire with a 4,000-mile guarantee.

The capacity of the company's plant will allow the manufacturing of from 100 to 500 tires daily, as well as from 500 to 1,000 inner tubes. The company is capitalized at $250,000 in common stock, having reduced the same from $500,000.

Champion Inaugurates Profit-Sharing Plan

TOLEDO, O., March 19—Marking the first appearance of the profit-sharing idea in fields other than those occupied by the automobile manufacturer, the Champion Spark Plug Co., Toledo, O., has put in operation a plan by which it will build up closer co-operation between itself and its dealers and at the same time materially stimulate the demand for Champion spark plugs. Under this plan, all the dealers will receive by check from the Toledo company an amount in proportion to the number of plugs they purchase through their jobbers. Cards are now being sent to all dealers upon which is to be entered the number of plugs the dealer will sell during the year. Upon receipt of the card properly filled out and accompanied by the jobber's invoice from whom the plugs were purchased, the Champion company will mail the dealer direct a check representing his pro rata share of the extra profits.

It is pointed out that a dealer need not handle Champion plugs exclusively to be eligible under the profit-sharing plan, though he must take the number of plugs he enters on his card. These may include any of the standard Champion products such as the types for Ford and Buick, types O or X, Heavy Stone, Priming Plug and Motorcycle. That there is little danger of the dealer overstocking is made plain by the fact that any plug found unsalable during the year of its purchase may be exchanged for another type.

The Champion company is now producing an average of 26,000 plugs a working day, and it is expected that this profit-sharing plan will increase the output to 40,000 or more per day.

CHICAGO, ILL., March 24—The Standard Oil Co. of Indiana has reduced the price of gasoline to 9 1-2 cents. The price in 1 year has been cut 5 1-2 cents, the present price giving only 1 1-2 cents gross profit.

Automobile Securities Quotations

NEW YORK CITY, March 24—Automobile securities continue to climb, so far, in fact, that they have caused an investigation to be made by the Police Committee of the New York Stock Exchange. Nothing startling developed out of this inquiry, the only reason for the strength of the stocks being that the automobile business at present is in a high state of prosperity.

The largest gain of the week was made by Ajax-Grieb common which rose 35 points; Willys-Overland common showed a gain this week of 9 points, this stock having risen since March 2 from 95 to 118, a gain of 23 points; General Motors continued to gain, both the common and preferred rising 3 points, the common making a new high mark during the week of 107; U. S. Rubber stocks were active last week, the common rising 3 1-2 points and the preferred, 1; and Stewart-Warner common, which has shown much strength lately, rose 3 points. Goodrich common rose 3 points for the week and 6 1-2 points since March 2. Maxwell Motor issues quieted down on Friday and Saturday then quickly rose, the common showing a gain of 2 1-4 points, and the first preferred, 1 point.

Firestone common, which is quoted higher than any other stock on the local exchange, experienced its first drop since January 14, that of 4 points. This stock has risen from 380 on March 2 to 396. The preferred, which is very steady, rose 2 points.

Quotations from the Detroit Stock Exchange show gains on the General Motors common and preferred of 7 and 3 points, respectively. Maxwell Motor stocks showed fractional gains.

	1914		1915		Net
	Bid	Asked	Bid	Askad	Ch'ges
Ajax-Grieb Rubber Co. com	200	..	285	..	+35
Ajax-Grieb Rubber Co. pfd	98	102	100	..	..
Aluminum Castings Co. pfd	98	100	96	100	+2
J. I. Case pfd	..	..	78	82	+3
Chalmers Motor Co. com	..	83	..	81	..
Chalmers Motor Co. pfd	..	94	91½	93	..
Electric Storage Battery Co	..	..	49	50	+ ½
Firestone Tire & Rubber Co. com	285	292	396	402	—4
Firestone Tire & Rubber Co. pfd	108	109	110	112	+2
General Motors Co. com	75½	75¾	100	107	+3
General Motors Co. pfd	92½	93	99	99½	+3
B. F. Goodrich Co. com	23	23¾	37	38	+3
B. F. Goodrich Co. pfd	86	88¼	98	101	— ½
Goodyear Tire & Rubber Co. com	175	180	190	193	—2
Goodyear Tire & Rubber Co. pfd	94	95	104½	105½	..
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	1½	..	..
International Motor Co. pfd	..	15	8	..	..
Kelly-Springfield Tire Co. com	56	60	111½	112½	— ½
Kelly-Springfield Tire Co. 1st pfd	143	145	81	85	— ½
Kelly-Springfield Tire Co. 2nd pfd	..	..	118	125	..
Maxwell Motor Co. com	8	8¼	32¾	33½	+2¼
Maxwell Motor Co. 1st pfd	32½	34	75	76½	+1
Maxwell Motor Co. 2nd pfd	12	12½	30	31	— ½
Miller Rubber Co. com	..	..	165	170	..
Miller Rubber Co. pfd	..	..	101	103	..
New Departure Mfg. Co. com	106	108	128	130	+3
New Departure Mfg. Co. pfd	120	125	105	108	— ½
Packard Motor Car Co. com	101	116	80	90	..
Packard Motor Car Co. pfd	95	98	93¾	97½	— ¼
Peerless Motor Car Co. com	20	30	20	21	..
Peerless Motor Car Co. pfd	..	80	..	55	..
Portage Rubber Co. com	..	30	34	36	..
Portage Rubber Co. pfd	..	85	85	95	..
*Reo Motor Truck Co	7	8½	11½	12½	..
*Reo Motor Car Co	18¾	19¼	28½	29	— ¼
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	58½	60½	56	58	—1
Stewart-Warner Speed. Corp. pfd	99	102	101½	104	..
Studebaker Corporation com	28½	29¼	48	49½	+1
Studebaker Corporation pfd	83	85	94	95	..
Swinehart Tire & Rubber Co	60	67	74½	76	..
Texas Co	..	..	132	133	+ ½
U. S. Rubber Co. com	62	62½	58½	59½	+3½
U. S. Rubber Co. pfd	104	104¼	103	104	+1
Vacuum Oil Co	251	254	180	181	..
White Co. pfd	107	110	103	108	..
Willys-Overland Co. com	63	66	118	120	+9
Willys-Overland Co. pfd	89	94	99	101	..

---

*Par value $10; all others $100 par value.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Chalmers Motor Co. com	..	83	..	81	—1
Chalmers Motor Co. pfd	..	94	90½	92½	—½
General Motors Co. com	74	76	105½	107½	+7
General Motors Co. pfd	92	93	99	100	+3
Maxwell Motor Co. com	8	8¼	32	33¼	+ ¼
Maxwell Motor Co. 1st pfd	32	35	74½	76	+ ½
Maxwell Motor Co. 2nd pfd	12	13	30½	32½	..
Packard Motor Car Co. com	101	116	80	90	—7½
Packard Motor Car Co. pfd	94	98	93¾	97½	..
*Reo Motor Car Co	18½	20	..	28¼	— ¼
*Reo Motor Truck Co	7½	8¼	11½	12⅛	..
Studebaker Corp. com	..	..	47	48½	— ½
Studebaker Corp. pfd	..	..	92	94½	—1½
Continental Motor Co. com	..	165	..	185	..
Continental Motor Co. pfd	..	75	..	85	..
INACTIVE STOCKS					
*Atlas Drop Forge Co	..	21	..	25	..
Ford Motor Co. of Canada	540	560	525	..	..
Kelsey Wheel Co	191	195	190	200	—5
*W. K. Prudden Co	..	21	19	20½	..
Regal Motor Car Co. pfd	..	50	..	25	..
BONDS					
General Motors Notes 6s, 1915	100¼	101¼	104⅛	..	..
Packard Motor Car Co. 5s, 1916	..	98	95	..	..

---

*Par value $10; all others $100.

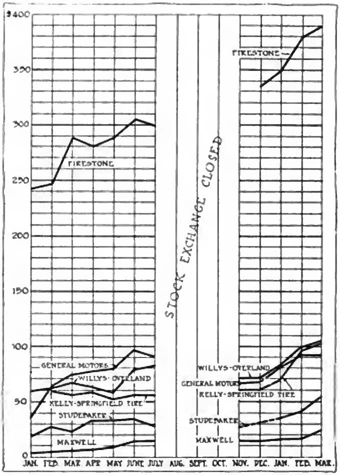


Diagram showing relative fluctuations of several of the most active automobile common stocks since January, 1914

New Transmission to Cheapen Electric

Dr. Steinmetz States Invention Will Hasten Advent of $750 Car He Predicted Last Fall

NEW YORK CITY, March 24—A little less than a year ago Dr. Charles P. Steinmetz, are of the foremost electric engineers in this country, speaking at the national electric convention, predicted the coming of 1,000,00 cheap electric cars to take care of the bulk of motoring in cities. He said that in his opinion this large number of electric cars would be in existence in less than 10 years, and that both the users and the central station interests would benefit mutually.

It seems that matters are not being left alone by Dr. Steinmetz to develop by themselves, but that he will take an active part in the production of the vehicles necessary to fulfill his prophecy since he now announces the existence of a simplified power plant which is being perfected under his direction, and which he expects will play an important part in the difficult task of cutting down the cost of making an electric passenger car.

Both Fields and Armature Revolve

Briefly, the new device consists of an axle design incorporating the motor, and with a minimum of gearing; this leaving merely the controller and battery to be mounted on the car itself. It is realized that one of the manufacturing difficulties which have faced electric car makers is the big gear reduction necessary between the fast running motor and the road wheels. In the new apparatus this is cut in two by the simple notion of allowing both parts of the motor to revolve, the armature in one direction and the field magnets in the opposite. This gives a shaft speed for armature or fields of 1,500 r.p.m. when the *relative* speed of fields and armature is 3,000 revolutions. In the complete axle design the motor is located centrally but its axis is not in line with the tubular drive shafts that carry the road wheels; it is parallel thereto but about an inch above them. On the end on one driveshaft there is an internally toothed ring and meshing with this is a pinion on the armature shaft, but on the other side, the field magnets carry the ring gear and the pinion is on the driveshaft. This means that rotation of armature and fields in opposite directions will cause the road wheels to revolve in the same direction, either forwards or backwards according to the direction of the current.

Since one driveshaft is in connection with the armature and the other with the fields there is no direct mechanical linkage between the shafts—no differential that is. Instead, the armature can slow down while the fields speed up or vice versa, so that a corner can be taken by slowing one member and accelerating the other, but without affecting the relative speed of armature and field.

While this arrangement eliminates certain mechanical parts and might therefore be made more cheaply than the usual motor and drive, it is claimed that greater saving is also introduced by simplification of the car frame which has no driving stresses to resist but is merely a weight carrier. Also, the controller is arranged so that the motor becomes a dynamo when running down hill and puts a small charge back into the battery, though it is not suggested that this would serve greatly to increase the radius of the vehicle, it might easily add a few per cent. to the miles obtainable from one charge.

Battery Is Obstacle to Low Price

One cannot see very clearly how this new motor construction can, of itself, serve to cheapen the car a great deal. Quantity production of electric cars will not reduce their cost as much as it reduces that of gasoline vehicles, because the most important part of an electric—the battery—is already a quantity production specialty. Given a cheap battery, or means for doubling the mileage radius obtainable from a battery of given size would immediately cut the cost, but we cannot yet cheapen the battery except by reducing the radius, and it is a debatable point whether an electric at whatever price, would sell unless its radius was at least as great as that of the present more expensive cars.

Dr. Steinmetz states the ideal price for the cheap electric to be about $750 and, in the light of the discussion at the Philadelphia electric convention last year, it is not easy to see how quantity production and this new axle alone can make this possible. It is, of course, conceivable that central station interests might finance a scheme to sell electric cars for practically no profit on first cost, and it might be a sound scheme, but had mechanical difficulties only stood in the way, we should have had the $750 electric years ago.

Standard Steel Car Eight and Six

PITTSBURGH, PA., March 23—The Standard Steel Car Co., this city, one of the largest industrial corporations in the world, has entered the automobile field with two cars, an eight at $1,735 and a six at $2,100.

The eight-cylinder model uses a Herschell-Spillman V motor, 3- by 5-inch bore and stroke, giving 28.8 S. A. E. horsepower, having a single camshaft with sixteen integral cams, three-speed selective gearbox, multiple-disk clutch with Raybestos-faced steel disks, floating rear axle in pressed steel housing and vacuum fuel feed. The car has a 121-inch wheelbase and springs are semi-elliptic front and rear, being 2 1-4 inches wide in front and 2 1-2 at the rear. Tires are 34 by 4 1-2 all around. The car is made in five- or seven-passenger form.

On the six, the bore is 4 inches and the stroke 5, or 38.4 S. A. E. horsepower, the motor used being a T-head type with the cylinders cast in threes. Wheelbase is 126 inches and tires are 36 by 4 1-2. Three-speed gearbox, vacuum fuel feed and floating rear axle are also found on this car. Springs are semi-elliptic in front, 40 by 2 1-4 inches, while in the rear they are three-quarter elliptic 53 1-2 by 2 1-4. Five-passenger body only is fitted.

F. C. Vanderhoof is manager of the automobile department which the company has organized.

Dudley Tool Co. May Build Electrics

DETROIT, MICH., March 24—An electric cabriolet designed by the Dudley Tool Co. and selling at $985 with standard equipment, has been constructed for demonstration purposes. If the new car finds favor the Dudley Tool Co. and the Menominee Electric Co., both of Menominee, Wis., will be reorganized and the Dudley company, which heretofore has made cyclecars, will devote all its attention to the construction of electrics. The car has a wheelbase of 100 inches with standard tread. The artillery wheels are 30 by 3 1-2. Bevel drive and semi-elliptic front and three-quarter elliptic rear springs are employed. The motor, which is of 1 1-2 horsepower, is made by the Menominee Electric Co. The designer is Henry Tideman, president of both companies.

TACOMA, WASH., March 23—A consignment from the East of sixty-six motor tractors has arrived here for transshipment to Vladivostock for military use by Russia.

Buick Output Sold—42,000 Cars

DETROIT, MICH., March 23—Buick dealers have been informed by the Buick Motor Co., Flint, that the entire output for 1915, that is 42,000 cars, has been disposed of and that it is impossible to increase any one's original allotment.

The 1916 Buick models will be announced in June instead of in August, as has been the custom of the company thus far. It is rumored that a production of at least 60,000 cars is being planned or 18,000 more than for the season 1915.

DETROIT, MICH., March 23—The Studebaker Corporation expects to have all its 1915 cars built and shipped by May 1. The 1916 models will probably be announced in July.

Autocar Reduces Chassis Price $200

ARDMORE, PA., March 19—The price of the Autocar delivery chassis has been reduced from $1,850 to $1,650. This is the third reduction the Autocar Co. has made since January 1.

1913. The first reduction was from $2,150 to $2,000 and then from $2,000 to $1,850. The company has 2,400 customers using from one to 280 Autocars each. Its business has increased 33 1-3 per cent.

Pass Bill Eliminating Compensation Commission

ALBANY, N. Y., March 22—The MacDonald bill, which eliminates the Compensation Commission as a necessary factor in the payment of claims under the Workmen's Compensation law which recently went into effect, has been passed by both the Senate and the Assembly at Albany, and it is expected that it will receive the governor's signature and thus become a law.

Under the compensation law as at present in force, all payments to workmen must be made through the Compensation Commission. The MacDonald bill amends Sections 20, 25 and 26 of the law and provides that an injured workman, or in the case of death, his chief dependent, may present his claim to his employer direct instead of through the commission as heretofore necessary. It is further provided, however, that the workman may present his claim to the commission if the employer rejects it or if within 10 days after it has been presented an agreement for compensation, signed by both parties, is not made and filed with the commission.

Where such an agreement is filed, the commission is required to examine it and if it is in accordance with the law to approve it, when it becomes an award, independent of the agreement; if it should differ from the agreement the award of the commission prevails. The commission is given power to impose on the employer a penalty of not more than 10 per cent. of the award where there is unfair dealing or bad faith on the part of the employer in connection with the settlement.

Should the employer be insured either with the State Fund or with a casualty company reimbursement from either agency is provided for in the bill for any amount paid to an injured employe, or to his dependents in case of death, upon presentation of proper receipts for the money paid. As the law is at present, intentional default of payment of compensation claims on the part of an employer would entail a penalty of 50 per cent. of the entire amount of compensation; under the MacDonald bill this is reduced to 10 per cent.

ALBANY, N. Y., March 23—The bill appropriating $425,000 for expenses of the Workmen's Compensation Commission until October 1, was signed today by Governor Whitman.

Patentee Cannot Fix Retail Sales Price

NEW YORK CITY, March 24—The substance of a decision handed down yesterday by Judge Hand of the U. S. District Court for the southern district of New York, indicates that under the patent law the patentee has not the right to fix the price at which a patented article shall be sold at retail. This decision will be of the greatest importance to manufacturers who have dictated the ultimate price at which their patented articles must be retailed as it means that if the dealer desires he may sell the patented article at any price at which he sees fit. In arriving at his decision, Judge Hand referred to the now famous Sanatogen case, in which the patented article was sold for less than its agreed price and the courts upheld the right of the dealer to do so. The present case is a suit brought by the Victor Talking Machine to restrain R. H. Macy & Co. from selling phonographs and records at a lower price than that fixed by the Victor company. The case was tried in the U. S. District Court for the southern district of New York.

CLEVELAND, O., March 23—In reporting the decision of Judge Clark sustaining the complaint of Wm. B. Hanlon against the Rauch & Lang Carriage Co. on the Hanlon windshield patent, THE AUTOMOBILE of March 11 stated that the National Automobile Chamber of Commerce was a co-defendant. This was an error of the correspondent, as the record shows that an effort to have the N. A. C. C. brought into the suit as a co-defendant was overruled by the court. Subsequently an independent suit by Wm. B. Hanlon against the N. A. C. C. was dismissed by the court.

Car Registrations Transferable in N. J.

TRENTON, N. J., March 23—Under an act just passed by the New Jersey State Legislature, a car registration may not only be transferred as at present from one owner to another, for the same car, but may be transferred from one car to another by the original holder of the registration. In transferring from car to car, the applicant must pay a transfer fee of $1, and surrender the original registration card.

If the new car belongs to a higher class of horsepower than the car originally registered not only the transfer fee of $1 must be paid, but the difference between the fee paid originally and that due if the automobile be properly registered in a higher class.

Licenses will be issued on and after December 1 of year, such licenses not to be used until January 1 of the succeeding year and hereafter only the licenses of the 1 year may be used during the month of January, namely, the license of the current year.

Hearing Held on Truck Limitations

NEW YORK CITY, March 20—The Mayor's Committee on Street Traffic and Safety of New York City, met on March 19 at the Craftsman Bldg., 6 East Thirty-ninth street, this city, for the purpose of hearing arguments for or against the limitation of size, speed, and weight of motor trucks and horse wagons.

It was shown that the limitation of the size and carrying capacity of motor trucks was directly contrary to the basic principles of progress and efficiency in that the history of transportation since before the Romans has been one of carrying larger and yet larger loads per unit at ever-increasing speed. It was brought out forcefully that the limit of 28 feet in length meant that a large portion of the horse vehicles, which, including the length of the horses and the poles, are longer than the average motor truck, would have to be discarded and the loads they carry placed on a greater number of smaller drays. Such limits, it was represented, meant the increase in the number of traffic units, with therefore enormously increased haulage cost and unbearable increase in traffic congestion; which could not but react disastrously on the welfare of business generally and on the cost of living.

The hearing was adjourned until an indeterminate date in the latter part of April.

N. A. C. C. Fights Truck Weight Restriction

ST. CLAIRSVILLE, O., March 22—The Court of Common Pleas in this city, having upheld the Mayor of Belmont in fining Roy Lake $200 for driving his truck through Belmont, the case is to be brought before a higher court by the Adams Bros. Contracting Co., Zanesville. The Adams Company is the employer of Lake, and the specific ordinance of Belmont that he violated is one limiting to 10,000 pounds the combined weight of trucks and load that may be driven over the Belmont streets. The National Automobile Chamber of Commerce is co-operating with the Adams company in fighting the case, it being felt, that should this local ordinance be upheld the use of motor trucks of over 2-ton capacity would be subject to restriction by any town or village that saw fit to pass prohibitory ordinances.

COLUMBUS, O., March 19—The officials of the Ohio Automobile Assn., have served notice on the legislature that unless the bill requiring all vehicles to carry lights at night is adopted, a suit will be started to test the constitutionality of the automobile license law. It is believed that the law is unconstitutional, but automobilists generally have not raised the question. The light bill was passed by the Ohio senate but defeated by the farmer vote in the house of representatives.

The officers of the Columbus Chauffeur's Assn., with the co-operation of similar organizations in other parts of the state, have launched an action to test the constitutionality of the law licensing chauffeurs. It is claimed that the present law is discriminatory, as it compels professional chauffeurs to submit to an examination, while owners of automobiles can drive their cars without such an examination.

Erie Suspends Proposed Ferry Increases

WASHINGTON, D. C., March 23—The recent increase in ferry rates proposed by the Erie Railroad has been suspended by the Interstate Commerce Commission for 4 months to July 23, to allow time for hearings. The proposed changes would impose a charge of 10 cents each for horses, automobiles and cattle, instead of 6 cents, as at present, and 25 cents for business wagons and trucks, horse drawn, up to 2,000 pounds, with an additional charge of 5 cents per ton and another additional charge of 5 cents for each 2 feet in length over 11 feet, instead of the existing rate of 18 cents on all trucks.

BALTIMORE, MD., March 20—Strong and blinding headlights on motor vehicles are to go into the discard in Baltimore on July 1. An ordinance prohibiting these lights is now on its way through the City Council and is being highly commended.

Used Car Report Is Nationalized

Covers Seven of the Twelve Zones into Which U. S. Has Been Divided —Lists 145 Makes

NEW YORK CITY, March 22—The Used Car Central Market Report of the Chicago Automobile Trade Assn. has made its appearance in nationalized form; the data covers seven of the twelve zones into which the United States has been divided and it is hoped within the next 3 months to have the figures in hand for statistics covering the remaining divisions.

The page arrangement is considerably different from that of the original Chicago report. Across the top are the headings of the zone columns, beneath which are the names of the central cities in each zone. The "As Is," "Partial Overhauled," "Rebuilt" and "As Is Appraised" nomenclature is retained and means the same as in the old reports.

The prices in the case of actual sales are the averages of all the sales of a particular model in the zone in question; at the extreme right is the average price for the whole United States. To show the number of sales upon which the average is based for the whole United States certain letters, placed after the price, indicate the number of sales; they are: a, 5 and under; n, 6 to 10; u, 11 to 15; v, 16 to 20; g, 21 to 25; x, over 25. The present number includes more than 3,000 used car sales, made during the last 3 months of 1914.

In the case of 1914 cars no appraisal value is given; it was found upon investigation that less than 2 per cent. of the 1914 cars were sold as used during the third quarter of 1914, so that an appraisal on this basis would not have been fair. Dealers are advised to make such sales on the customer's account or consider each car on its own merits.

No appraisal is made on enclosed bodies because of the great variety of style and price.

Subscriptions to the list are $24 a year—for four issues—but in clubs of twelve or more, through manufacturer's organizations or otherwise, a price of $12 is made.

The latest list covers 131 makes of gasoline pleasure car and fourteen electrics. The zones which have not thus far been listed in the book are, with their central cities: 6, Atlanta; 8, St. Louis; 9, Minneapolis; 11, Dallas; 12, San Francisco.

GRAND RAPIDS, MICH., March 22—The Michigan Automobile Owners' Assn. which was organized a few days ago has elected H. B. Webber, Ionia, as its president; P. T. Colgrove, Hastings, vice-president and H. J. Kennedy, Ionia, secretary-treasurer. The board of directors includes F. W. Blair, and H. H. Smith, Detroit; H. E. Wilson, Grand Rapids; G. E. Nichols, Ionia; B. F. Hall, Belding and P. T. Colgrove, Hastings. E. P. Whitney, Grand Rapids, has been chosen as general counsel.

The principal object of the new association is to maintain an inter-insurance exchange among bona fide automobile owners in the state of Michigan. It appears that the cooperative plan as to the automobile insurance resulted in a saving of 51 per cent. to California owners and of 44 per cent. to those members of the association in Kansas City.

Headquarters are in the Houseman building, this city. An office will however be opened soon in Detroit.

DETROIT, MICH., March 23—One hundred and twenty Michigan Studebaker dealers met at a convention at the plant of the Studebaker Corp., this city, last Friday, the object being to enable as many of the state dealers as possible to get acquainted with each other. Sales manager E. R. Benson presided and the Studebaker sales policy and business details were discussed; suggestions were made as to what can be done to improve business and give more service. Following the convention the dealers were tendered a banquet at the Tuller. The opinion was practically unanimous that business is better in all territories than at any time during the last few years and that the future outlook is most encouraging.

BUFFALO, N. Y., March 22—At the annual meeting of the Automobile Dealers' Assn. of New York State which was held in Buffalo, N. Y., on March 18, all of the directors were re-elected with the exception of the Director representing Rochester. No delegate for this city having been named. The directors include: R. E. Brown, Buffalo; C. D. Hakes, Albany; R. H. Johnston, New York City; G. H. Norris, Syracuse; H. L. Carpenter, Brooklyn, N. Y.; Emanuel Lascaris, New York City, and H. J. Hartwell, Troy.

Dodge London Agency Not Closed

DETROIT, MICH., March 23—An item appearing in THE AUTOMOBILE of March 11, stated that Guy Lewin had taken the Dodge Bros. agency for London. This was incorrect as the agency for that city has not yet been closed.

Vulcan Insurance Lowers $1,500 Car Rates

NEW YORK CITY, March 20—Reduced rates on automobile insurance have been promulgated by the Vulcan Insurance Co., this city, applying to cars selling under $1,500. Policies including theft and valuation clauses now carry a rate of 1 1-2 per cent. for new cars instead of 1 3-4; for last year's cars under $1,500 list, the rate has been cut from 2 3-4 to 2 1-4.

TORONTO, ONT., March 20—The increasing number of automobiles in the province led the Mutual Fire Underwriter's Assn. of Ontario to discuss the insurance of them at the thirty-third annual convention.

It was decided that automobiles should not be insured for more than 1 year at two-thirds of actual value, and the premium should not be less than $1 per $100 per annum.

Pan-American Road Congress September 6

NEW YORK CITY, March 22—Preliminary plans were completed at a meeting in Montpelier, Vt., on March 18, for what promises to be the largest gathering of good roads advocates ever held. This meeting will be held at the Panama-Pacific International Exposition, and will be known as the Pan-American Road Congress. It will be under the joint auspices of the American Road Builders' Assn. and the American

Row of eight-cylinder Cadillac chassis ready for testing and body fitting. The company is building 100 cars a day

Highway Assn. The tentative date selected is that of the week of September 6.

The plans for the forthcoming congress will be handled by an executive committee of five. This committee is made up of Governor C. W. Gates of Vermont, chairman; W. W. Crosby, former State Highway Engineer of Maryland and E. L. Powers, Editor of *Good Roads*, representing the American Road Builders' Assn., and J. H. MacDonald, former State Highway Commissioner of Connecticut, and J. E. Pennybacker, Chief, Division of Economics, U. S. Office of Public Roads, representing the American Highway Assn.

Fiat Building Trucks for Italian Government

New York City, March 22—Joe Joseph, of the Fiat Automobile Co., returned on March 16 after a 5-week's visit to Italy. The Fiat factory in Turin, he reports, is producing motor trucks and other material in enormous quantities for the government, the output of motor vehicles reaching close to the 1,000-a-month mark. Such production would be impossible without the help of the Poughkeepsie factory, which is building motors, transmissions and other parts as fast as possible and shipping them to Italy for assembly.

To Build Chassis for the Trade

Pontiac, Mich., March 22—The Pontiac Chassis Co., of Pontiac, Mich., has been incorporated under the laws of Michigan with an authorized capital of $100,000 for the manufacture of automobile chassis for the trade. Besides a number of Pontiac and Detroit capitalists the incorporators include: R. A. Palmer, Pontiac, former general manager of the Cartercar and Oakland companies; Robert Perkins, of the Massnick-Phipps Co., Detroit, and H. H. Brooks, formerly general sales manager of the Marathon Motor Works, Nashville, Tenn., and recently general sales manager and secretary of the Herff-Brooks Corp., Indianapolis, Ind.

Hans Equipment To Be Reorganized

LaCrosse, Wis., March 18—Reorganization of the Hans Motor Equipment Co. and the saving of the factory to this city are assured by an agreement entered into between Trustee D. G. MacMillan and P. M. Gelatt, and the preferred stockholders of the corporation, at a recent meeting.

As a result of the agreement the preferred stockholders will retain their interest in the plant, without investing any additional money, and the factory will continue to operate, under the management of Mr. MacMillan and Mr. Gelatt. They have acquired the interests of J. H. Hans, president, and Edmund Hans, vice-president.

Articles of incorporation of a new company are now being drafted. The National Gauge and Equipment Co. is expected to be the name decided on. The factory is now operating with 100 employees. The plant will continue to manufacture gauges and automobile appliances.

Reading, Pa., March 18—J. D. Esterly has been appointed a receiver for the Oakbrook Motor Mfg. Co., this city. This company manufactures cyclecar motors. W. F. Young, the plaintiff, is a stockholder of the company and a creditor to the extent of $9,849. The action has been taken to preserve the assets for the benefit of the creditors.

New York City, March 22—John L. Poole, European sales manager of the Hupp Motor Car Co., Detroit, Mich., with headquarters in Paris, France, reports that he has sold over 100 cars per month since October, 1914, which is under his regular trade, and not included in his war orders.

Columbus Track Races May 15

Columbus, O., March 22—The dates for the Columbus race meeting has been definitely fixed at May 15 and 16 by the contest committee of the Columbus Automobile Club of which C. C. Janes is chairman. The program for the 2 days will consist of 5, 10, 15, 25, 50 and 100-mile races. It has been decided not to hold a 200-mile race as in former years.

New York City, March 23—Everard Thompson, Graduate Manager of the Yale Ticket Bureau, will resign to become manager of the Sheepshead Bay motordrome. He will also take charge of the construction work of the arena, which will include a 2-mile track and accommodations for 200,000 spectators with seats for half that many.

Plan $50,000 Exposition Road Race

Grand American Sweepstakes To Be Held in October—No Piston Displacement Limit

Chicago, March 22—Encouraged by the attendance at the Grand Prize and Vanderbilt Cup races of 1915, officials of the Panama-Pacific exposition are planning to promote a third road race on the exposition course in October and in order to attract the star drivers of this country and Europe, will hang up a purse of $50,000, the largest ever offered for a road race.

This was the announcement brought from San Francisco to Chicago by A. J. Hill, manager of the Peugeot Auto Import Co. of New York City, who accompanied Dario Resta, winner of the Grand Prize and Vanderbilt cup, from the Pacific coast and stopped over in this city Saturday when he and the triumphant Italian were guests of honor at a luncheon given at the Chicago Automobile Club by Edward Duffield, Chicago manager of the Thermoid Rubber Co.

The $50,000 fall race will be called the Grand American Sweepstakes and will be open to the cars and drivers of the world. No piston displacement limit will be placed on the entries and much the same rules will apply as now prevail in the grand prize. William L. Hughson, chairman of the racing board of the exposition, plans to come to Indianapolis for the 500-mile race in order to induce the foreign drivers to remain in this company for the Exposition contest.

If the exposition authorities decide to hold such a race the course will be improved.

Oldfield and Carlson Win at Tucson

Tucson, Ariz., March 20.—Following up their victory in the Venice race a few days before, the veteran Barney Oldfield, and his team mate Billy Carlson, both in Maxwells, finished one, two in the 100-mile road race staged in Tucson, Ariz., on Saturday, March 20. Oldfield averaged better than 67 miles an hour over a dusty 4-mile desert course and Oldfield made no stops. He used Firestone tires. R. H. Delano's Moon was third. Nine cars started.

Only 30 Stops in Venice Race

Venice, Cal., March 24—A non-stop record was established last week by Barney Oldfield, winner of the 300-mile Venice race, when he succeeded in going through the race without having gone to the pits once nor having stopped on any part of the course. He also drove throughout the race without shifting a gear. His Maxwell was equipped with Bosch magneto, Rajah plugs, Master carbureter, Firestone tires, Oilzum, Houk wheels and Boyce motometer.

During the entire race there were but thirty stops made at the pits. Oldfield's pit was the only one that was not visited during the day.

Rickenbacher's only stop was the one that cost him his place in the race.

Carlson made but one stop and in less than 10 seconds had filled up with oil and gas.

Ruckstell's 16-minute stop was the longest of any during the day.

Most of the stops were just for water and oil although Durant in the Chevrolet was called in with a broken rocker arm once. Le Cain stopped once to take on water before he went out in the fifth lap with a broken radiator, making three stops in all.

Grant made a stop in the eleventh lap to change a set of spark plugs and he was an unfortunate from that moment.

Cadwell made a number of visits to his pit during the time that he was in the race and Disbrow was in three times.

Lewis stopped for oil and gas on his fiftieth lap, his only stop in ninety-six rounds. The Parsons Special stopped in the twenty-fifth and again in the sixty-sixth, the lap before he went out. The first stop was to take on oil and the second was for a motor adjustment.

Eddie Hearne in the Case went half way through the race before he was forced to stop at the pits. He took on oil and gas, then was in with oil line trouble later which was responsible for his losing the race.

New Jitney Buses

Studebaker, Koehler and Kissel Special Vehicles of This Type

Exterior and interior views of the new Studebaker jitney bus

STUDEBAKER has recognized the importance of the jitney bus movement, and to meet the demand for a vehicle specially designed for the service has added a Transportation Model, so called, to its line. Mechanically it adheres to standard Studebaker practice, but to care for the increased loads is more strongly built, the rear construction in particular being designed for heavier work than usual.

Fourteen passengers can be seated comfortably in the body of this car. Entrance and exit are by the front door only, which is on the right side and is controlled by an opening and closing lever in front of the driver who sits on the left. Standard center control is used.

The body is carried on sills placed both lengthwise and crosswise of the chassis. There is only a 16-inch step-up to the floor. A sanitary floor of wooden grids covers the floor of the body. All seats are leather upholstered. They are 16 inches deep and the backs are 18 inches high. The body is 60 inches in inside width, which gives ample knee room for all passengers.

Electric dome lights give a brilliant illumination at night and the windows may be removed in pleasant weather. The driver's window is clear vision, rain vision, and ventilating.

The standard Studebaker four motor of 3 1-2-inch bore and 5 inch stroke is used. The Studebaker-Wagner electrical system, the Willard storage battery, the Remy ignition and the Studebaker carbureter are the chief motor accessories.

A 25-gallon gasoline tank is carried in the rear, and feeds to the carbureter through the Stewart vacuum system.

The wheelbase is 116 inches which is 8 inches longer than the Studebaker delivery car. The pressed steel frame is 5 inch channel section. Large Timken bearings are used throughout the chassis. The gear ratio is 4.6 to 1.

Tires are Goodrich 35 by 5 with a spare on the side. The bus sells for $1,235 complete. It is finished in an olive green with red wheels.

Above—The new jitney bus built by H. J. Koehler & Co., Newark, N. J., which has been placed in service in that city. This is mounted on the Koehler truck chassis and is a pay-as-you-enter design. The distance between ends of the run is 3.3 miles, and it is figured that a paying basis is reached with fifteen passengers per trip

Right—Kissel jitney bus used by the students of Compton Union High School, Compton, Cal. This is an excellent example of the carrying power of machines of this type

Developments in the Jitney Bus Field

COLUMBUS, O., March 19—The jitney bus idea is still rapidly developing in the state of Ohio. It first appeared in the larger cities, but later on smaller municipalities and even towns and villages are enjoying bus service. One of the features is the fact that bus lines are being established between cities and suburbs or surrounding towns. This is being done often in competition with traction lines. Everywhere the jitney bus is a thorn in the side of the street car lines. Steps are being taken by the officials of several of the traction systems to combat the jitneys, but so far their efforts have not been very successful.

In many cases the fare is higher than a nickel, although the nomenclature of the jitney bus still clings to the movement. The higher price is readily paid by passengers who prefer the bus to the slower and unsanitary street cars.

In Columbus the buses are meeting with better success than at the start.

Buses have made their appearance in Akron, O., with a large number of private owners. Service has been inaugurated from the down-town district to the suburbs. Many of the workers in the rubber plants are patrons.

The Ohio Electric Railway Co. is to have competition between Columbus and Reynoldsburg, a small town east of the Buckeye Capital. The Reynoldsburg Transportation Co. has been chartered under Ohio laws and an hourly service both ways will be established at once.

Reports from Lima, O., show that the truck factories in that place have been compelled to turn down orders for jitney buses. This is due to the large number of orders which are on the books of the companies. Orders for 100 buses from Boston and fifty buses from New Orleans were turned down.

Milwaukee Jitney Operators Organize

MILWAUKEE, WIS., March 13—In the short space of 1 month, Milwaukee's jitney bus industry has grown to comparatively large proportions and hardly a day passes without the issue of at least one license to operate a bus. The jitney bus owners have already formed an association for mutual benefit and is even now planning a system of transfers or interchange of passengers.

On March 15 the city of Milwaukee had issued licenses to fifty-seven owners of cars for purely jitney service. The license costs $10 annually and is the same that covers taxicab and other car-for-hire operation. At this time licenses are granted for $5 for the short term, all grants expiring July 1.

About 50 per cent. of the jitneys in operation in Milwaukee are Fords. The list of machines shows nearly forty different makes, among them two Wintons, two Locomobiles, two Mitchells, three Ramblers and other makes of considerably higher power and more weight than the Ford. Several Ford jitney operators claim to average a gross revenue of $25 per day of 12 hours.

CONCORD, MASS., March 20—New England appears to be adopting the jitney bus gradually, but surely. Lines are operating in Portland, Me., and a company has been organized in Providence, R. I., which will begin operating a system of automobile coach lines in April. The cars will each seat twenty-one persons. Independent cars to the number of 200 are already licensed to run in the streets of Providence.

In Boston several buses have for some time been run between the Commonwealth Fish Pier, South Boston, and the foot of State street, on Atlantic avenue. The district about the pier has no convenient electric service. There are two Velie buses, of the front entrance, prepayment type, each accommodating eighteen persons. Trips are made on a 20 minute schedule, the distance being about a mile. The fare is 5 cents and the running time 7 minutes. As many as 400 passengers a day per car have been carried. Besides the two Velies, there are three Autocars, each accommodating eight to twelve passengers.

At Lynn, Mass., five large motor buses are in regular operation on fixed routes, each one paralleling street car lines. There are three nineteen-seat Federal cars, a sixteen-seat Autocar, and a nineteen-seat Universal. All the vehicles are operated individually, each by its owner.

One operator reports that 3,000 passengers a week is about the average number of fares of each of the vehicles. The daily run in each case is about 90 miles.

Besides the cities mentioned, automobile buses are also operated between Greenfield and Turner's Falls, Mass. Here their route does not parallel the street car line.

Another successful line is being operated between Salem and Peabody, Mass. Here two cars make a circuit, every trip in the opposite direction from the last.

Claims Minimum Daily Profits of $4

DES MOINES, IA., March 22—Replying to the Des Moines City Railway Co. and other interests which have predicted that the jitney bus will prove a failure in Des Moines, G. A. Fosdick, a local jitneer, has made a statement to the press which is in part as follows:

"I have an Oakland five-passenger car, 1911 Model 30, for which I took out a city taxi license, and have been operating as a jitney 27 days. I have driven about 3,000 miles and have taken in $270.70, or a fraction over $10 a day, mostly in nickels, with a few 25-cent, 50-cent, and $1 special drives mixed in. I use about $1.25 worth of oil and gasoline per day and figure $2 a day for tires. The other expense, such as accidents and repairs, are hard to figure for a short period, but if I allow myself wages of $4 per day, I would have left $2.75 per day or $860.75 for the 313 working days in the year for repairs and deterioration."

FINDLAY, O., March 22—Nearly every town and city in Northwestern Ohio has its jitney buses now, and all of them appear to be making good. Among the big propositions in this direction is a jitney line between Tiffin, Fremont and Port Clinton. Motor trucks carrying fifteen people and a 2-hour service between the places has been planned.

DANVILLE, ILL., March 22—Four jitney bus routes are now in operation in Danville, Barkman and Gast, operating the Lincoln park line report a haul of 400 passengers daily, considerably above operating expenses.

Jitney Buses Thrive in Baltimore

BALTIMORE, MD., March 20—Women in the jitney bus business seems to be the growing fad in Baltimore. Another has entered the field and she plans to give transfers from one of her lines to another in the near future. At present, however, she has started only three cars, all running from South Baltimore to the business section of the city. The woman who has entered the business is Mrs. A. M. George, and she is at the head of the Auto-Coach Co.

Three new jitney lines were placed in operation this morning and one of these will be the first to run cars on Sunday. It will begin tomorrow. Hardly a day passes that the putting into operation of new lines is not witnessed. All the lines seem to be doing a thriving business.

VENICE, CAL., March 18—The Venice chief of police, acting under orders from the city trustees, has notified jitney bus drivers that they could no longer operate between Los Angeles and Venice, as no permits would be granted for jitney bus service within the city limits of the beach resort. More than seventy-five machines will be put out of the service by the ruling. The Venice city council met March 8 and adopted an ordinance fixing a $100 license fee for passenger-carrying machines of the jitney bus class. It left the issuing of such licenses to the city trustees and today the trustees decided to issue no licenses.

TACOMA, WASH., March 18—The Washington State legislature has passed a bill over the Governor's veto compelling each jitney driver to put up $2,500 surety bonds. Jitney bus drivers in this city will join organizations in Seattle to obtain a vote by the people against the bill.

Velie Ships 12 Jitneys to Coast

MOLINE, ILL., March 19—The Velie Motor Vehicle Co. shipped twelve twenty-passenger cars to San Diego, Cal., this week for jitney bus service. These cars have the lines and appearance of very large automobiles and do not resemble the ordinary sight-seeing bus of the large cities. A row of lights is recessed in the sides of each body.

Factory Miscellany

REPUBLIC Truck to Enlarge—The business of the Republic Motor Truck Co., Alma, Mich., is keeping on increasing in such a way that the enlargement of the plant will most likely be necessary within a short time. During the week ending March 6 a total of forty-two orders for trucks were received and during the week ending March 13 thirty trucks were built and shipped. This month's business, it is estimated, will total more than $150,000.

Dile to Build—The Dile Motor Co., Reading, Pa., contemplates building a $50,000 plant at Lititz, Pa.

New Plant for Rockton—The U. S. Wheel & Tire Co. expects to break ground for its new factory at Rockton, Ill., not later than March 1.

Judson Adds—The Judson Motor Car Co. has let a contract for a one-story brick and steel addition to its factory building at Detroit, Mich.

Kellogg Pump at Full Capacity—The Kellogg Mfg. Co., Rochester, N. Y., which makes the No. 101 all-metal engine-driven tire pump, is working day and night.

To Mfr. Valves—Automobile valves will be manufactured by Harry Brown, who has leased 6,000 square feet of floor space at 48 Twenty-fourth street, Detroit, Mich.

Johnstown Rubber Moves—The Johnstown Rubber Co., Johnstown, Pa., will move its plant to Lacolle, Westmoreland County, Pa., where a new factory, 100 by 200 feet, will be erected.

Mullins Co. Purchases Land—The W. H. Mullins Co., manufacturer of automobile parts and bodies, has purchased a lot north of the present plant in Salem, O., upon which a large addition to the plant will be erected.

Grant Using Tent—The Grant Motor Co., Findlay, O., has erected a large tent in its south plant premises, where it is assembling its six-cylinder cars. The company is away behind with its orders and is doing this to facilitate matters.

Manufacturing Portable Garages—The Portable Garage & Construction Co., Columbus, O., incorporated recently with a capital of $5,000, has started to manufacture portable all-steel garages for private use. B. H. Thompson is at the head of the company.

Kentucky Battery Co. Equipping—The Kentucky Revivo Battery Co., Louisville, Ky., which manufactures what is said to be a rechargeable dry storage battery, is equipping its factory in the large building at Ninth and Jefferson streets for a capacity of $1,000 worth of batteries per day.

Jeffery Running Full Time—The factory of the Thomas B. Jeffery Co., Kenosha, Wis., is running three 8-hour shifts per day, and the output of trucks and pleasure cars it is expected will reach forty-five per day by the first of April. The daily shipments now average twenty pleasure cars and twenty trucks.

Schendel Makes Change—W. A. Schendel, assistant purchasing agent of the A. O. Smith Co., Milwaukee, Wis., motor trucks, pressed steel frames, parts, etc., has resigned to accept the post of purchasing agent for the A. J. Lindemann-Hoverson Co., Milwaukee, a large sheet metal working interest.

The Automobile Calendar

Mar. 22-27	Bangor, Me., Show, Bangor Auditorium.
Mar. 22-27	Newark, O., Show, Arcade Bldg.
Mar. 24-27	Oil City, Pa., Show, New Armory.
Mar. 25-27	Mason City, Ia., Show, New Armory.
Mar. 30-April 2	Johnstown, Pa., Show, The Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
April 4	Los Angeles, Cal., Track Race.
April 5-10	DuBois, Pa., Show, Moose Hall.
April 7-10	Calumet, Mich., Show, Coliseum Rink.
April 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
April 20-22	Oklahoma City, Okla. Road Race, S. W. Auto Racing Assn.
May 15-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17-18	Boston, Mass., A. A. A. Annual Meeting
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4-5	Tacoma, Wash., Road Race.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.

Drednot Truck Enlarges—The Drednot Motor Truck Co., of Montreal, Que., Ltd., has acquired additional premises and the same are being remodeled for the installation of more machinery as rapidly as possible. The building adjoins the present factory and will afford floor space to the extent of 20,000 square feet.

Hupp Spending $150,000 on Additions—The Hupp Motor Car Co., Detroit, Mich., is spending $150,000 for additions to its plant, including a two-story office building, 1,800 by 300 feet; a top and body building, 1,500 by 300 feet; a testing laboratory, 350 by 200 feet, and an engineering building, 200 by 200 feet.

Roberts Plant to Be Reopened—The plant of the defunct Roberts Motor Co., Sandusky, O., will be in operation in the near future. Purchased recently by F. P. Zollinger, trustee for the creditors, it will be turned over to a new company, of which W. H. Burke, president of the old company, is temporarily at the head.

To Mfr. Carbureters—The Bright Mfg. Co., 204 Castle Hall Bldg., Indianapolis, Ind., is being organized with a capital stock of $75,000 to manufacture carbureters and other patented accessories for automobiles. It will be in the market for a complete brass foundry equipment and machinery. J. R. Crawford is general manager.

Want Criter Carbureter Plant—Efforts are being made by Lima, O., to secure the plant of the Criter Carbureter Co., which has been incorporated recently with a capital of $50,000 by Hamilton (O.) capitalists. The device is the invention of V. C. Criter. Hamilton officials are also trying to secure the location of the plant in that city.

Fire in York Plant—Fire destroyed a portion of the plant of the York Wagon Gear Co., North Belvidere avenue and the Western Maryland Railway, York, Pa., engaged in the manufacture of wagon and automobile bodies, recently, entailing a loss of $10,000. The fire originated in the drafting room and many valuable patterns were destroyed.

Moon Makes Factory Changes—Many factory changes have been made by the Moon Motor Car Co., St. Louis, Mo., because of the increase of business. The company has had new switches laid connecting its yards with the tracks of two railroads and has enlarged its enameling ovens. Hereafter an entire floor will be devoted exclusively to painting and varnishing.

Canadian Ford's Garage Output—All previous records for continuous output of Ford cars are being broken this month by the Ford Motor Co. of Canada, Ltd., Ford, Ont., an average of about 115 cars per day being maintained so far. During the first week in March nearly 600 Ford cars were turned out, and within the next few days it is expected to reach an additional 10 cars per day.

To Make Tires in Elyria—A site has been selected by the officials of the Elyria Tire & Rubber Co., Elyria, O., for a factory, to be located at Elyria. The incorporators of the new concern have been connected with the Firestone company, of Akron, and have considerable experience in building and marketing tires. It is the intention to make solid tires at first, but later to make pneumatic tires. A total of $50,000 will be used to install the machinery.

Youngstown Co. Adds—The erection of a battery of coke ovens capable of producing 50,000 tons monthly and finishing mills capable of turning out 25 tons in a 30-day period is planned by the Youngstown Sheet & Tube Co., Youngstown, O. Construction of coke ovens has been positively decided upon while the finishing mills may be either additional sheet mills, merchandise mills, jobbing mills, or tin plate mills, as conditions seem to warrant later. An outlay of more than $6,000,000 will be required to carry through the plan.

The Week in the Industry

Motor Men in New Roles

FUESSLE Chalmers Advertising Mgr.—N. A. Fuessle has been appointed advertising manager of the Chalmers Motor Co., Detroit, Mich., taking the place of Lee Anderson, who is now in a like capacity with the Hupp Motor Car Co. Mr. Fuessle comes from the advertising department of the Packard Motor Car Co., where he was during the last 6 months. Previous to that he has been during many years a magazine writer in Cleveland, contributing to publications like "Collier's," "Everybody's," etc.

Spear Scripps-Booth Mgr.—R. H. Spear has been appointed general manager of the Scripps-Booth Co., Detroit, Mich.

Lurie Heads Singer Dept.—Robert Lurie is now in charge of the used-car department of the Singer Motor Co., New York City.

Harrington Joins Fuller—F. C. Harrington has taken charge of the truck department of the Alvan T. Fuller Co., Boston, Mass., agent for Packards.

Wagner Detroiter Secretary—E. H. Wagner has become secretary-treasurer of the E. M. Owens Sales Co., Indianapoils, distributor for the Detroiter.

Chilman Detroit Regal Mgr.—W. L. Chilman has been appointed manager of the Detroit (Mich.) branch of the Regal Motor Car Co., at 758 Woodward avenue.

Armstrong Makes Change—J. A. Armstrong, who was in charge of the offices of S. F. Bowser & Co., Detroit, Mich., automobile gasoline tank manufacturers, has joined the Cutting & Smith Sales Co.

Mabley Joins S. K. F. Co.—C. R. Mabley, for the past 5 years general manager of the R. I. V. Ball-Bearing Co., has joined the selling organization of the S. K. F. Ball-Bearing Co., New York City.

Loechler Standard Mgr.—H. F. Loechler, formerly connected with the Ohio Electric Co., Columbus, O., has been made manager of the electric department of the Standard Motor Car Co., Columbus.

Hewitt with Four-Wheel Drive—G. P. Hewitt, of Appleton, Wis., formerly with the Buick agency there, has been appointed manager of the sales department for the Four-Wheel Drive Auto Co., Clintonville, Wis.

Feltz White Service Mgr.—C. E. Feltz, connected with the automobile business in St. Louis, Mo., for the past 10 years, has been appointed manager of the service department of the local White establishment.

Desautels Heads Detroit Hammond Branch—The Detroit (Mich.) branch of the Hammond Steel & Forging Co., Inc., Syracuse, N. Y., is located at 1613 Dime Savings Bank Bldg., with George Desautels as manager.

Aldrich Promoted—A. L. Aldrich, second vice-president of the Shaw Motor Co., organized at Chicago several years ago, and now permanently located in its new works at Sauk City, Wis., has been promoted to first vice-president.

Komp Heads Lansden—F. S. Komp, formerly manager of the Lehigh Valley Structural Steel Co., has gone to Brooklyn, N. Y., where he is the head of the Lansden Automobile Co., manufacturer of electrically propelled vehicles.

Potter Gets Dodge Appointment—Dodge Bros., Detroit, Mich., have appointed A. M. Potter as manager of claims of their service department. Mr. Potter was formerly manager of the service department of the Lozier Motor Co.

Wilkening Makes a Change—F. W. Wilkening, for some years manager of the Boston branch of the Motor Parts Co., has been transferred to Philadelphia to take charge of the branch there, and his brother has been put in charge at Boston.

Harper Burlington Brass Mgr.—George Harper, Chicago, Ill., has been appointed superintendent and general manager of the Burlintgon Brass Works, Burlington, Wis., to succeed W. B. Crawford, who resigned to return to Eastern connections in a like line.

Woodwin District Sales Mgr.—T. C. Woodwin, formerly of Detroit, Mich., has been appointed district sales manager for the states of Kansas, Missouri and Nebraska by the Lewis Spring & Axle Co. He will have his headquarters in Kansas City, Mo.

Slater Resigns—W. J. Slater has resigned his position as assistant sales and advertising manager of the motor car department of the Durant-Dort Carriage Co., Flint, Mich., to join the sales organization of the Firestone Tire & Rubber Co., Akron, O.

Jones Pyrene Mgr.—A. C. Jones, formerly manager of the Dayton (O.) branch of the Pyrene Mfg. Co., has been appointed manager for the company in Indiana and has opened a sales and distributing branch at 345 North Capitol avenue, Indianapolis.

Howard Louisville White Mgr.—The White Co., Cleveland, O., has established a branch at 728 South Fourth street, Louisville, Ky., with G. M. Howard, district manager of Kentucky and southern Indiana territory, in charge. The Van Patton Motor Car Co. has acquired the agency.

Dasey in Detroit—Offices have been opened in the Kerr Bldg., Fort and Beaubien streets, Detroit, Mich., by P. J. Dasey, who is now in charge of the sales department of the Michigan Crown Fender Co., of Ypsilanti, Mich. Mr. Dasey was formerly sales manager of the George W. Hook Co., Buffalo, N. Y.

Sackett with Cadillac Again—L. S. Sackett, at one time with the Cadillac in Boston, Mass., and later manager of a branch in Providence, has returned to Boston to join the sales force of the company again. The service, stock and accounting departments of the Cadillac agency have been moved to 79 Brookline avenue.

Smith Heads Airplex Tire—A. F. Smith has been named president of the Airplex Inner Tire Co., St. Louis, Mo., which has established a plant at 312 Pearl street, that city. R. D. S. Bennett was named vice-president and Arthur Ralston, secretary-treasurer. These officers and J. M. Wilkerson and R. M. Lowe will constitute the board of directors. The capital will be increased from $3,000 to $20,000.

Henne Columbiana Tire Mgr.—The Columbiana Tire & Rubber Co., Columbiana, O., has secured W. C. Henne, formerly sales manager of the Mansfield Tire & Rubber Co., as general manager of the new plant. The Columbiana company was recently incorporated for $300,000 to manufacture automobile tires and other rubber articles. W. C. Henne, G. W. Henne, W. F. Henne, J. C. Henne and Charles Hoffman are the incorporators.

Austin Studebaker Superintendent—W. W. Austin, who has been superintendent of service, parts, machine and experimental work in Detroit, has been made general superintendent of the Studebaker South Bend Works, South Bend, Ind. W. R. Cavanaugh, who has been in charge of methods department of the Studebaker corporation, Detroit, has been appointed assistant general superintendent of the Studebaker works in South Bend.

Burgess Heads Dorris Sales—W. L. Burgess, formerly manager of the rim department of the Firestone Tire & Rubber Co., Akron, O., and later sales manager of the Enger Motor Car Co., Cincinnati, O., has joined the Dorris Motor Car Co., St. Louis, Mo., taking entire charge of sales. The Dorris line includes four-cylinder and six-cylinder pleasure car models, a 1,500-pound delivery wagon and a 2-ton truck, and an extensive selling campaign will be initiated at an early date.

Dr. Taylor Heads Ford Hospital—For the purpose of gathering data for use in the organization and operation of the Henry Ford Hospital, which the automobile maker will establish in Detroit, Dr. J. N. E. Taylor, who will head the new institution, Dr. Frank J. Sladen and E. G. Leibold, Mr. Ford's private secretary, spent a large part of Monday in going over Johns Hopkins Hospital, Baltimore, Md. They gathered much information while there. Dr. Sladen is a graduate of Johns Hopkins.

Garage and Dealers' Field

Rex Tire in Philadelphia—A newcomer, the Rex Tire & Rubber Co., Philadelphia, Pa., featuring the Blackstone non-slip tire, has opened salesrooms at 304-306 North Fifteenth street, under the supervision of I. B. Humphreys.

Orange Chevrolet Moves—The Motor Sales agency of the Oranges, East Orange, N. J., agent for Ford and Chevrolet cars, has moved to a new sales and service building at Main and Clinton streets. H. F. Herdman is manager.

Agent Adds Another Tire—The Costello-Lang Co., San Francisco, Cal., Pacific Coast distributor of the Hardman Sure-Grip tires, have opened for business and have also received the Pacific Coast agency for the Cross-Grain tube and the Falls tire.

Recent Incorporations in the Automobile Field

Ohio

CINCINNATI—Heeb Automobile Service Co.; to Packard Auto Service Co.

CINCINNATI—Ideal Service Co.; $25,000; dealer. E. M. Henderson, A. Krippendorf, J. E. C. Kohlsatt, S. B. Sutphin, E. M. Reinhart.

CINCINNATI—Numatic Co.; $15,000; to manufacture and deal in tires. O. H. Foster, Hubert Franken, Frederick Havekotte, F. L. Richard, P. W. Weber.

CLEVELAND—Adams-Oakland Co.; $55,000; automobile dealer. H. M. Adams, A. A. Sterne, J. C. Royan, J. A. Chamberlain, L. A. Krause.

CLEVELAND—Allbaugh Motor Sales Co; $10,000; dealer. J. W. Allbaugh, C. S. Allbaugh, T. K. Allbaugh, W. A. Allbaugh, R. K. Allbaugh.

CLEVELAND—Auburn Sales Co.; $15,000; dealer. P. R. Ward, E. C. White, E. E. Deem, E. H. Clay, W. P. Street.

CLEVELAND—Clonse Tire Repair School Co.; $2,500; to teach tire repairing. J. A. Borke, C. A. Burke, F. F. McFadden, R. M. Schrod, E. C. Spades.

CLEVELAND—F. J. Erney Mfg. Co.; $3,000; automobile signal lamps. J. H. Pavolik, Jr., A. J. Knach, J. F. Pavolik, F. J. Erney, A. A. Lutton.

CLEVELAND—Gholson Auto Co.; $10,000; dealer. K. M. Gholson, W. F. Gholson, A. N. Meyer, Esther Hayes, J. G. Murphy.

CLEVELAND—Gutman Tractor Co.; $10,000; manufacturer. E. K. Hoy, L. M. Henges, B. A. Shatto, M. J. Kurka, O. D. Eshelman.

CLEVELAND—Rohs-Bennhoff Wagon and Auto Co.; $5,000; dealer. J. W. Bennhoff, E. H. Rohs, C. T. Rose, W. N. Hoppensack, J. A. Fogle.

COLUMBUS—Hub Motor Truck Co.; $300,000; manufacturer. J. B. Bass, J. C. Chester, T. C. Hauly, J. L. Herpich.

COLUMBUS—Kissel Service Co.; $10,000; dealer. C. G. McCune, R. T. Fisher, William Gaither, J. M. Garard, L. B. Dunning.

DAYTON—Bates Motor Car Co.; $10,000; dealer. O. E. Bates, E. G. Bates, C. E. Bates, A. M. Rebhart, J. C. Schoeffer.

DEFIANCE—Elliott-Markey Co.; $10,000; dealer. G. W. Elliott, J. C. Markey, H. L. Elliott, R. E. Markey, R. J. Emory.

DEFIANCE—McCleary Garage Co.; $20,000; garage. A. C. McCleary, D. W. Cook, D. A. Baker, W. J. Miller, E. R. Mallett.

LOGAN—Main Motor Car Co.; $25,000; dealer. T. C. Johnson, A. H. Johnson, Flora Spohn, F. A. Keppe, L. K. Kienle.

SIDNEY—Sidney Auto Sales and Supply Co.; $20,000; dealer. W. H. Persinger, W. L. Allton, B. H. Mires, J. D. Barnes.

TOLEDO—H. P. Dodge Engineering Co.; $10,000; dealer in batteries. H. P. Dodge, N. A. Whitney, M. S. Dodd, F. C. Averill, G. F. King.

TOLEDO—Toledo Central Garage Co.; $10,000. I. O. Denman, G. S. Leteman, Gustave Ohlinger, D. P. Smith, Rosamond Fuller.

WILLOUGHBY—Standard Fuel Oil Co.; $50,000; engine manufacturer. J. E. Morley, C. H. Gale, H. C. Jones, B. A. Kittinger, W. T. Kinder.

YOUNGSTOWN—Motor Sales and Supply Co; $10,000; dealer. W. V. Bornett, D. L. Rose, A. C. Hendry, D. F. Griffith, R. C. Fuhrman.

Oklahoma

MUSKOGEE—Muskogee Automobile Dealers Assn.; mutual capital stock. W. A. Campbell, C. L. Anderson, Harry Kitto, Henry Waterston, S. J. Miller.

OKLAHOMA CITY—Elerick Jitney Auto Co.; $25,000. C. F. Elerick, A. M. Elerick, L. C. Palmer.

SAPULPA—Sapulpa Gasoline and Oil Co.; $15,000; dealer. P. E. Smith, L. E. Smith, P. F. Smith.

TULSA—Auto Repair & Mfg. Co.; $10,000. L. F. Barnes, M. O. Randall, M. A. Campbell.

WAKITA—Clinesmith Motor Co.; $5,000. F. L. Clinesmith, John Clinesmith, William Clinesmith.

Oregon

PORTLAND—Portland & Suburban Auto Transit Co.; $200,000; jitney bus line. F. L. Waller, W. P. Andrus, E. W. Morgan.

Pennsylvania

ALLENTOWN—Great Eastern Rubber Co.; $100,000; manufacturer tires. C. R. Fluck, D. M. Knabb, V. A. Nagle.

PHILADELPHIA—Olewine's Garage; $50,000; to maintain storage houses and garages. F. R. Hanssell, G. Purnell, S. C. Seymour.

Tennessee

CHATTANOOGA—Spring City Auto Co.; $1,000; dealer. J. D. Carlin, G. W. Stephenson, J. M. Adams, O. P. Darwin, C. C. Moore.

Texas

EL PASO—Motor Bus Co.; $2,500; operator line of motor buses. J. V. Robins, J. J. McCourt, J. W. Kirkpatrick.

HOUSTON—Magnolia Motor Sales Corp.; $12,000; dealer. J. D. Kerr, P. H. Carr, G. E. Gilmore.

NACOGDOCHES—Schmidt Auto Sales Co. and Garage; $15,000. H. J. Schmidt, Albert Bright, John Schmidt.

Virginia

PULASKI—Pulaski Motor Car Co., Inc.; $25,000; dealer. J. W. Eckman, H. L. Trollinger, R. B. Moore, W. H. Trollinger, F. J. Laughon, H. W. Steger.

West Virginia

CLARKSBURG—Motor Ignition & Devices Co., $400,000; ignition systems. E. R. Diehm, Ernest Angell, C. C. Owens, W. D. Fleming, H. T. Clark.

WHEELING—Jitney Transportation Co.; $5,000. Jos. Weiskircher, Chas. Weiskircher, E. Weiskircher.

Wisconsin

ANTIGO—Utility Steel Tractor Co.; $24,000; manufacturer tractors and trucks. S. D. Stewart, N. C. Nurdin, F. A. Hecker.

APPLETON—Appleton Ford Co.; $6,000; dealer. W. C. Hall, R. A. Schwartzberg, J. L. Tollefson.

BELOIT—Rex Gasometer Co.; $35,000; manufacture measuring devices for gasoline tanks, etc. W. H. Corcoran, R. H. Goodwin, E. R. Young.

CANTON—Globe Motor Car Co.; $100,000; dealer. C. S. Lochamer, E. M. Raber, G. A. Marks, J. W. Rover, J. R. Boline.

GRAND RAPIDS—Prentiss-Weaver Mfg. Co.; $20,000; automobile parts manufacturer. D. B. Philleo, T. A. Taylor, G. O. Babcock.

MANITOWOC—Dicke Taxicab Co.; $1,000. W. C. and L. S. Dicke and Hugo Menzel.

MILWAUKEE—Boggis-Dietz Electric Co.; $10,000; manufacturer in electrical devices. H. F. Boggis, E. L. Dietz.

MILWAUKEE—Burgett Auto Co.; changed to Milwaukee Motor Sales Co.

MILWAUKEE—Federal Rubber Mfg. Co. of Milwaukee; $2,000,000 to $3,000,000.

MILWAUKEE—Milwaukee Steel Type & Die Co.; $20,000. A. C. Moeller, F. H. Scheiner, Emmet Horan.

MILWAUKEE—Pirate Motor Mfg. Co.; $50,000; manufacturer gasoline engines. Herman Roth, Julius Tanck, John Krohn.

MILWAUKEE—Wells Garage Co.; $10,000; garage. Charles Bublin, E. A. De Sarnelle, Samuel Carroll.

MILWAUKEE—Wisconsin Automobile Business Assn. of Milwaukee; no capital stock. H. E. Wilson and eleven others.

NEW GLARUS—New Glarus Automobile Co.; $5,000; dealer. N. K. Zweifel, H. M. Stensby, N. H. Stensby.

OSHKOSH—Universal Motor Co.; $25,000; to take over the business of Termaat & Monahan Co., gasoline engines and motors. J. D. Termaat, L. J. Monahan, A. R. Dye.

RACINE—Electrical Shop; $5,000; to manufacture, repair and deal in electrical devices, etc. William Pratt, Kerner Brandeis, Fulton Thompson.

Automobile Agencies Recently Established

PASSENGER CARS

Arkansas

Fort Smith	Franklin	J. Witherspoon

California

Arbuckle	Kissel	A. J. Atran
E. Auburn	Kissel	O. E. Thomas
Los Angeles	Simplex	Simplex & Mercer Pacific Coast Agency
Los Angeles	King	English Motor Car Co.
Los Angeles	Ohio	Washington St. Electric Car.
Marysville	Kissel	Marysville Garage
Oakland	Ohio	Huey-Hood Motor Car Co.
Riverside	Kissel	Fairmount Garage & Mch. Wks.
Sacramento	Oldsmobile	F. C. Peters
San Francisco	Simplex	Simplex & Mercer Pacific Coast Agency

Canada

Berlin	Regal	L. C. Browne
Calgary	King	Diamond Motor Car Co.
Chatham	Ford	J. M. McCoig
Hamilton	Chandler	F. G. Morris
London	Oldsmobile	London Motor Sales Co.
London	Franklin	London Engine S. Co.
Mildmay	Regal	G. Kuneman
Mildmay	Saxon	Hunstein & Reuber
Montreal	Grant	Legare Gadbois, Ltd
Montreal	Hupmobile	The Comet Motor Co.
Montreal	Grant	Gareau Motor Car Co.
Montreal	Briscoe	Lussier Garage, Ltd.
Port Arthur	Franklin	D. Boreau
Port Arthur	Saxon	Central Garage
Quebec	Moon	Le Page Co
Regina	King	Wright & Mitchell
St. John	Oldsmobile	New Brunswick Motor Car Co.
Sarnia	Oldsmobile	R. Milligan
Sault Ste. Marie	Regal	G. P. Black
Sherbrooke	Reo	R. A. Webster
Toronto	Oldsmobile	Crofton Storage Battery Co.
Toronto	Paterson	F. A. Harvey
Toronto	Simplex	Thompson

Colorado

Denver	King	Mid West Auto Sales Co.

Connecticut

Greenwich	Detroiter	Enders & Abrams
Hartford	Davis	Asylum Hill Garage
Hartford	Davis	J. C. Collins
New London	Oldsmobile	J. B. Getchell
Stamford	Lexington	The Motor Sales, Inc.

Georgia

Atlanta	Remington	Arlington Motor Co.

Idaho

Twin Falls	King	F. A. Nelson

Illinois

Altamont	Case	F. Schlotterbeck
Anna	Oldsmobile	R. Tuthill
Bloomington	Davis	Davis Motor Car Co.
Chicago	Simplex	Tennant Motor, Ltd
Chicago	Lexington	T. C. Vawter
Creston	Case	Louis Vesta
Decatur	Davis	F. M. Welde
Effingham	Metz	G. F. Walters
Elksville	Pullman	C. T. Bass
Madison	Metz	A. V. Wallace
Minonk	Davis	Minonk Central Garage
Morrison	Franklin	O. Woods
Mt. Carroll	Case	W. E. Brown
New Baden	Pullman	J. J. Kock
Noble	Metz	E. Warren
Oak Park	Davis	W. A. Pillinger
Pekin	Davis	Pekin Palace Livery Co.
Pontiac	Case	W. Algoe
Pontiac	Davis	C. C. Johnson
St. Jacobs	Pullman	St. Jacobs Hardware Co.
Springfield	Lexington	R. Haas Elec. & Mfg. Co.
Standord	Davis	Standford Auto Co.
Sycamore	Case	Loptien Bros.

Indiana

Crawfordsville	Saxon	Arnold, Hill & Turpin
Dyer	Case	Fitch Brothers
Indianapolis	Cole	Cole Sales Co.
Lafayette	Saxon	Columbia Tire & Auto Co.
Moreland	Davis	M. A. Clark
Pendleton	Davis	J. Benefiel
Tipton	Davis	J. E. Lower

Iowa

Burlington	Lexington	Farmers Motor & S. Co.
Conrad	Case	Case Motor Car Co.
Coon Rapids	Lexington	Geiger & Martinson
Davenport	Mitchell	McGivern Motor Co.
Fairfield	Oldsmobile	E. S. Thomas
Fort Madison	Glide	Winke Brothers
Keystone	Imperial	Miller & Shreeves
Lansing	Case	Hufschmidt & Wendel
Mason City	Imperial	Snyder & McCall
New Hampton	Davis	J. L. Curtis
Toledo	Franklin	Jones Bros. Auto Co.
Westgate	Imperial	Tegtmeier Bros.

Kansas

Argonia	Case	Achelpohl & Bringer
Great Bend	Imperial	E. E. Cook
Hutchinson	Case	E. H. Steinford & Rexroad Engineering Co
Independence	Oldsmobile	R. A. Stone

Kentucky

Winchester	Case	People's Motor Car Co

Maine

Anson	Dodge Bros	George Hovey Sullivan
Camden	Kissel	W. C. Howe
Casco	Maxwell	Cook-Hall Co.
Easton	Detroiter	Kneeland Bros.

Maryland

Baltimore	Simplex	The Rice Garage
Baltimore	King	Randall Mfg. Co.
Federalsburg	Detroiter	R. S. Messenger
Preston	Oldsmobile	H. J. M. Hollis & Co.

Massachusetts

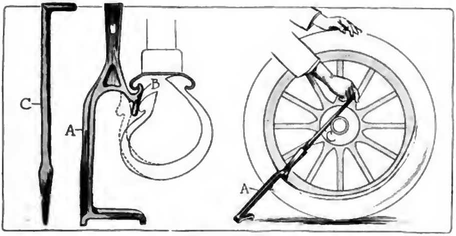
Boston	Allen	E. A. Gilmore
Boston	Milburn	E. Y. Simpson
Boston	Paterson	R. W. Vining
Boston	Pathfinder	W. Hilliard
Boston	Empire	Leo Spigelmilch
Boston	Apperson	Brown-Apperson Co.
Boston	Premier	Eads-Loud Co.
Boston	Simplex	G. W. Canterbury, Inc.
Boston	Stewart	H. Ross Maddocks
Boston	Regal	C. P. Robinson Co
Boston	Ohio	D. C. Tiffany Co
Campello	Detroiter	Franklin Motor Co
Fall River	Oldsmobile	Pocasset G. & M. Co
Fall River	Maxwell	T. Paquin
N. Adams	Saxon	A. S. Williams
Springfield	Hudson	Harrington-Gifford Co.
Woburn	Overland	J. H. Bates & Son
Worcester	White	White Motor Co.
Worcester	Detroiter	Louis Bellinger

Michigan

Battle Creek	Imperial	Independent Garage
Battle Creek	Saxon	Frank Palmer
Battle Creek	Saxon	F. Palmer
Charlevoix	Saxon	B. Brown
Clare	Saxon	Kelley & Ballard
Davison	Dodge	Art Cullen
Detroit	Ohio	Gordon Auto Sales Co.
Detroit	Monarch	Addison Garage
Detroit	Empire	Addison Garage
Detroit	Kissel	Addison Garage
Detroit	Milburn	E. I. Rumsey

ACCESSORIES

TIRE-REMOVING Tool—It is somewhat remarkable that considering the age of the pneumatic tire it should still be possible to design or invent improved tools for removing it from or placing it upon the clincher type of rim. There have been very many attempts to produce tools which would render this task quick and easy to the least skilled, but few of these have been really satisfactory because they have rarely been easy to use without some practice, while they have often been costly to buy. Meanwhile the coming of detachable flange rims and similar devices has made it less easy to produce a tool which was both good enough and cheap enough to be worth buying.



Off-an-On tire tool

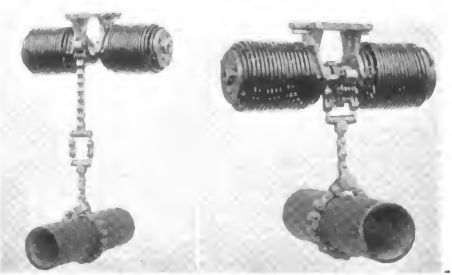
The most recent attempt to solve the tire-handling problem in a way that can appeal to the owner of a low-priced car who naturally does his own work and has not either money or inclination for the purchase of costly equipment, is illustrated here and its action is so simple that it is difficult to describe. Once seen in action the tool proves its own case, but by careful reference to the sketches it will be possible to understand the simple theory of the operation.

The principle of the tool is that of the ordinary tire lever, but instead of applying a lifting leverage to several points on the tire, a short lever is inserted at one place and turning the wheel then causes the tire to be lifted from the rim all the way round. The main part of the tool is the malleable "leg" A, which has on it the little lever or wing piece B. There is also a plain lever of fair length C, which is used for releasing the first inch of the casing from the clinch of the rim and then is combined with part A to hold the latter while the wheel is pulled around by hand. The plain lever is easy to insert and as soon as the tire casing is lifted at one point the wing B is inserted and the leg A turned through an angle so that one wing tip rests in the clinch of the rim and the other is hooked inside the bead on the casing. Having reached this stage the wheel is turned round till the foot of the leg part A comes in contact with the ground, and the plain lever is then socketed into A and rested against the hub cap and on pulling the wheel round against the resistance of the tool the tire simply falls off.

To replace the casing one tip of the wing piece is put in the rim clinch as before, but instead of hooking the other tip inside the bead of the casing it is left *outside*; turning the wheel then forces the shoe back just as it pulled it off in the previous operation. During the replacement the tube and valve must be in place, as the valve is relied upon to prevent the casing standing still while the wheel is pulled round within it.

For use with a wheel that has no hub cap, such as a wire wheel for example, there is a second socket hole in part A so that the plain part C can be put in at right angles and its outer end also brought against the ground so as to give a rigid support against the turning of the wheel. The tool sells for a ridiculously small sum and, being in two parts, takes up but little room; it could be accommodated easily in any ordinary tool kit.—Stewart Accessories Co., Detroit, Mich.

Rebound Check—A new type of rebound check for mounting between the axle and frame of a car is the Parker, which employs the principle of the cam. Fixed to the frame at any convenient point is a bracket bearing a pair of torsion springs, two ends of which are anchored to the bracket. The other two ends are attached to a short shaft carrying a cam, and on this cam is wound a steel chain which is also clipped to the axle. Thus when the car strikes an obstacle the axle rises toward the frame and the torsion springs wind up the chain as it does so. As soon as the axle has reached its top position and begins to descend the springs hold the chain taut and resist the rebound action of the main car spring. The effect of the cam is to proportion the pull of the springs to the range of movement provoked by any shock.—Rupe & Kemp, Muncie, Ind.



Parker rebound check in extended and contracted conditions

Inner-Tube Construction—There are two weak spots in the ordinary tube, one where the two ends of the tube are lapped to make the joint, and the other the inner periphery of the tube, where it lies in the rim. The joint of the ends is weak because increased thickness causes increased heating and also reduces expansibility of the rubber, and the part in the rim is weak because it is not so well supported as are the parts of the tube in contact with the outer casing. In the "American" inner tube an attempt is made to overcome these two defects by proportioning the parts to meet the conditions. Firstly, as regards the joining of the ends of the tube, this is done by a flush vulcanization which does away with the increased thickness, and then to guard against weakness caused by extra stressing of the part in the rim, the inside circumference of the tube is made of double thickness. Thus instead of making up the tube so that its walls are of even thickness, there is an extra bulk of rubber to fill the rim between the edges of the beads on the casing. The effect is that of having a cushion bedded in the rim, but has none of the inconvenience of a loose bit of rubber; also a loose ring to fill the rim would be a nuisance and a danger, too, as it might easily nip the tube.

A feature of the tube is also the nature of the rubber cure employed, this being claimed to render the rubber capable of constant repair, should the owner be unfortunate with punctures. Thoroughly cured rubber of the right quality can be repaired by vulcanization an endless number of times without injury and it is an advantage to have tubes of this class in use, because the time always comes sooner or later when repairs will be needed.—American Tire and Rubber Co., Akron, O.

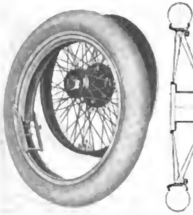
G. R. C. Wire Wheels

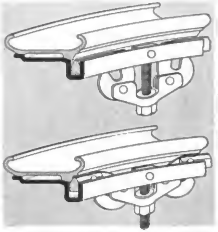
Detachable wire wheels were introduced in Europe largely on account of the use of regular clincher tires which are hard to remove from the rim, particularly in the larger sizes. For this reason, the wire wheel, made detachable, received a royal reception in Europe as it was a means of reducing the labor of tire-changing, one of the most disagreeable drawbacks to motoring. In America, where detachable tires and demountable rims are standard practice, there is not the same reason why additional wheels should be carried in order to carry spare tires.

On a new wire wheel called the G. R. C. the method of attaching rim to wheel, by means of an expanding ring, operated from a single point, cuts down the time required for removing the rim from the wheel to a few seconds. There is less weight to handle in making a tire change on the road, as there is only weight of rim and tire to consider.

Each wheel is permanently bolted to the car and no special device is necessary for carrying spare tires, as any rim carrier now in use will accommodate the spare rim with tire.

The tire-carrying rim is attached to the wheel band by means of an expanding ring located in a groove forming the front portion of the wheel band. This ring engages the front surface of a supporting bead, on the under surface of the rim and the ring is expanded or contracted by means of a toggle device, operated from a single point. The wheel band and ring are assembled as a unit, and when applied to wheels, there are no other parts to be considered except the tire-carrying rim, which consists of a single piece section (either clincher or straight side interchangeable on the same size wheel band) cut transversely at one point; the cut or split being joined together by a clip attached to the under side of rim end on one side of the split, the clip having its opposite end upturned to engage a slot on the other side of the split. When the rim is in its closed position, a swiveled lever engages the clip which locks the rim in its circular shape.


G. R. C. wire wheel


G. R. C. rim lock

The rim is supported around its entire circumference by the wheel band, including the portion at the split, and the ends of the rim at the split are supported and lined up by means of the wheel band and expanding ring, making a smooth joint which cannot injure the tire.

The details are made fairly clear by the illustrations which show the action of locking the detachable rim in place and also the complete wheel. Alongside the latter it will be noticed there is a sectional view showing the spoke arrangement and this is a feature of the design, for it is claimed that setting the spokes in this way gives the greatest possible strength to resist side stresses. The makers of this new wheel are very confident that the slow progress of the wire wheel in America has been due to the marketing of some faulty patterns and that the wire wheel will win out in the end is their belief. Certainly the rim detachment is simple and should be very easy to operate, while there can be no doubt concerning the efficiency of the locking arrangement.—General Rim Co., Cleveland, O.

Catalogue and Pamphlet Review

Rawhide Pinions—These are used a good deal in electric motor drives, though they are not often found on automobiles in these days. A recent circular calls attention to the fact that they are a specialty of—Turley Gear & Machine Co., St. Louis, Mo.

Warning Bell—There are a few people who prefer a bell as a warning signal for automobile use, and in some circumstances it is desirable for special reasons. There is not a very wide choice of such accessories, and it is thus useful to know of a maker whose product is rugged in detail and good in external appearance.—Liberty Bell Co., Cleveland, O.

Folding Tire Pump—This is a short-stroke, large-diameter pump that clips to the running board of the car, and is then operated by a long lever arranged for easy hand manipulation. When out of use the whole pump folds together into very small compass so that it may be stowed in the tool kit very easily.—Eugene Atkins Co., Elkhart, Ind.

Radiator Curtain—A radiator curtain for use in cold weather is no novelty, but a new concern is embarking on the manufacture of a design that is under the driver's control from his seat. The whole thing can be attached without bolts. Briefly, it consists of the application of the spring blind roller to the special needs of the location.—Delaney & Lamothe, Fitchburg, Mass.

Inexpensive Shock Absorber — The value of the ordinary type of spring shock absorber—more properly called supplementary coil springs—is now fully appreciated, and there are many different kinds to choose from. One of the simplest, and also one of the cheapest, is the Pamco, which is applicable to practically any car with a minimum of trouble.—Auto Devices Co., St. Louis, Mo.

Anti-Rattle—Two parts of a car that are apt to rattle when old are the steering tie rod ends and the starting crank. A spring support for the latter and a pair of neat little clips for the former parts are specialties made for Ford cars in special patterns and also in a universal pattern for all other cars. The anti-rattlers for the tie rod utilize a small spring to keep the parts in tight contact and so prevent shaking.—King Specialty Mfg. Co., Brookline, Mass.

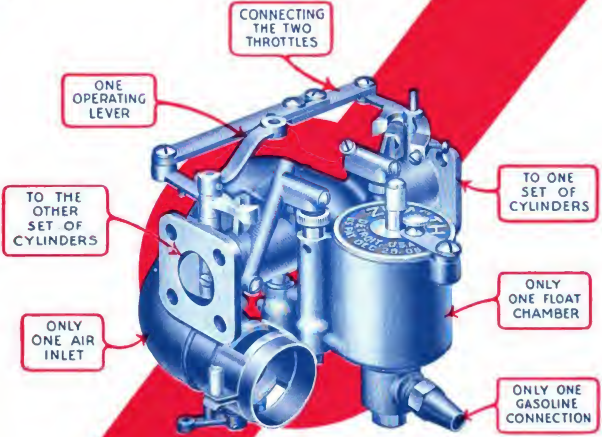
Battery Charging—A simple and inexpensive apparatus for charging ordinary automobile batteries is always useful, for it is sometimes convenient to use the lights on the car for long periods in the evening without running the motor. For users whose homes are supplied with alternating current the "Autrec" is a small rectifier which costs very little, and will give a charging current of about a couple of amperes. It will revive a partially exhausted battery over night.—American Battery Co., Chicago, Ill.

Welding Outfit—The value of acetylene welding for the repair of automobile parts is now an accepted thing, and very many garages are equipped for work of this character. It is sometimes troublesome, however, to choose the details that go to make up a proper outfit and the repairman is liable to find that the cost when he has got everything, exceeds his estimate by a good deal. The "Economy" portable welding outfit has been got together to meet this condition containing every necessary tool for ordinary jobs and is obtainable at a price which the purchaser can be satisfied includes everything he needs except the oxygen and acetylene gases.—Economy Welding Machine Co., Kansas City, Mo.

For Engineers—"Blaisdell Equipment" is a book that ought to be amongst the manuals of every engineer who has anything to do with compressed air, as it is much more than a catalogue of Blaisdell machines. Pages are given to discussion of the uses of compressed air, to the problems of compressor design and to the installation of pipe lines and equipment for dealing with compressed air. There are also useful tables of data regarding all sorts of things, such as the amount of air passed per minute by a round hole, given the size of the hole and the pressure behind it. It is altogether a quite exceptional book of its kind for the useful facts contained in it.—Blaisdell Machinery Co., Bradford, Pa.

ZENITH DUPLEX

For 8 Cylinder Motors


CONNECTING THE TWO THROTTLES
ONE OPERATING LEVER
TO ONE SET OF CYLINDERS
TO THE OTHER SET OF CYLINDERS
ONLY ONE FLOAT CHAMBER
ONLY ONE AIR INLET
ONLY ONE GASOLINE CONNECTION
ZENITH DETROIT U.S.A. U.S. PAT. DEC. 29.08

Due to the innate simplicity of the Zenith and the high quality of its workmanship we are enabled to build this carburetor a true twin in action and performance.

ZENITH CARBURETOR CO.

DETROIT U.S.A.

Fashionable—Yet Inexpensive

The Overland Coupe has the advantages of a limousine without its large cost.

It has that distinction which makes it smart. Every detail of its construction displays taste.

Electric control buttons on the steering column place starting, lighting, ignition and horn controls within natural reach of the driver's hand. Any woman can operate the car.

Comfortable seating capacity for four passengers.

Immediate deliveries.

Catalog on request. Please address Dept 38.

"Made in U. S. A."

The Willys-Overland Company
Toledo, Ohio

Automotive Industries

REFERENCE
West Branch
MAGAZINE LOAN COLLECTION

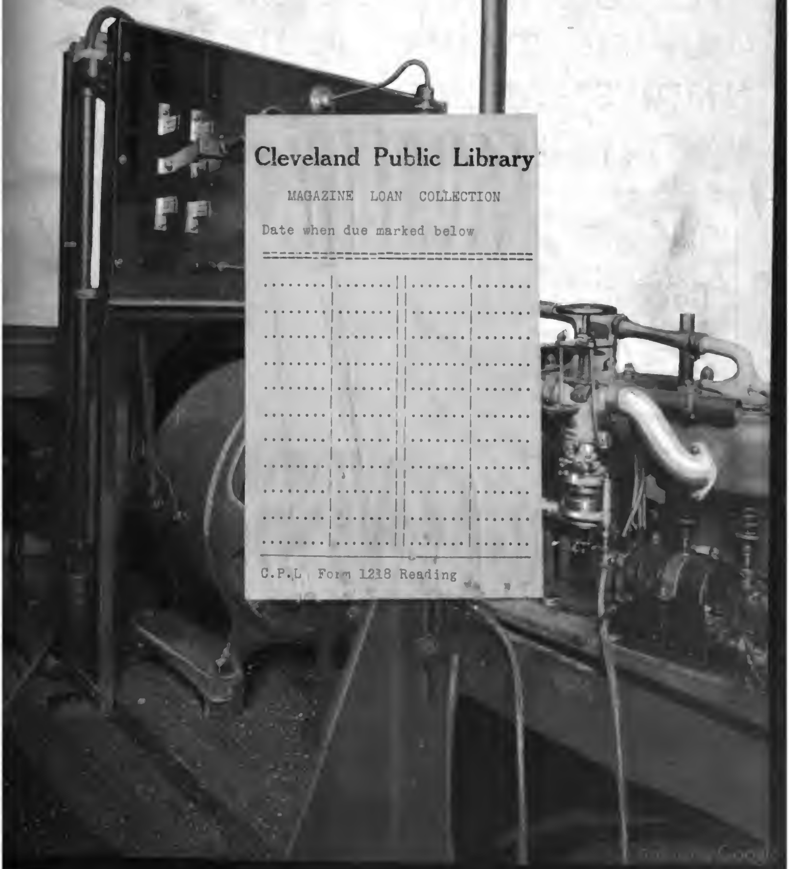
CW

The AUTOMOBILE

APRIL 1, 1915

MAGAZINE LOAN COLLECTION

10 CENTS A COPY



Cleveland Public Library
MAGAZINE LOAN COLLECTION
Date when due marked below
C.P.L Form 1218 Reading

TO THE TRADE

Very often we receive letters from our subscribers requesting the names of manufacturers making cars, parts and accessories.

> Class Journal Co.,
> 239 West 39th St., New York City.
>
> Gentlemen:--I have your publication "Automobile" of January. I wish to take up the sale of American cars, hence would ask you to give me, if possible, a list of houses that are not represented in France or that wish a representative for Southern France, with headquarters at Marseilles. I shall be especially interested to know of houses that furnish trucks capable of carrying 1000 to 2500 kilograms (2200 to 5500 pounds) net load.
>
> If necessary I can give references and bank guarantees.
>
> Also kindly state where I can find your publication in France.
>
> Hoping to hear from you, I remain,
>
> Very truly yours,
>
> (Signed) Name on Request.

These letters will be published from time to time and the name and address of the inquirer will be mailed on request.

This letter from a dealer asking for pleasure car and truck agency for southern France, his bank references are ready—

Are You Interested?

ADDRESS—ADVERTISING DEPARTMENT

THE CLASS JOURNAL COMPANY

239 West 39th Street **New York City**

Vol. XXXII New York—Thursday, April 1, 1915—Chicago No. 13

The AUTOMOBILE

Flint—Second City of Industry

Produced 40,700 Cars in 1914 and Expects to Build 58,400 This Year—Accessories Important

By L. V. Spencer

MAKING an investigation of the position which Flint, Mich., occupies in the automobile industry, reminds one of the type of man, who, though he has accomplished great things and has gained a certain amount of fame in the world, is very quiet and unassuming and does no bragging about it. The stranger would never guess from the information gained from him that he was a prominent personage.

So it is with Flint. Though the city has grown in a few years until it now has a population of over 50,000, and is doing a big work for the automobile industry, it does it all in a quiet way, complacently crediting its growth to the automobile business and annually turning out more motor vehicles than any other city in the world except Detroit.

58,400 Cars for 1915

The estimated 1915 output of the five Flint motor vehicle factories now actively operating is to be 58,400 automobiles. It requires the services of one-fifth of the city's population to do the work of building this volume of automobiles, including the employees of the parts and accessory firms allied with the industry.

The output of cars for the previous season—that is, from the start of the production of 1914 models in 1913 until the end of the 1914 selling year,—was 40,700. Thus in one year, a jump of about 43.5 per cent. is expected if present manufacturing schedules are lived up to.

FLINT'S CONTRIBUTION TO THE AUTOMOBILE INDUSTRY

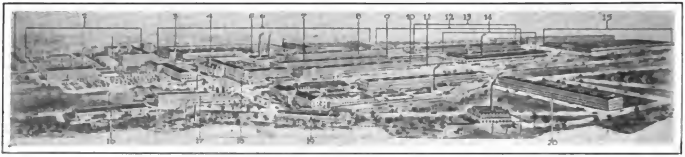
Name	Product	Incorporated
Armstrong Mfg. Co.	Springs	1897
Buick Motor Co.	Automobiles	1904
Champion Ignition Co.	Spark plugs	1908
Chevrolet Motor Co.	Automobiles	1911
Dort Motor Car Co.	Automobiles	1914
Durant-Dort Carriage Co.	Automobiles	1896
Flint Varnish Works	Car varnishes	1909
Imperial Wheel Co.	Wheels	1912
Marvel Carbureter Co.	Carbureters	1908
Mason Motor Co.	Motors	1911
Michigan Motor Castings Co.	Castings	1907
Monroe Motor Co.	Automobiles	1914
W. A. Paterson Co.	Automobiles	1896
W. F. Stewart Co.	Bodies	1898
Walker-Weiss Axle Co.	Axles and hubs	1912
Weston-Mott Co.	Axles and hubs	1906
Total capitalization	$8,850,000	

There are several factors responsible for this increase. The first is the stepping up of production by the Buick company, which will increase its output this year to 42,000 as compared with 33,000 vehicles last year. Chevrolet expects its production total to reach 10,000 for 1915 which is 3,000 cars more than last year. The Paterson company is figuring on a 900-car output, whereas it built practically 700 last season. Then the Dort Motor Car Co. with 2,000 cars planned, and the Monroe concern with a 3,500 schedule, both newcomers, complete the reasons for the prediction of a 43.5 per cent. total increase for the city. At the present time with each factory getting well under way, there seems to be no reason why the new high mark will not be reached.

The Backbone of the City

These automobile concerns, some idea of the size of which can be gained from the above figures and from additional statistics to be touched upon later, together with the parts and accessory plants, are the backbone of Flint today.

In the list of Flint institutions closely allied with the automobile industry will be recognized many names well known to the automobile



Bird's-eye view of the Buick plant, showing such factories as the following: 1, Spark plug factory; 2, body plant; 3, company garage; 4, office; 5, power house; 6, front and rear axle factory; 7; one of the assembly plants; 8, six-cylinder car assembly; 9, finished car storage; 10, assembly; 11, shipping; 12, sheet metal and radiator factory; 13, parts and service departments; 14, drop forgings; 15, motors; 16, paint; 17, springs; 18, machine; and 19 and 20, wheels

fraternity at large. They are: Weston-Mott Co.; Champion Ignition Co.; Imperial Wheel Co.; Marvel Carbureter Co.; Walker-Weiss Axle Co.; Mason Motor Co.; Michigan Motor Castings Co.; Flint Varnish Works; W. F. Stewart Co., and the Armstrong Mfg. Co. The total capitalization of these sixteen car and parts companies is $8,500,000.

Above—Chevrolet plant. The Chevrolet Motor Co. came to Flint from Detroit in 1912 and absorbed the Little Motor Car Co. From an output of 3,500 cars in 1912, the concern has laid plans for a 10,000 output this year. About 560 men are employed

From these facts it will be evident that Flint has attained an enviable position in the industry, and its growth is due to several causes. Originally a center for the making of carriages and wagons, which gained for it the title of the Vehicle City, it was but a natural step for many of the concerns at one time strong manufacturers of horse-drawn vehicles to turn to the making of automobiles and parts when they became a factor in the world's commerce. Some of the factories are still interested in both horse and automobile transportation.

Due to a frank tendency on the part of employers and employees alike to understand one another, Flint is strikingly free from labor troubles. It has pure water, plenty of room for respectable homes for the men in the factories and other features which would naturally attract the workman and the manufacturer.

Right—Factory of the W. A. Paterson Co. in Flint. This firm began making carriages in 1869 and entered the automobile field in 1909. It plans to turn out 900 cars for 1915. Working force is 350 men at capacity. Floor space of the plant is 102,000 square feet

Although Flint was a community earlier, settlement began in earnest in 1836, and the town was incorporated in 1855 with 2,000 people. It is therefore not a very old city, but in its comparatively short career has had lively development. Detroit, some 60 miles away, had been established since 1701 when Cadillac founded it as a trading post, becoming the capital of the Michigan territory in 1805.

Bottom right—Plant of the Monroe Motor Co., a new Flint concern having the same stockholders as the Chevrolet company. It is expected to manufacture 3,500 Monroe cars this year. The plant has an area of 160,000 square feet

Since Flint's industrial activity really began, the manufacture of vehicles has dominated. In 1886 W. C. Durant interested J. D. Dort in the organization that today is one of the largest vehicle-making concerns, operating under the title of the Durant-Dort Carriage Co. Even earlier than this, W. A. Paterson, now prominent in both the car and carriage fields, started in the carriage business. W. F. Stewart also appeared as a carriage body maker and woodworker in the early days.

It is a significant fact that names that are today prominent in the big automobile enterprises of this country run through the industrial history of Flint. Among these are W. C. Durant, C. W. Nash and J. D. Dort.

Beginnings of the Industry

The automobile history of Flint probably dates back to the time when Walter L. Marr, chief engineer of the Buick Motor Co. of today, designed the first Buick, the model B with its two-cylinder engine. Mr. Marr describes this first Buick, which he built some 16 years ago in Detroit, as a regular automobile with pneumatic tires. The beginning of the present Buick organization was on the fourth floor of a factory building in Detroit, where under the imposing name of the Buick Auto Vim and Power Co., marine engines were made under Mr. Marr's design and where this first car was constructed.

In 1904 W. C. Durant became interested in Marr's car, the firm was moved to Flint and the name changed to the Buick Motor Co. The first Buick under the present organization was built that year and before the year was out the then little plant had succeeded in making a total of thirty-seven cars. But the business grew so fast that the second year saw an output of 750 cars, and it was soon discovered that no plant in Flint was large enough to take care of the assembly of the cars. So they sent Marr to Jackson, Mich., to take charge of a plant which was available there. After 2 years in Jackson, this plant was given up, as by that time sufficient factory space had been built in Flint by the ever increasing concern.

The Great Buick Plant

Today the plants of the great Buick organization give employment to 5,000 or 6,000 men. The total number varies. For instance, on February 22 there were 5,329. At this time the number is greater than usual, due to the stepping-up of production.

There are now eighteen factory buildings in the Buick plant, and they cover over 56 acres. The total value of the machinery equipment comes to $2,417,580. Buick is now well along towards the final stretch in its year's schedule of 42,000 cars, some 35,000 having been produced to date. In all probability the production for 1916 will approximate 60,000 machines.

Upper—Factory of the Marvel Carbureter Co., 70 per cent. of whose output goes to the Buick company. During the last 5 months of 1914, and January, 1915, 35,000 carbureters were produced

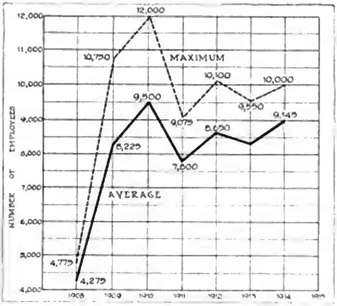
Lower—Mason Motor Co. plant. Started in 1911 with 150 men and built 1,500 motors the first year. Now employs 475 men and plans to manufacture 12.000 engines for 1915

The Buick company of today is strictly a General Motors property, that organization owning all of the stock. It was in 1908 that the holding company, the General Motors, began acquiring its stock, although Buick may be regarded as the nucleus for the entire General Motors Co., Mr. Durant being instrumental in bringing about the transfer.

The bird's-eye view of the Buick plant appearing at the top of page 570 gives a fairly good idea of the extent of this tremendous industrial organization. To gain a conception of some of the buildings going to form this plant let us take a few of them up briefly:

The general office or administration building 104 by 56

Plant of the Weston-Mott Axle Co., which ranks second to Buick among the Flint concerns. It has 380,000 square feet of floor space, employs 1,490 men and makes 300 sets of front and rear axles per day



Showing rise in number of employees in Flint automobile and accessory plants since 1908. 1910 was the boom year

feet is three stories and basement in height and contains 17,472 square feet of floor space. The average number of employees in this building is from 200 to 225, the payroll approximating $8,750. All manufacturing and selling business is conducted here and the officers and department heads have their offices in this structure.

The general machine shop where complete transmissions are produced and containing a wood and metal pattern shop, experimental and engineering department and chemical and physical laboratories is 349 by 268 feet with floor space of 226,750 square feet. From 900 to 950 men are employed, the payroll averaging $34,149.

There are three final assembly buildings. One of these is three stories high, 74 by 750 feet and containing 168,600 square feet. Average number of men employed 350 to 400 payroll being nearly $15,000. Another is three stories, 74 by 800 feet with floor space of 177,600 square feet, employs 300 men with a payroll exceeding $16,000. The third assembly building is three stories, 74 by 758 feet with a floor space of 168,600 square feet.

The shipping department has a floorspace of 85,800 square feet being 211 by 308 feet. Average number of men employed is 165 to 200 and payroll averages nearly $6,000. This department has a record of loading 237 automobiles in a day.

The drop forge plant contains 85,400 square feet, has 215 machines worth $292,000 and employs 250 to 300 men with a payroll of $25,000.

The motor manufacturing building is 360 by 782 feeet giving an area of 278,460 square feet. There are 683 machines worth $804,130 in this building and 1300 to 1450 men are employed with a payroll of $74,290 per month. It has a capacity of 250 motors per day. The motor testing room contains 200 testing benches.

Service and sundry stock, body priming, top building and central factory storage departments are contained with the officers of the works engineer and electrical engineer in a building 74 by 782 feet with floorspace of 173,000 square feet.

Table Showing Growth of Flint's Assessed Valuation

1909	$14,418,960	1912	$24,569,228
1910	20,105,886	1913	33,902,697
1911	23,555,106	1914	40,000,000

The longest building in the group is 1,110 feet and contains 166,800 square feet. In this building are located the brass and aluminum foundry, the sheet metal and radiator factory and the enamelling department.

Motor casting department is 70 by 526 feet with two wings 80 by 170 feet, giving an available floorspace of over 65,000 square feet. Between 325 and 350 men are employed, the average payroll being $9,000.

The four story body-building plant has 121,800 square feet and the equipment consists of 140 special machines worth $88,000, and from 650 to 700 men are employed, the payroll being $40,000 per month. From 250 to 300 car and truck bodies are produced daily.

In addition to the buildings mentioned are power plants, company garage and other structures which go to make up the tremendous total.

It was probably the great success of the Buick that encouraged other business men to pin their faith to the automobile industry in Flint. Some of the vehicle and vehicle parts concerns which had long been established added departments for the building of automobile products as the demand grew and as they saw openings which they could fill.

Weston-Mott Co.'s Growth

The Weston-Mott Co., second largest of Flint's industries, and employing 1,490 men with an output at present of 300 to 320 sets of front and rear axles and hubs per day, was originally started in Utica, N. Y., in 1884, the early days of the bicycle. In 1905 the company was approached to establish a Michigan factory and as the limit of the Utica works had been reached, it was decided to leave it altogether and to build a modern factory in Flint. Accordingly, the concern was incorporated in 1906 under Michigan laws for $1,500,000, and in 1907 a factory of 60,000 square feet was completed. But this was soon outgrown, and expansion was in steps of size equal to the original buildings until 180,000 square feet had been acquired. Today, the Weston-Mott plants have a total floorspace of 380,000 square feet, and it is utilized to make one product—axles and hubs for motor cars. In 1909 about 25,000 sets were built, while some 75,000 sets will represent the factory this year. The concern has developed a highly specialized heat treating department and goes exhaustively into the engineering end of its business. Weston-Mott is now entirely a General Motors property, as is the Buick.

Champion Ignition Co. History

The Champion Ignition Co., one of the foremost in the country in the manufacture of spark plugs, was started in Flint in 1908. Previous to that time, Albert Champion, its founder, had been in the ignition business in Boston, managing the Albert Champion Co., importer and manufacturer. His first connection with spark plug importation really dates back to 1904. Mr. Champion, in forming the Flint company, associated himself with A. Schmidt, an authority on ignition, and B. deGuichard, also expert in such matters.

The Champion Ignition Co., now manufacturing more than 9,000 plugs per day, imported its porcelains at first, but in 1910 added a complete porcelain making plant, many of the processes of which are held secret, due to the extreme accuracy attainable by them and to the special form of clay resulting. With the advent of the high speed engine, Mr. Champion devised a new process for the making of plugs to care for metal expansion at the time of assembly, and thus do away with leakage which is a fault that this type of engine will soon bring to light. These new plugs were put on the market in May, 1914, and have met with success.

Armstrong Develops Springs

The J. B. Armstrong Mfg. Co., commenced operations in Flint in 1889. The company was, in reality, an offspring of the J. B. Armstrong Co., Ltd., of Guelph, Ont., which concern has been engaged in the manufacture of carriages, carriage springs and axles for many years previous in the Canadian city. The company's product met with considerable favor in this country, and after the death of J. B. Armstrong, the company was incorporated under the Michigan laws by his son, R. T. Armstrong in 1897. The Armstrong company's original factory burned in the winter of 1899, and a new factory was erected in 1900. The present site, which is within a stone's throw of the mammoth Buick factories, was built a number of years later. At the start of the automobile business, the Armstrong concern gave much time and attention to developing springs suitable for automobiles, and in 1908 ceased the manufacture of carriage springs entirely. Realizing that the automobile trade demanded a much better spring that the carriage trade, the company added a heat-treating department to the original factory in 1911. The concern's sales at the present time total approximately $750,000 a year, and it gives employment to 175 men with an average weekly payroll of $3,500.

The Imperial Wheel Co. is another concern which started business in Flint to make products other than those required by the automobile. It commenced operations in 1904 in the building of vehicle wheels. In 1908, automobile wheel manufacture was added, and 3 years ago a new corporation bought this branch of the business, moved into a new plant fitted largely with new machinery, and since then capacity has been added until today 125,000 Imperial wheels for automobiles are made per year. The concern has southern connections for the supply of hickory wheel stock, no other wood being used. The present number of employes varies from 250 to 300.

Paterson Enters the Field

The W. A. Paterson Co. has long been a factor in the industrial growth of Flint. It was back in 1869 that W. A. Paterson first started carriage making, continuing this business vigorously until 1909 when, to keep abreast of the times, the making of automobiles was undertaken. That first year, only sixty-four Paterson cars were built, but the following year their manufacture was extended with the result that some 450 cars were made. The 1915 output will be close on to 900, it is said. The Paterson factory buildings have a total of 102,000 square feet of floor, and when working to capacity about 250 men are employed.

Michigan Motor Castings' Appears

The Michigan Motor Castings Co. was organized in 1907 as a foundry making gray iron castings for automobile parts. The plant has more than doubled in size since its beginning. While some extensions were made in 1908, it was during the following year that practically 180 feet was added to the foundry length, and also 83 by 180 feet for the core room and 82 by 185 feet for the cleaning department. The present floor area totals 61,220 square feet.

The concern was first organized by some Detroit men and the one important change in the organization was when the plant was sold to the General Motors Co. in 1909. In the early days of the business, 25 to 30 tons of metal were melted per day and that was considered a good output.

But it has been gradually increasing during the past 5 1-2 years, so that now the daily average is close to 55 tons. Up to 2 years ago the concern made castings for Cadillac, Northway, Buick and several others, but since 1913, Buick has taken the whole production.

Marvel Carbureter Plant

Flint is also the home of the Marvel Carbureter Co., which is now supplying all the carbureters for Buick, Oldsmobile and Oakland. It began business in 1908 and has an incorporated capital of $50,000. The output this year will be 65,000 carbureters, of which the Buick allotment is 70 per cent. The concern operates with about 110 men.

Growth of Number of Employes in Flint's Automobile Industry

Year	Average	Maximum	Year	Average	Maximum
1908	4,275	4,775	1912	8,650	10,100
1909	8,225	10,750	1913	8,300	9,550
1910	9,500	12,000	1914	9,145	10,000
1911	7,800	9,075			

Stewart, Body-Builder

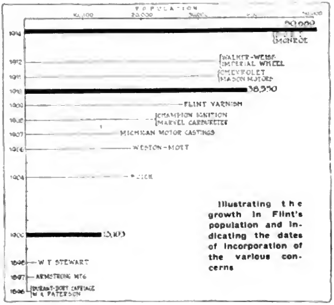
The W. F. Stewart Co. is one of Flint's old-timers which is just now getting into the automobile line strenuously. Organized in 1880 and incorporated for $100,000 in 1898, the concern has built only carriage bodies up to 1914, and during last year devoted only part of its attention to this field. Some 5,000 bodies were turned out, however. Now, with a force ranging from 375 to 400 men, Stewart bodies are to be built to the tune of 25,000 a year, carriage and wagon body business being abandoned. A large percentage of these will go to Buick, while Paterson and some outside manufacturers will take the rest.

The Value of Varnish

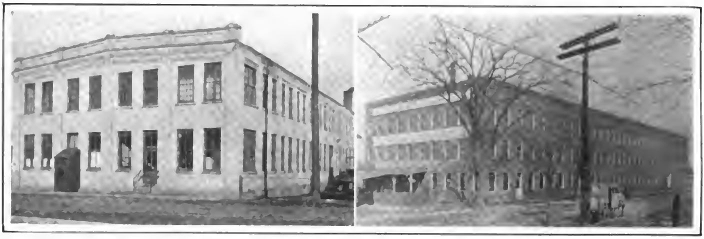
The making of varnish is not usually associated with the automobile industry as an accessory. Nevertheless, the Flint Varnish Works is a concern which specializes in varnishes and body colorings for the automobile trade. It takes up the car manufacturer's problem from the painter's standpoint, advising the number of coats to use, the kinds of finishing varnishes, and so on. The Flint Varnish Works began in a small way 6 years ago, doing business with the Buick company. That business extended until for several years now, the concern has been furnishing all the paints, enamels and varnishes used not only by Buick, but all the other General Motors properties as well, with the exception of Cadillac. There are 130 men in the factory and seventeen in the sales force. With a production last year considerably over the $1,000,000 mark, the plant is exceedingly busy. It measures 120 by 426 feet, is four stories high and is valued at $389,000.

12,000 Mason Motors for 1915

The Mason Motor Co., building motors exclusively, will this year build 12,000. It was incorporated in 1911 with



Illustrating the growth in Flint's population and indicating the dates of incorporation of the various concerns



Left—Champion Ignition Co. plant. Has been in business since 1904. The company makes the porcelains from raw clay. Right—Plant of the Imperial Wheel Co., which commenced in 1904 and began making automobile wheels in 1908. It employs 250 men and makes 125,000 wheels per year

$100,000 paid in, employed 150 men and built 1,500 motors that year. The second year, 3,500 engines went out from the plant. In 1914, this production was doubled. The Mason company now employs 472 men, and its product goes principally to Chevrolet, to the new Monroe company and to the Dart Motor Truck Co., Waterloo, Ia. Its buildings are valued at $65,000, and its equipment runs to $145,682.

Launching the Chevrolet

It was on October 30, 1911, that the Little Motor Car Co. was incorporated to do business in Flint with a capital stock of $1,200,000. Soon after that, on November 8, 1911, the Chevrolet Motor Co. was launched in Detroit with $2,500,000 capitalization. On September 1, 1912, about a year after the Little company was begun, the Chevrolet plant was moved to Flint and absorbed the Little, starting active manufacture in the same plants.

While in Detroit about a year, Chevrolet turned out some 500 cars, but the output took a jump to 3,500 the first year in Flint, stepping from that figure to 7,000 a year later. The plan for this year is to build 10,000. The plant gives employment to 560 men, and covers 8 3-4 acres, with a valuation of $667,000. Chevrolet also has plants in Tarrytown, N. Y., and New York City.

In 1912, F. J. Weiss, an old Flint Axle man; W. T. Walker, then assistant general manager of the Weston-Mott Co., and C. H. Bonbright, former sales manager of the Durant-Dort company, formed the Walker-Weiss Axle Co., whose output the first year, with sixty men, was from 5,000 to 6,000 sets of axles and hubs. Now, with 200 employed, the annual production is 20,000 sets in a plant that has doubled in value since the beginning.

Dort and Monroe the Latest

The first of this year, Flint received a new industry in the Dort Motor Car Co., which has a capitalization of $500,000. Its officers are all identified with the Durant-Dort Carriage Co., with which it is closely related. They are: J. D. Dort, president; D. M. Averill, vice-president and general manager; F. A. Aldrich, secretary and treasurer; J. D. Mansfield, sales manager; Etienne Planche, engineer. Regular production, which will be carried on in the Durant-Dort works, will start in April, and the schedule calls for 2,000 cars.

The other newcomer in Flint's growing list is the Monroe Motor Co., whose stockholders are the same as those of the Chevrolet, although the management is separate. R. F. Monroe is the president and general manager, W. C. Durant is vice-president, Curtis Hathaway is secretary, and A. G. Bishop, treasurer. The capitalization is $250,000, and the first year's contemplated output is 3,500 cars. The organization was effected on August 1, 1914, and now the concern is getting well under way. It is occupying the same plant that Chevrolet used for the building of its large six-cylinder car, and expects to have about 200 men on its payroll.

These little romances of business in tabloid form tell the story of the growth of Flint. Each industry is making its way in enviable fashion, helping to make Flint the busy industrial center that it is. And just as each has done its part in making Flint, so the growth of the automobile business is responsible for the development of every plant. This great transportation industry has pulled Flint out of the mud onto the boulevard of progress.

Environment and advantages had to be there before the industries could thrive, for, with equable taxes, good schools, plenty of fresh air on all sides, to attract the employes on the one hand, and cheap electric power, good transportation facilities and level-headed city administration to interest the manufacturer on the other, the town was destined to grow.

The organizations of employers and employes, which

Above—Walker-Weiss Axle Co. factory. Employs 200 men, has 45,660 square feet of floorspace and has increased output from 5,000 sets of front and rear axles to 20,000. Lower—Front of W. F. Stewart plant. Up to this year automobile bodies were a side issue and only 5,000 were built in 1914, but now they have been made the main production and 25,000 are planned work together for the betterment of all, have done their part in making Flint a center which is strikingly free from labor troubles. The workingmen's organization is the Flint Vehicle Factories Mutual Benefit Assn. and that of the manufacturers is the Manufacturers' Assn. of Flint.

The vehicle workers' organization was formed that the men might have the advantage of benefit insurance at lowest possible cost. The factories encourage this work and help it along. Since its inception in 1901, the association has paid out $137,480.53 in sickness, accident and death benefits. Its dues are 10 cents a week for a benefit of $1 per day after the sickness or accident has disabled the man for 5 days, and benefits may be drawn for 18 weeks in any 1 year. A funeral benefit of $50 is also included. Dues of 15 cents give the member $1.50 per day under the same conditions, with $75 funeral benefit. But only employes whose pay amounts to $12 a week or more are eligible to this class.

Plan for Aiding Needy Members

Supplementary to the benefits thus derived, and of which 77 per cent. of Flint's factory workers take advantage, the manufacturers' association maintains a plan for aiding needy men who are members of the workers' association. This supplementary help of the manufacturers extends to those of their employes who are still sick and in need of financial assistance after they have received the benefits provided for by their policies in the vehicle workers' association. No fees or other expenses are incurred by the workman in getting this supplementary assistance, and its benefits are: For death or for total disability from sickness from causes covered by certificate of the Flint Vehicle Factories Mutual Benefit Assn. during a period which cannot exceed 104 weeks, $7, $8 or $9 per week, depending upon whether the beneficiary is a single man, or married man with no dependent children, married with one dependent child under 15 years, or married with two or more children under 15 years.

More than 2 years have passed since the supplementary plan was first put in operation, and over $16,000 has been spent to relieve suffering and want—sixty-eight of the plants' employes and their families having been aided.

Flint Appeals to the Workmen

Is it any wonder that Flint attracts intelligent workmen? They are given a chance to live, and are helped through their difficulties by the men who hire them. In return, they give the best service they can, and are a contented lot, on the whole. Such conditions are the foundations of successful manufacturing communities.

As another indication of Flint's growth, consider Uncle Sam's business in the city. From the time the automobile began to make itself known as a part of the city's prosperity, the postal receipts have been growing rapidly, as may be seen when it is shown that in 1903 the receipts were $35,714, but last year they had reached a figure nearly four times that amount, or $128,716.

A Valuation of $40,000,000

Flint was the victim of a slight over-growth in 1910, when somewhat of a boom condition was experienced. The factories expanded a bit too rapidly, as the tables and diagrams of total employed men will indicate. Following that year, business settled back to a sound basis, real estate values and other values which had been somewhat bloated got their bearings, and Flint started in on a steady and healthy growth. This will be brought out by an analysis of the various figures herewith. Flint cannot fall back now as it did then. Its foundations are now laid sanely and securely, and only the most unheard-of conditions could now cause a slump.

Flint today has an assessed valuation of about $40,000,000. It has two steam railroads for its shippers, and two electric traction lines. Its 1914 bank clearings were $23,985,113.76, through its five banks.

Upper—Factory of Flint Varnish Works, which employs 150 men and whose product last year was valued at over $1,000,000

Middle—Michigan Motor Castings Co. plant, which has an area of 61,220 square feet, 350 employes and melts 55 tons of metal per day

Lower—J. N. Armstrong Mfg. Co. factory, which took up the automobile end of the spring business in 1908. Has 175 men and a $750,000 annual business. Makes motor truck springs

Located an equable distance from all commercial centers of the country, Flint is a modest little city of industrial opportunity.

Testimonial Banquet Given Handley

INDIANAPOLIS, IND., March 27—A testimonial banquet to J. I. Handley, president of the Mutual Motors Co. and the Marion Motor Co., held at the Columbia club here, brought together about seventy-five of the most prominent men of the city to give Godspeed to the guest who is to leave the city to take up his work with the Mutual company at Jackson, Mich. C. A. Bookwalter, ex-mayor of Indianapolis, acted as toastmaster, introducing Lieutenant-Governer O'Neill the first speaker. The lieutenant-governor spoke of the tremendous resources of Indiana and their effect upon the automobile business of the city and state and praised the men in the industry for their good work under trying conditions.

Mr. Handley in his parting words to the men who have stood by him during his ups and downs, could not speak too highly of the bankers of the state who, he stated, did more for the automobile industry in Indianapolis than we believe. "The bankers lost money on the deals with many car concerns, but, despite the losses, which were heavy in many instances, they cheered us up and asked us not to quit but to come back for more because they were back of us. When the Marion company lost about $250,000 in the flood 2 years ago, the bankers stood by to see the company again on its feet."

INDIANAPOLIS, IND., March 27—W. D. Oakes, president of The Oakes Co., manufacturer of automobile accessories, has been elected general secretary of the Indianapolis Chamber of Commerce, of which F. I. Willis of the Hearsey-Willis Co. and a director of the Indianapolis Automobile Trade Assn. was recently elected president.

Car and Truck Sales in Southwest Gain 64.2% in 3 Months

$90,000,000 Grain in Bins of Farmers in Mississippi Valley Still Untouched—Horse and Mule Buying Increases Car and Truck Demand—$300,000 in Trucks in 3 Months—Crops in Fine Condition—Money Plentiful

KANSAS CITY, MO., March 27—The answer is coming every day to the standing question in the automobile industry as to just what bearing the enormous wheat crop of 1914 with its war prices will have on the sale of cars in the big grain states of the Mississippi valley. With the first 3 months of 1915 gone, it is possible to arrive at conclusions based on actual figures.

Alarmists have freely predicted that the farmers, to whom the bulk of the low and popular priced cars have been going, would quickly come to the end of their rope as the result of such a huge investment in a so-called luxury. They pointed to the fact that Kansas—always a weather vane in the grain states—had on January 1 of this year 50,467 automobiles, representing a total investment estimated at $40,363,200. This allows an average price of about $800 per car, which appears conservative when it is figured that of the 15,000 Fords in the state, many were bought at a higher price than prevails this year on the same make.

Returns on Car Investment

These men asserted that this money should have gone into wealth-producing investments, although the farmer gets 10 per cent. pleasure out of his car and 90 per cent. business where the average city man just reverses the proposition. However, what the automobile returns to the farmer on the investment is another story. The distribution of cars indicates that the farmer is buying cars more heavily this year than ever, instead of using his wheat money to pay debts brought on in the past, in so-called motor dissipation.

Business 64.2 Per Cent. Better

To get quickly to the point, the deliveries of low and medium priced cars in the southwest, as shown by the figures of factory branches and distributers in Kansas City, prove an increase of business the first 3 months of 1915 over the same period of 1914 of 64.2 per cent.

This takes into consideration that conditions in March this year were unusually bad for deliveries. Figures secured from the branches and agencies here, it may be mentioned, represent deliveries, not sales for future deliveries. Differences in territory and changes in territory, besides the closing of some agencies and the opening of others, make it difficult to make tabular comparisons. In many instances, too, it was impossible to secure the exact figures on deliveries unless the name of the manufacturer was omitted. In order, therefore, to secure figures without exaggeration, in some instances these names will be withheld. Among the cars represented in arriving at the percentage of increase of business are these:

> ¶ *This is the second of a series of monthly industrial reviews on conditions in the southwestern territory embracing such states as Kansas, Missouri, Nebraska and Oklahoma, which comprise an important section of the Mississippi Valley, one of the greatest grain-producing regions in the world.*
>
> ¶ *Higher grain prices and an unprecedented demand for horses and mules for the European armies render this region particularly important as an automobile and motor truck market this spring.*
>
> ¶ *The author is one of the most widely recognized authorities in this territory, having watched the progress of these states for 25 years while in daily contact with their leading financial and industrial movements*

Ford—Figures on Kansas and western Missouri.

Overland—Kansas, western half of Missouri and northern Oklahoma.

Buick—Kansas, western tier three counties of Missouri.

Studebaker—Kansas, Oklahoma and western half of Missouri.

Maxwell—Kansas, Oklahoma, Arkansas, Louisiana, Texas, New Mexico, Wyoming and western half of Missouri.

Reo—Kansas, Oklahoma and western half of Missouri.

Chevrolet—Kansas, Oklahoma and western half of Missouri.

Chalmers—Thirty-five counties in Kansas and twenty-six in Missouri.

Hudson—Eastern half of Kansas and western half of Missouri.

Jackson—Kansas, Oklahoma and western half of Missouri.

Abbott-Detroit—Missouri, Kansas and northern half of Oklahoma.

Paige-Detroit—Kansas, Oklahoma and western half of Missouri.

Peerless—Kansas and western half of Missouri.

Marmon—Kansas, Oklahoma, western half of Missouri.

Packard—Kansas, Oklahoma and western half of Missouri.

Pierce-Arrow—Kansas, Oklahoma and western half of Missouri.

Locomobile—Kansas, Oklahoma, Texas and western half of Missouri.

This list gives a comprehensive idea of the cars and territory upon which the figures are based. Inasmuch as the low-priced cars and popular-priced cars represent farmer sales more largely and the higher-priced ones city deliveries, the Packard, Marmon, Locomobile, Pierce-Arrow and Peerless have been placed in one group and the lower-priced cars in another.

Fords Increase 98 Per Cent.

Ford deliveries in Kansas and western Missouri in the first 3 months of 1915 are given as 6,000 cars, which represents an increase of 98 per cent. The Ford cars in Kansas number almost three-tenths of all the cars in the state and the percentage will hold fairly well throughout the Mississippi valley.

Studebaker shows a delivery in January, February and March of 488 cars, 52 1-2 per cent. increase.

Overland, which has been a popular car in this region, gives some interesting figures, its increase of business in 3 months being 83 per cent.:

Deliveries	1914	1915
January	14	112
February	84	149
March	140	175
Total	238	436

Maxwell, with its great range of territory out of Kansas City, shows the delivery of 2,300 cars in 3 months of 1915, an increase of 500 per cent.

The deliveries of Reo and Chevrolet are combined in figures for 1914 and separated this year because of a change in dealers, but with a slight change in territory, the increase is estimated at 120 per cent.

Then taking in some of the smaller agencies and some of the others like Buick, which shows an increase of 50 per cent. with deliveries held up in 1 month, the average of increase in business is estimated at 64 per cent. The four largest companies show an increase of 68.7 per cent. While this is an average on percentage, it must be borne in mind that one of these companies does a business in this district estimated at three-fourths of all cars sold. Taking this in view, a really closer estimate would be 74.2 per cent.

High-Priced Cars Sell Steadily

The Marmon, Locomobile, Packard, Peerless and Pierce-Arrow, placed in one group, show an increase in the first 3 months of 1915 of 66.1 per cent. over the same period of 1914. This, however, is not a fair average because of the 200 per cent. increase of business in the Kansas City branch of the Marmon company. This company in 1914 sold very few cars in this territory. However, last fall with an entire change of representatives at the branch, better results have been achieved. Only one of these cars shows no increase of business, while the other three, which are the largest sellers of the five high-priced cars mentioned, show an increase of 49 per cent., which represents a steady growth under normal conditions.

$300,000 in Trucks in 3 Months

The first 3 months of 1915 show a gain of 50 per cent. in the deliveries of trucks over the first 3 months of last year. The estimate placed on deliveries in Kansas and the western part of Missouri in the 3 winter months this year has been $300,000. Of this number, trucks worth $65,000 have been delivered in Kansas City.

The winter demand is a new thing here. Usually the truck dealers have settled back for a rest from December to March, but the inquiries commenced coming in this year in December and the sales of January, February and March are 50 per cent. greater than any previous year. One dealer has doubled his selling force and has sold forty-nine trucks, where the same period last year brought only nine sales. He has been in the business in this city 7 years and his conditions are exactly the same, except for the new salesroom.

A new demand is that for 1-ton trucks for jitney buses. However, the call from business concerns, hauling companies, has also increased and now the farmers are sending in many inquiries regarding trucks and are buying some for farm use.

Light Trucks for Jitney Work

The light truck seems destined to have a great use for inter-city jitney service. The motor bus which can haul passengers and some baggage and light freight is being asked for and it is predicted that regular routes will be established wherever the roads will permit in Missouri, Kansas, Oklahoma, Texas and Nebraska. Twenty-five trucks have been sold for this purpose in the last 6 weeks and they are growing in favor for city use instead of the rebuilt light pleasure cars.

Farmers Buying Trucks

The demand from the farmers for trucks is practically new. There are a few in use in Kansas and Missouri for hauling feed and for general use about the farm but quite a number are being used to replace driving teams. A 1-ton truck hauls the produce to town and hauls back feed, flour and supplies, serving as a semi-pleasure vehicle at the same time. The dealers are handling inquiries from the farm with a view of developing this sort of demand.

In accounting for the heavy sales which usher in 1915, Estel Scott, president of the Kansas City Motor Car Dealers' Assn., assigned several reasons:

One, of course, is the record-breaking crops of last year and the encouraging prospects for another big wheat crop this season. The high price of lead and zinc has made the mining district of Southwest Missouri and Southeast Kansas heavy buyers.

Also, the low price of gasoline and the high price of horse feed have helped the truck business. In addition to this a foot of snow that came the first of March, demonstrated the superiority of trucks over teams in a trying time.

Few Horses—More Trucks

But greatest of all the influences that is creating a demand for trucks and touring cars as well and just beginning to be felt, is the shortage in horses. A revolution is taking place in the truck business and a few months will see a condition that the motor truck producers have wanted but none dared hope for.

The British army has been buying liberally of horses in this section since Europe has been at war and the French have been fairly large purchasers too, but only the last few days have horse and mule buyers begun to realize what the demand is. A few days ago Thompson & Robinson, horse and mule dealers here, closed a contract with the French government for the immediate delivery of 26,000 head of horses. One day, March 20, forty-seven carloads left Kansas City for New Orleans. A contract is pending with the Belgian government for the delivery of 20,000 head. And if this does not mean sales of trucks and touring cars, listen then to the extremities to which the horse dealers are put in gathering horses to fill their orders in Kansas City, the second largest horse and mule market in the world.

When the foreign army officers first began buying horses and mules in this market, they segregated the animals and conditioned them with vaccination and other means. That has been abandoned in the rush. The animals are shipped immediately to New Orleans or Newport News. A fleet of ships is now waiting at Newport News to convey them.

And Missouri, Kansas, Oklahoma, Nebraska, Colorado and the Dakotas literally combed for horses for the British, are to be finecombed now to supply the French 26,000 head more. If the pending contract for 20,000 horses for the Belgian government goes through the demand will be still more urgent.

$12,000,000 for Horses and Mules

Approximately 60,000 horses and mules, valued at $12,000,000, have been purchased in the states mentioned since September 1 and have been marketed through Kansas City to the British. The desirable cavalry type were soon exhausted and the rule that all horses must be under 7 years of age was soon abandoned. Also the price has gone up from $25 to $35 a head since September.

For more than 2 months the British have been buying only artillery horses for which they pay around $225. The farmer gets from $160 to $185 for these animals. The type is the general utility farm horse, weighing from 1,200 to 1,400 pounds, up to 12 years in age, and a wire cut or a small blemish does not disqualify. The smooth-mouthed horse, whose teeth indicate he is over 9 years old, is going now if he has good short teeth.

The British are also buying mules for artillery purposes and are having to pay a little more for them than for the horses.

In getting the horses for the French contract, the efforts will be confined to the states already covered by buyers from Kansas City. The other districts of the country have been gone over as thoroughly as this and the scarcity of horses is general.

United States and Italy Buy Horses

The Italian government is now vieing with the United States government in purchasing young horses. Recently in Grand Island, Neb., the Italian buyers bought a lot of Spaghettis. These are horses 3 and 4 years old, and many of them unbroken. Branded western horses of this age, and so wild that they could not be handled except with a lariat, brought $100 to $110 apiece.

The United States army is also buying an exceptionally large number of young, unbroken horses true to type. These are being put on the government ranches at the remount stations. The action of this government is believed by horsemen to mean that the United States army fears a horse famine and is trying to stock up.

The scarcity of draft animals is beginning to be felt in the cities because of a movement to stock up in advance of higher prices. Teams suitable for brewery and packing house wagons are selling as high as $600.

Crop Conditions Excellent

The month of March has shown improvement in the condition of the winter wheat crop now in the ground. The great winter wheat crop states are Kansas, Nebraska, Oklahoma and Missouri. These states represent 44 per cent. of all the winter wheat acreage in the United States. These states show a percentage of 108 for area sown as compared with

1914. The spring wheat of Nebraska and the Dakotas, of course, will not be sown until next month, but these states, like the southwest winter wheat states, have had great supplies of moisture in the ground this summer. The winter wheat states show an average condition of 85 per cent. last December by the Department of Agriculture reports. It is believed the forthcoming report will show a condition above 90 per cent., which is exceptional.

Only the extreme western counties of Kansas have failed to show a decided improvement in the condition of the crop that will buy automobiles in the fall of 1915 and the spring of 1916. As a rule the March winds expose the roots of the wheat and much damage results, but March this year has been almost without wind and no damage has resulted.

Very little of the 1914 winter wheat crop, which has been in farmer's bins last month has been moved in March owing to the condition of the roads. The writer estimated in THE AUTOMOBILE last month the winter wheat still held on the farms—and representing surplus available for automobile purchase—to be less than 20 per cent. of the crop. The Department of Agriculture bulletin, published March 4, gave its estimate at 17 per cent. So apparently the heavy purchases for the winter months of automobiles has not yet touched this surplus wheat of which there is nearly $90,000,000 worth still in the farm bins of the southwest.

Corn Has a Good Start

While the wet March will make the starting of farm work late, it will leave the ground full of moisture in the corn belt, which means great things to the farmer. The cattle quarantines in the west, while disquieting, have not demoralized the stock in any sense of the word. The government is taking vigorous steps to stamp out the foot and mouth disease. It is bending every energy to keep the disease off the big ranges because it is feared that if it gets started there it will travel on account of the absence of fences. The action of the western states in uniting with the federal government to pay for all stock killed as a result of finding the disease has caused every farmer to be on the alert to detect the first symptoms so the government can act. The payment by states for slain cattle, too, has made the farmer continue to handle cattle that he would not otherwise risk doing. This situation need not cause any alarm about general prosperity in the west.

Banks Full of Money

The money market of the grain states shows money easy for strictly commercial purposes. The bank deposits in Kansas City, as representative of the western states, showed an increase in the last bank statements, March 4, to $122,000,000 against $110,000,000 last December and $106,000,000 a year ago. The business man with products in course of marketing, and this applies to the farmer, has little difficulty in getting money, though there is little cash for building enterprises, etc. However, farm loans and real estate loan money is plentiful and there is greater demand for this paper than there is for the loans. The banks March 4 showed loans $1,000,000 less than last December. Since March 4 there has been a slight decrease in deposits, due to the farmer's inability to market his products over muddy roads.

Critical Days for Jitney

These are critical days for the jitney. In Kansas City, the city Democratic administration, closely tied to the Metropolitan street railway company, is trying to put through the city council an ordinance with these jitney-killing provisions:

A $5,000 to $10,000 bond; a 15-minute schedule; $5 to $10 a month according to the number of passengers; must get special permission from the park board to cross or use boulevards; must get special permission from the board of public works to use streets.

The whole, of course, is prohibitive and warranted to put the jitney out of business. The proposed ordinance is now before the council committee. At the first meeting of the committee there were 300 jitney sympathizers present and labor was there to protest the methods being taken to deliver the town to the street railway company. The motor dealers and the jitney men each had an attorney. Apparently the ordinance will have much modification in the council, but to what extent remains to be seen. The council is divided in two Democratic factions, but each is tarred with the Metropolitan stick. There are about 300 jitney cars operating here, but the ordinance fathered by the city counselor has frightened would-be jitneyists so that the number is not increasing very rapidly at this time. At the last meeting of the council committee, the members of the committee favored a less drastic ordinance.

Automobile Trade Increasing in Texas

AUSTIN, TEX., March 26—From a trade standpoint the automobile situation in Texas at this time is highly satisfactory. This condition is particularly true in the western part of the state where the demand for automobiles is larger than ever before known. Dealers in that region are having some trouble getting their orders for cars filled promptly. In the wheat-growing territory around Amarillo an extraordinary large number of orders have been placed recently. In the territory lying immediately south of the Panhandle, where milo maize and Kaffir corn are the principal crops, an unusually large automobile trade is reported.

There is some little quantity of cotton still in the hands of the farmers of Central, North and South Texas, but the movement of the staple to market has been heavy and steady since last December. The money derived from this source is now in general circulation and while the aggregate sum is by no means as large as it would have been had normal prices prevailed, it is sufficient to keep all lines of business moving to a prosperous degree. In the strictly cotton growing region there has been a large falling off in sales of cars to farmers but the prospects as to this class of trade are brightening daily. Prospects are promising for another good crop season and this adds to the prevailing optimism.

The demand for motor trucks and delivery cars is constantly increasing in the cities and towns and there promises to be a far greater number of sales of these vehicles during the current year than during any previous yearly period in the history of the industry in Texas.

---

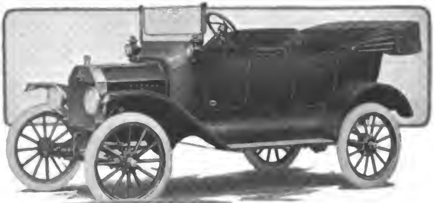
1 and 2-Ton Trucks Popular in England

NEW YORK CITY, March 29—That there is a good market in England now for 1- and 2-ton trucks for regular commercial use, is certain, according to a statement recently made by P. D. Saylor, managing director of the Goodyear Tyre & Rubber Co. of Great Britain, the Goodyear company's European organization. Mr. Saylor, who is now in Akron, O., states that most of the English trucks go to the army and business organizations have a hard time supplying themselves. He also says that the American truck manufacturers should have the best possible representation, or, better still, send their own representatives to handle the business. No pleasure cars have been commandeered by the government, however, despite the demand for any vehicles in truck form.

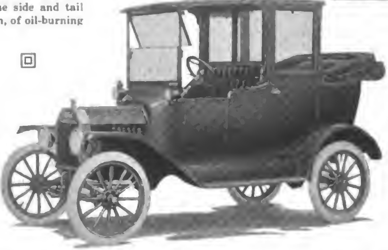
LONDON, ENGLAND, March 24—The American motor ambulance corps operating with the French army has been transferred to the British army. The corps is to be enlarged.

Electric Headlights on New Fords

Pressed Steel Dash, Stronger Windshield, Louvres in Hood—New Side and Tail Lamps and Curved Rear Mudguards—Flywheel Magneto Is Enlarged for Lighting



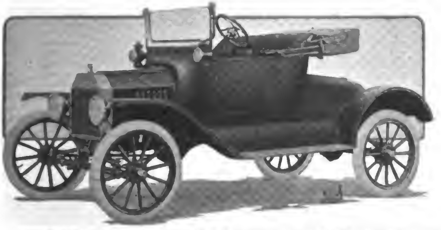
DETROIT, MICH., March 29—Although the Ford Motor Co. has been supplying its new type of roadster, touring car and town car models for a little over a month, no announcement of the new designs has been given out until today. The shipment of these is now quite general to dealers and branches. Changes are principally in the body and appearance, the model T chassis adhering to standard Ford practice with the exception that the flywheel magneto has been somewhat enlarged to take care of the lighting of the electric headlamps, which are now standard equipment. Lighting of the new lamps is through a dash switch. The side and tail lamps are also of a new form, of oil-burning variety. They are more compact and conform better to the body lines.



Switches Under Cowl

The most noticeable change is the incorporation of the pressed steel dash in place of the formerly used straight wood type. The switches and other apparatus are placed back under this cowl, on the dash. Other improvements are in the windshield, which is a stronger and more compact type to fit the cowl, and louvres in the hood to give better ventilation to the engine.

Another noticeable change is in the rear mudguards, which now conform to the curve of the wheels rather than running straight back horizontally from the point of greatest height. These guards are made of heavier metal than the former ones, and their form admits of better bracing against rattle or vibration than with the other type.



New Ford touring car, town car and roadster, showing improved design, comprising pressed steel dash, stronger and more compact windshield construction which fits the cowl and louvres in the hood to give better ventilation to the engine. Note the rear mudguards which now conform to the curve of the wheels instead of running straight back from the top. These mudguards are made of heavier metal than those formerly used and are less susceptible to rattle or vibration. In all models the flywheel magneto has been enlarged to take care of lighting the electric headlamps

The Ford flywheel magneto generates the ignition current, and by increasing the size of its windings, the taking on of the headlight current was made permissible. Heretofore, with the smaller generator, the Ford company did not favor this lighting system, though a number of older models have been so equipped by their owners with apparatus purchased from outside firms. The generated current is alternating, and the lamps are of standard type with focusing attachment and Ediswan sockets.

There is no change in the prices of either model, the roadster listing at $440, the touring car at $490, and the town car at $690.

The town car has been adapted to the new lines of the pressed steel dash and curved rear mudguards. Both this model and the roadster have all improvements found in the touring car.

Eisemann's Train-Dispatcher System

Signal Shows When Tracks Are Clear and Marks Progress of Production Train from Start to Termination—Factory Expanded and New System Installed While Three Shifts a Day Are Working

By J. Edward Schipper

A ROOM is not complete until all the furniture is placed in it. Furnishing the room is like the final assembly of a magneto. Before the furniture can be put in the room it must be made. The manufacture of the furniture corresponds to the manufacture of the smaller parts in the magneto. Again, the fittings for the furniture, such as the castors, the upholstery, the tacks and fastenings, must themselves be manufactured. These correspond to the small screw machine parts on the magneto which must be manufactured before even the smaller groups can be made. Thus it is an alternate process of manufacture and assembly until finally the main groups are made and the furniture is put into the room or the various parts of the magneto joined together to form the finished product.

Production in groups, where each little group is completed and then moved on to form a member of the next larger group, and that in turn goes through the same process until at last the joining together of a few units completes a finished article, is the method that must be followed in the manufacture of an article involving a multitude of small and distinct parts. Such an article is the magneto, and to meet the intricate problem of the inter-weaving of a large number of separate sequences such as is found in its manufacture a well organized system must be utilized in order to avoid chaos.

Three System Requirements

Through an overwhelming number of orders necessitating a new addition to the factory and the necessity for installing a complete new system of production, the Eisemann Magneto Co. has found itself confronted with three simultaneous problems. One—The factory had to expand into the new addition. Two—Production must not be interrupted. Three—A complete new routing and recording system installed.

The plant is working night and day. Three shifts of men and women divide the 24 hours of each week day into equal periods of steady productive work, and yet the new system has been installed, the new factory space is being utilized and production has been not only uninterrupted, but men in various departments have been able to make rapid inroads on work in which they were several weeks behind owing to the deluge of output problems in relatively small space.

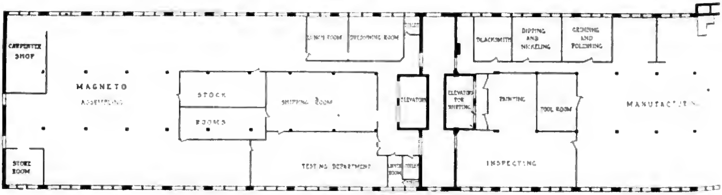
A simple system installed by the Associated Efficiency Engineers has been the oil that stilled the troubled waters of hurried production, and the smoothness of operation which now characterizes the course of an order from the time it enters the offices of the plant until it enters the elevators of the Bush Terminal Co. forms a vivid comparison to the chaotic condition which could exist in the manufacture of several hundred magnetos per day, not to mention the coils and switches and other electrical products turned out by this concern under other conditions.

Orders are carried through on the train-dispatching system. The dispatcher at his desk takes care not to fill the tracks with too many trains of orders. He knows when a train is late, he knows when it is due but has become lost upon some siding along the route, and he knows the cost of carrying the train through from its starting point to its destination. This is done by a two-fold form system in which the production or manufacturing order is first written, and the job order follows.

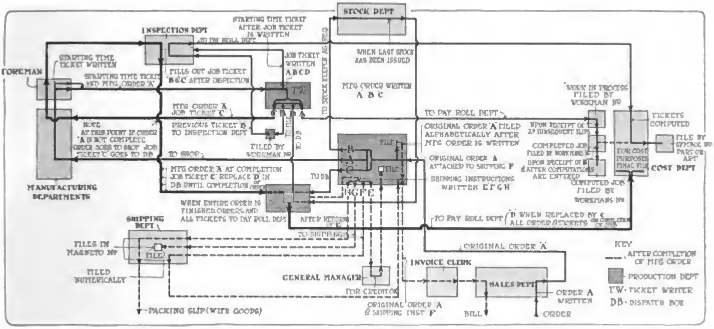
Production Department Is Biggest Factor

The biggest factor in the situation is the production department. When an order comes in for a number of magnetos it has its starting point in the sales department which secures the order. From this point the order is forwarded to the production department, where it enters the hands of the clerk, who starts the entire system in operation. The form first made out is threefold, and for simplicity this triplicate document may be named manufacturing orders A, B and C. A goes to the shop and stays with the goods until they are delivered to their final destination. This identifies the work, and to prevent the loss of the order or its misplacement the form A is placed in a celluloid envelope, and in company with the blueprint of the work and a standard operation sheet provides the workman on that particular job with all necessary information.

B goes to the stockkeeper and forms a requisition upon him for the materials and the tools for the particular job in hand. This is one of the confusion-preventers. Instead of a number of men loitering around the tool department desk waiting for dilatory clerks in this department to fill their



Floor plan of the Eisemann factory which shows the location of the various departments


STOCK DEPT
STARTING TIME TICKET AFTER JOB TICKET IS WRITTEN
INSPECTION DEPT
TO PAY ROLL DEPT
FOREMAN
STARTING TIME TICKET WRITTEN
STARTING TIME TICKET AND MFG ORDER 'A'
FILLS OUT JOB TICKET 'B&C' AFTER INSPECTION
JOB TICKET WRITTEN ABCD
TW
TO STOCK KEEPER AS REQ
WHEN LAST STOCK HAS BEEN ISSUED
MFG ORDER WRITTEN A B C
MFG ORDER 'A' JOB TICKET 'C'
C B D A
NOTE AT THIS POINT IF ORDER 'A' IS NOT COMPLETE ORDER GOES TO SHOP JOB TICKET 'C' GOES TO DB
PREVIOUS TICKET B TO INSPECTION DEPT
FILED BY WORKMAN NO
TO DB
TO SHOP
MFG ORDER 'A' AT COMPLETION JOB TICKET 'C' REPLACE 'D' IN DB UNTIL COMPLETION
TO DB
B A C
FILE
HGFE
MANUFACTURING DEPARTMENTS
WHEN ENTIRE ORDER IS FINISHED ORDERS AND ALL TICKETS TO PAY ROLL DEPT
SHIPPING DEPT
FILES IN MAGNETO NO
FILE
FILED NUMERICALLY
TO SHIPPING
PACKING SLIP (WITH GOODS)
GENERAL MANAGER
FOR CREDIT OK
ORIGINAL ORDER A & SHIPPING INST F
TO PAY ROLL DEPT
ORIGINAL ORDER 'A' FILED ALPHABETICALLY AFTER MFG ORDER IS WRITTEN
ORIGINAL ORDER A ATTACHED TO SHIPPING F
SHIPPING INSTRUCTIONS WRITTEN E F G H
WORK IN PROCESS FILED BY WORKMAN NO
UPON RECEIPT OF 2D SUBSEQUENT SLIPS
COMPLETED JOB FILED BY WORKMAN NO
UPON RECEIPT OF B & AFTER COMPUTATIONS ARE ENTERED
COMPUTED JOB FILED BY WORKMAN'S NO
TICKETS COMPUTED
FOR COST PURPOSES FINAL FILE
FILE BY SYMBOL NO PART OR ART
COST DEPT
TO PAY ROLL DEPT
'D' WHEN REPLACED BY C ALL ORDER & TICKETS ON COMPLETION
ORIGINAL ORDER 'A'
INVOICE CLERK
SALES DEPT
ORDER A WRITTEN
BILL
ORDER
KEY
AFTER COMPLETION OF MFG ORDER
PRODUCTION DEPT
TW - TICKET WRITER
DB - DISPATCH BOX

The above chart shows the plan of the tracks which guide the wheels of progress of work in the Eisemann factory. This is the key to the form system

needs, the order itself is a requisition, and IT IS UP TO THE HEAD OF THE STOCKROOM TO SUPPLY THE MATERIAL FOR THE JOB.

C is the follow-up copy. It is an exact duplicate of A except that it is printed on heavy manila card, and on its reverse side, as shown on page 586, there is a complete form in which cost-keeping records may afterwards be conveniently kept. This is the keynote card of the system in several ways, because it is the form by which the dispatcher keeps tabs on the work. Across the top of the card are printed the numbers 1 to 31, the days of the month. These cards are filed in the dispatch box along with all the other corresponding cards of different jobs, in their proper classifications.

As soon as the order is entered in the dispatch box a dark red signal is clipped to the number corresponding to the date. When the dispatcher's signals tell him that the track is clear and he has forwarded the order through to the foreman of the department which will handle the work he will receive from that foreman a starting time slip which signifies at once that the work is under way. At this moment the dark red signal is replaced by a black signal, indicating that the work has been started on that date.

When the dispatcher is advised by the receipt of a job ticket, hereinafter described, that the work is completed, and before it returns from the factory, another colored signal is clipped to the date that the work is finished. When the work is shipped from the factory the card has finished its useful career and passes to the cost department, where it is filed, together with the cards A and B. When the card C is filled out on the reverse side the information is entirely complete.

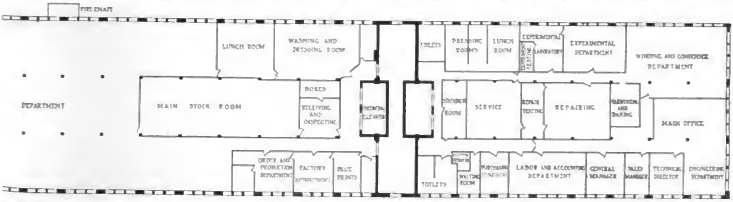
Should the order be specified for a certain date the dispatcher will attach a white signal a few days before the date that the order has to be shipped. In this way delinquent deliveries will be avoided.

Dispatch Box Is Heart of System

THE DISPATCH BOX IS THE HEART OF THE SYSTEM. The dispatcher can tell at a glance by the colored signals just how every bit of work stands. When an order is stationary for a time he knows immediately that there must be some reason for its not moving forward, and it is up to him to find out why. Only when a green indicator is displayed showing that the work is held up for legitimate cause should he tolerate a lack of advancement of the signals as they progress along the row from number to number.

The actual process of manufacture is set in motion by the manufacturing orders described and the starting-time slip. This starting-time slip is the only form that must be made out by the foreman. The workman himself need not have a pencil and need not know how to write. On this starting-time slip the foreman enters the number of the workman to do the job, the number of the machine that it is to be done upon, the starting time of the job, whether the work is to be paid piecework or day work, and the numbers of the operations to be performed, as ascertained from the accompanying standard operation sheet.

In the production department is the ticket writer who, when he receives word by means of the starting time slip



which in connection with the organization chart above, forms the basis of the routing system

Progressive Steps in the Manu Under the Train-

1—Receiving department and inspection of raw stock

2—Small parts manufacture—note good light for detail work

3—Special machinery in the manufacturing department for heavier parts

4—Girls at work in the airy and light armature and winding department

that a job has been started, will write in quadruplicate the tickets which may be called AA, BB, CC and DD. Each set of four of these tickets will be numbered serially and will provide for the date, the workman's number, the part number, the number of hours he works, operation numbers, starting time, method of paying, rate of pay, finishing time, inspector's count, quantity accepted, quantity rejected, cause of rejection, the account to which the job is charged, lost time, overtime and the amount paid.

When these four job tickets are made out the starting-time slip is placed in an envelope and sent to the chief inspector in order that he may know what work is in progress and assign his floating inspectors thereto. These floating inspectors not only examine the set up of tools but prevent wastage in material and labor by seeing that the workman properly starts the job. The destinations of the four job tickets after they have been filled out as far as possible by the ticket writer at the beginning of the job are as follows:

Envelope Picked Up By Messenger

AA goes to the payroll department to be filed in the Work in Process File. BB is filed by the ticket writer in a card index file by workman's number, thus forming a complete record of what each workman has done with his time. CC is inserted in the celluloid envelope, which is picked up by the semi-hourly messenger and returned to the foreman with the order. DD is delivered to the dispatcher and filed in his follow-up file with manufacturing orders C.

It will thus be seen that when card BB is filled by the ticket writer it will mean that the job previous which that particular workman has been engaged upon is finished, and this can be taken from the file and sent to the inspection department, thus notifying this department that this particular work is done and must be inspected at once.

The messenger service which has been briefly men-

facture of Eisemann Magnetos
Dispatcher System

5—Inspection department—note use of standard stock boxes

6—Final assembly on stands specially prepared for magneto bases

7—Final testing which shows whether or not magneto is fit for arduous service

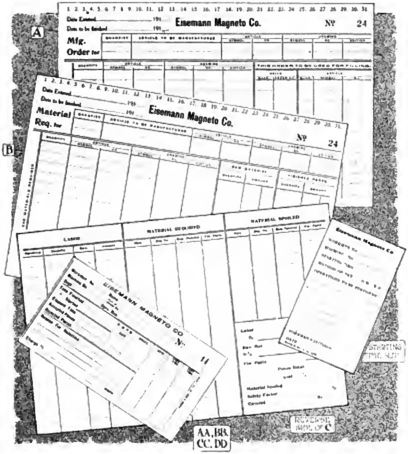
8—Shipping department where the goods are delivered to the Bush Terminal

tioned consists of a boy who makes the entire rounds of the shop every 30 minutes for both collection and delivery of the forms, etc., which go to make up this system. He is the dispatcher's telegraph service which keeps the entire plant in operation. Each foreman is provided with a rack containing three holders, one of which is used for incoming envelopes; second, for outgoing envelopes, and the third, for extra or empty envelopes. Each foreman in addition is supplied with pads of starting-time slips to start operations on any job in his own particular department. When the messenger boy makes his rounds he takes the envelope from the outgoing, deposits any envelopes he may have for that department in the incoming, and then proceeds to the next department on a preordained route, from which he is not permitted to depart.

Job Ticket Returned

After a job is finished and inspected the celluloid envelope containing the manufacturing order A, the standard operation sheet, the blue print and the job ticket CC is returned to the dispatcher and indicates that the job need not be followed up further. The dispatcher then withdraws all data pertaining to this order and sends this to the accounting department for cost purposes.

To summarize, the orders which have taken care of the production have been in two groups, first what may be called the manufacturing orders A, B and C, which in turn are, respectively, a notification to the manufacturing department that the job is to be done, a requisition to the stock room for the tools and stock and a bulletin to the dispatcher that the job is under way and must be followed up. The second group comprises the four similar job tickets which first notify the payroll departments that the job is under way and that workmen are employed thereon; the second tells the ticket writer and in turn the inspector that the previous job is ready for inspection; the third is a traveling record accom-


A
Eisemann Magneto Co.
Nº 24
Mfg. Order for
B
Eisemann Magneto Co.
Nº 24
Material Req. for
Eisemann Magneto Co.
Nº
Starting Time Slip
Reverse Side of C
AA, BB, CC, DD

The skeleton of forms upon which is based the system put into the Eisemann plant and which is already resulting in increased production. Forms A, B and C are in triplicate except C, which has a record on the reverse side for cost accounting purposes. AA, BB, CC and DD are in quadruplicate and form the job tickets. The starting time slip puts the job under way. These manufacturing orders and job tickets are the main supports in the framework of the system, the balance of the blank being more or less in the nature of by-products of production

panying the job through every operation until its completion, and the fourth goes to the dispatcher, notifying him that the job has been started.

In a system of this kind there are a number of by-products which take care of extraordinary circumstances. Also, there are non-producing departments which must be looked after. For instance the shipping department. This is handled by a quadruplicate shipping instruction ticket which is issued by the production department upon the receipt of the final job ticket, one slip going to the general manager for final credit O K authorizing the shipment. After this O K has been granted the remaining three slips go to the shipping department and one is placed in the box as a packing slip, the third goes into the shipping clerk's own files, and the fourth returns to the production department with B. of L., etc., showing that the order has been shipped. The production department delivers the slip finally to the invoice clerk, who makes the proper billing and files with the original order and all correspondence pertaining thereto.

Irregular circumstances such as the rushing of one order, the taking of a man from one job and placing him on another, the replacement of parts that have been broken or the deductions from a man's pay of articles broken through willful neglect or carelessness, overtime, lost time, etc., are all provided for in separate slips.

This, then is the method which has been selected for group production which must be used in a magneto and which would of course apply to other manufacturing jobs where vast numbers of small parts and minor operations are involved. When an order comes in for a number of magnetos, say 1,000, it will necessitate perhaps eight main groups which must be manufactured absolutely independently until the final assembly is reached. These jobs, like the spokes of a wheel, converge toward the hub, which is the final assembly. But this is not all. Beyond this main grouping is another division into sub-groups, which may in turn be still further sub-divided. Thus, if one of the groups be the armature, this may be sub-divided into other groups, such as the core, the winding, the condenser, etc. The order blanks make the chain complete, for a separate manufacturing order is issued for each of the main groups, and then another order for each of the sub-groups. Each of these orders carries with it, as has been shown, a requisition for the material needed and the tools required to perform the work.

Factory Layout Helps System

Hand in hand with the system employed, the layout of the factory helps towards the successful fulfillment of the object. As the system forms what may be called a series-parallel connection of small groups of units, so does the factory layout constitute a continuous chain of these manufacturing groups.

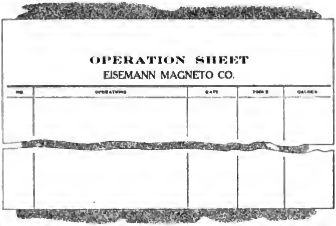
The plant occupies a very long oblong space, extending the entire length of the top floor of one of the huge Bush Terminal buildings. This long space is in turn subdivided into three other oblongs by two walls running squarely across the space separating the central part from the two end portions. At each of these divisions are the elevators, thus providing two separate passages for the materials. These passages are separated from one another by the whole length of the central portion of the plant. These have been logically utilized by employing one solely for incoming material and the other for outgoing. Adjoining the incoming is a receiving and raw material inspection department, and adjoining the outgoing is the shipping room.

Manufacture moves by steps from one end of the building to the other, generally tending to travel in the shape of a fishhook. At the base of the hook is the receiving and raw material inspection department, together with the main stock room just behind. Step by step, operation proceeds along the shank of the hook until assembly is reached at its top extremity and then proceeds to work backwards to the testing department, from where, like the barb on the hook, it proceeds into the shipping room. There is one exception to this uniform step-by-step process, and that is in the winding and condenser department, where women are employed and which hence is kept secluded from the remaining part of the plant. Here the armatures are largely completed, and although entailing carrying the material to and from the department away from the remainder of the plant, the benefits of seclusion are reaped and, since the weights to be handled are small, no noticeable loss is felt.

The administrative, technical and sales departments are arranged in a row along the windows at the opposite end of the plant from the final assembly. They are close together and convenient for interdepartmental communication and consultation. Another portion of the building is devoted to the service work, and in addition there is an experimental department for routine and research work. Dressing rooms and lunch rooms for men and women are also provided. Also to take care of normal expansion, the Eisemann company has far-sightedly secured an additional space adjoining that in which the final assembly work is now carried on, so that when necessary this can be utilized without disturbing either system or layout.

Plenty of Light for Machine Work

The arrangement of machines is such that small detail work is carried on in close proximity to the source of light. This source is a series of large windows which extend the entire length of the plant on each side. It must be remembered that Bush Terminal buildings are laid out in a large U shape, and the Eisemann plant takes in the entire branch of one of these U's. Thus, light enters from both sides. Arranged along the wall in the direct flow of the light are the small parts manufacture, inspecting, assembling and testing departments. In the center are the larger special machines which do their work either automatically or semi-automatically and do not require a great use of eyesight on the part of the operator. Since the plant is on the top floor, skylights illuminate these machines. This system puts the light where it is needed and makes for the best possible work and the complete best attainments of the results from the precision tools which are needed in manufacture.



OPERATION SHEET
EISEMANN MAGNETO CO.

Standard operation sheet on which are noted the operation, together with the tools, gauges and rate of pay for any stated job

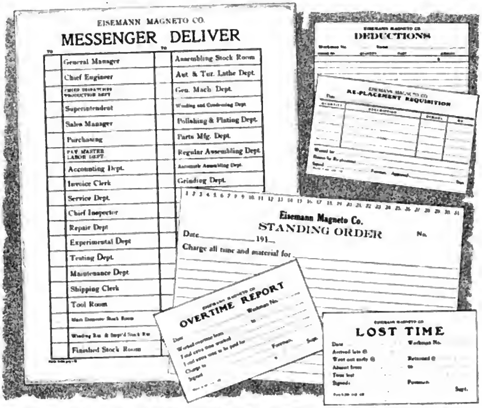
Broad aisles, light, good air, lunch rooms, lavatories and general conditions essential to the welfare of the workers have as much to do in many ways as the installation of production methods. They are part of a well-balanced plant and are a factor in Eisemann results.

Building Chassis for the Trade

A NEW wrinkle in the automobile business is the plan of the Pontiac Chassis Co., Pontiac, Mich., a new concern whose incorporation was announced last week, to build for the automobile trade chassis minus bodies and tires. The customer receives the chassis in this form, mounts his own design of body and top, puts on the tires, and then sells the completed car under his own name. The chassis is built for assemblers only, and it is stated that by this method, the small assembler is enabled to produce a car at as low a price as the larger manufacturer.

The incorporators are R. A. Palmer, of Pontiac, formerly general manager of the Cartercar and Oakland companies; Robert Perkins, secretary of the Massnick-Phipps company, maker of eights and four-cylinder motors in Detroit, and H. H. Brooks, formerly sales manager of the Marathon Motor Works, Nashville, and later of the Herff-Brooks Corpn., Indianapolis. The authorized capitalization is $100,000, and it is said that other Detroit and Pontiac capital is interested in addition to that represented by the above-named principals.

The first design of chassis produced in the plant formerly occupied by the Flanders Mfg. Co., is a 25-horsepower type using the Perkins small four-cylinder engine, which has a bore and stroke of 3 1-4 by 4 1-2 inches. It is an L-head engine with cylinders in a block and three-speed gearset in unit. There is nothing unusual about the chassis or its power plant, conventionally-accepted practice being adhered to. It was described in THE AUTOMOBILE for March 18.



EISEMANN MAGNETO CO.
MESSENGER DELIVER

General Manager
Chief Engineer
Superintendent
Sales Manager
Purchasing
PAY MASTER LABOR DEPT
Accounting Dept.
Invoice Clerk
Service Dept.
Chief Inspector
Repair Dept.
Experimental Dept.
Testing Dept.
Maintenance Dept.
Shipping Clerk
Tool Room
Finished Stock Room

Assembling Stock Room
Aut. & Tur. Lathe Dept.
Gen. Mach. Dept.
Winding and Condensing Dept.
Polishing & Plating Dept.
Parts Mfg. Dept.
Regular Assembling Dept.
Automatic Assembling Dept.
Grinding Dept.

DEDUCTIONS
Workman No. Name

RE-PLACEMENT REQUISITION

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Eisemann Magneto Co.
STANDING ORDER No.
Date 191
Charge all time and material for

OVERTIME REPORT
Workman No.
Date
Foreman. Supt.

LOST TIME
Date Workman No.
Arrived late @
Went out early @ Returned @
Absent from to
Time lost
Signed: Foreman.
Supt.

Here are shown the messengers' envelope and the special slips for deductions from pay for damaged material, replacement requisitions, standing orders for charging salaried and other time, overtime report and lost time. The tags are the by-products of the system and take care of extraordinary circumstances in the Eisemann plant

The Rostrum

Battery Needs Recharging or Overhauling

EDITOR THE AUTOMOBILE:—The storage battery seems to charge on my 1915 Hudson model 6-40, so that it will furnish current for the lights and start the motor. Then, suddenly, it will become discharged. Where should I look for the trouble? It discharges 1.125 specific gravity.

2—Can a Bosch high-tension dual-system be attached to this motor?

Lima, Mont. E. R. GLEED.

—From the information you furnish it would seem that the battery is either completely discharged or you have a short circuit in the system. It would seem quite likely that it is the former and if this is the case a thorough recharge will remedy the difficulty unless the battery has been left in the discharged condition for too great a length of time. If so, the battery will probably require overhauling. The symptom for this trouble is exactly what you describe, *i.e.*, the battery starts the motor and also gives a very bright light for a few moments, and then apparently becomes dead.

2—A Bosch dual system can be made up for the Hudson 6-40 car by means of a bracket which will be especially designed for the car. These installations are provided by the Bosch company or, if desired, can be made by you by simply securing a bracket which will take the standard magneto base supporting screws and then fastening the bracket to the car and the magneto to the bracket.

The Delco system which you have on this car should give you perfect satisfaction in every respect and it is very possible that the only reason it is not working properly is through a defective or damaged cell. This may be caused either by the piling of sediment in the bottom or disintegration of the separator which permits an occasional contact of the plates, resulting in quick discharge. If the trouble is not remedied through the advice under paragraph 1, it would be well to look here. A diagram of this system is given in Fig. 1.

Oil Gauge Probably at Fault

Editor THE AUTOMOBILE:—As a subscriber to your magazine, will you give me a solution to my troubles with carbon? I find it necessary to either burn or scrape out the carbon from my motor at least every 400 miles, sometimes less. I removed it between fifteen and twenty times last season, having run nearly 8,000 miles. I have tried all kinds of oils with various results, the more expensive oils giving the best. Have also tried different size jets in the carbureter; putting kerosene in the intake every week while the engine is hot; carrying the oil level about half full, etc., but to no avail. The manufacturer has not been able to help us yet.

I have also tried leak-proof piston rings but they did not give the desired results. The engine is made by a very reliable firm and in my judgment is over-oiled. The pipes from the oil-pump supply the main bearings, overflowing on to the crankshaft and thence being thrown by centrifugal force, into the cylinders. The pistons have three rings and two oil grooves. Underneath the lowest ring are six holes through the piston. The connecting-rods have large pressed steel scoops which dip in the oil 3-16 inch.

My solution of the trouble is to build a box over each main bearing to hold the oil and to install overflow pipes from these boxes to the connecting-rod troughs. Also to put in new pistons without the holes beneath the lowest piston ring. Finally to replace the steel dippers on the connecting-rods with smaller brass pipes dipping the same distance.

Do you think this would remedy the trouble? I expect more carbon trouble with the high-compression motor than with the old style, but it seems to me I am getting more than my share.

The motor never misses either at low or high speeds and runs beautifully when free from carbon.

Pittsfield, Mass. EARL L. JOHNSON.

—The cause of carbonization in this motor is probably due to too much oil being pumped into the cylinders. This would be due to the gauge on the oil base not registering correctly and hence bringing the oil level too high. It is suggested that you empty all the oil out of the oil base, cleaning it thoroughly with kerosene and then refilling with 21 pints of engine oil. If the gauge does not register full at this point, bend it until it does. The illustration, Fig. 2, shows the method of checking the oil dip.

Poor Final Contact Stalls Starter

Editor THE AUTOMOBILE:—I am driving a Paige 25, 1914 model and not being very familiar with the electrical part of same, would ask if you would kindly answer a few questions. This car has a 12-volt Disco starting and lighting equipment.

First, on the dash it has an indicator made by the Dungan Co., of Detroit, which I would like you to explain. It consists of a round glass with a small hole in black dial. When I turn the current for light, a white dot shows in the hole in the dial. When the current is turned off you can see nothing to indicate whether current is going into battery or not.

Now, I would like to know that if, instead of the above indicator, I could install an ammeter which registers both charge and discharge; thirty points both ways? If so, shall I connect it to the same wires?

2—I have a voltmeter, and would like to know if it would be to any advantage for me to have this connected to the battery? If so, please show me how and where to wire it.

3—When I press down on the starter pedal, the electric motor starts but when it engages with the flywheel it stalls, seeming not to be able to turn the engine over. This used to work all right, but lately it has not. The battery is very well charged. Can you give me any advice regarding this?

New Brunswick, N. J. JOHN C. HUNT.

—This is merely a form of indicator to show whether the current is circulating or not. For instance, with the motor running and the lights turned on the current is being supplied directly from the generator, this instrument not being strong enough to send a charge to the battery at the same time so that no current is passing through the indicator and naturally the white dot does not appear.

With the motor running and the lights turned off the current is passing from the generator to the battery and the white dot then appears in the indicator, showing that the current is circulating.

If the motor is dead and the lights are turned on, current is being supplied from the battery and the white dot then appears in the indicator, also showing the circulation of current.

2—It does not seem to be any advantage in connecting a voltmeter to the storage battery. In fact, it would be useless equipment as the voltage does not show the volume of current. Test the battery with hydrometer at least once per week; each cell should show a solution registering 1.275 or 1.3 and if below that the motor should be run long enough to bring the charge up to this point.

3—The trouble with the starting motor stalling when the pinion is meshed in the teeth on the flywheel is due to a weak final contact in the starting switch. It would be advisable to clean the switch and then readjust the plunger to get a good contact.

Using Starter Motor as Generator

Editor THE AUTOMOBILE:—A short time ago you explained the voltage of the Ford magneto at a speed of 980 r.p.m. The voltage varies from 16 to 24 and amperage depends upon voltage but you did not state the amperage. As 12 or 14-volt bulbs are used in the head lamps of the Ford, is there not danger of burning them out at, say, 24 volts?

2—What is the magnetic pull or how many pounds will a Ford magnet lift?

3—What amperage does an Atwater Kent coil take?

4—If a 6-volt starter motor were turned into a generator, what would be the probable amperage and voltage?

Germantown, Pa. J. H. M.

—The lamps adapted to Ford cars are constructed to take care of this varying voltage and very little trouble is experienced with burning out. THE AUTOMOBILE has consulted a number of concerns in this business and they state that they have had no trouble of this kind.

2—This is such a variable quantity that it cannot be answered definitely.

3—Tests made by the makers on the Atwater Kent system show that at 1,000 r.p.m. of the crankshaft the current reading is .24 ampere. At 500 r.p.m. the current used would be one-half this. The spark heat, however, would be the same at the low speed as at the higher velocity, the difference in primary current consumption being due simply to the fact that a definite quantity of current is consumed per spark and the number of sparks, of course, increases in proportion to the speed.

4—These starting motors are series-wound machines and consequently cannot be used at all as generators for supplying constant voltage lighting circuits or for charging a storage battery. The only way in which the starting motor could be used as a generator would be to completely rebuild it, providing for new armature and commutator construction with suitable field and armature windings. The characteristics of such a rebuilt machine would have no relation to the characteristics of the original series-wound motor.

Piston Displacement Figure Corrected

Editor THE AUTOMOBILE:—If the piston displacement of a single cylinder equals bore times bore times stroke times .7854, the piston displacement of a multiple-cylinder engine would be bore times bore times stroke times .7854 times number of cylinders.

In THE AUTOMOBILE for February 18, page 327, you will notice that the piston displacement of a six-cylinder engine 5.75 by 6.5 is given as 506.4 cubic inches. The figure obtained by the above formula is 1012.72.

Cleveland, O. J. PARKS.

Laboratory Tests on Radiator Efficiency

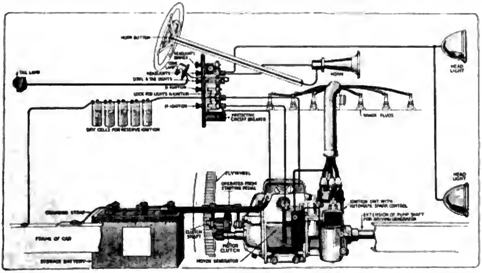
Editor THE AUTOMOBILE:—Will you kindly send me a few suggestions for conducting efficiency tests on automobile radiators where efficiency is understood to be the cooling effect per square foot of radiating surface.

Laboratory tests are to be made on several different makes of radiators and the radiators are not to be mounted on a car.

Louisville, Ky. H. O. WAGNER.

—A laboratory test on radiator efficiency is not a very difficult one to make. There are three variable factors which you will have to accurately measure. One is the temperature of the water entering the radiator; two, the temperature of the water leaving the radiator; three, the temperature of the air surrounding the radiator. If you have any type of blower to force a draft against the surface of the radiator, you will then have to know the velocity of this draft.

It is, of course, assumed that you have accurate knowledge of the number of square feet of radiator surface and also the volume of water which is passing through the radiator in pounds per minute. It must be remembered in making these tests that the foundation of all your results will be read in terms of the amount of heat units carried off in


HORN BUTTON
TAIL LAMP
HEADLIGHTS
DIM & TAIL LIGHTS
LOCK FOR LIGHTS & IGNITION
DRY CELLS FOR RESERVE IGNITION
PROTECTIVE CIRCUIT BREAKER
HORN
HEAD LIGHT
SPARK PLUGS
HEAD LIGHT
FLYWHEEL
OPERATED FROM STARTING PEDAL
IGNITION UNIT WITH AUTOMATIC SPARK CONTROL
EXTENSION OF PUMP SHAFT FOR DRIVING GENERATOR
GROUND STRAP
FRAME OF CAR
STORAGE BATTERY
CLUTCH SHAFT
MOTOR CLUTCH
MOTOR GENERATOR

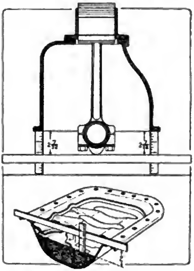


Fig. 1—Diagram of the Delco system as used on the Hudson 6-40. Fig 2—Checking the oil dip on Hudson 6-40 motor

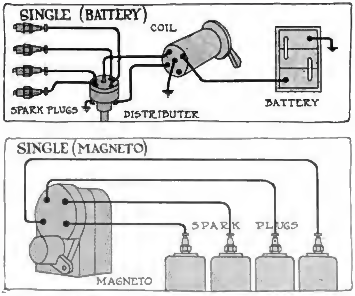


Fig. 3—Diagrammatic representation of single ignition systems

a unit of time by a given weight of water per square foot of radiating surface. This figure gives you your radiator efficiency.

To give a concrete example, if the area of the radiating surface is A, the temperature of the water entering is T, the temperature of the water leaving the radiator T1, the amount of water passing through the radiator P pounds per minute, then the heat units carried away by the radiator will be P(T—T1) B.t.u.

The heat units carried away per unit of area will be: $\frac{(T-T1)P}{A}$ and the heat units carried away per pound of water per unit of area will be $\frac{(T-T1)}{A}$ for any fixed condition of draft. Radiators can of course be directly compared by maintaining the draft conditions constant.

Parts for Old Model Thomas

Editor THE AUTOMOBILE:—I recently purchased a second-hand Thomas roadster. According to the number of the plate it is a Model D, and should judge was made in 1909 or probably 1908. It has four 5-inch cylinders, 5 1-2-inch stroke, has two entirely separate timing systems, one driven from the camshaft for battery ignition, the other a high-tension Bosch magneto. Can parts be obtained from Buffalo of the E. R. Thomas Motor Car Co.?

In taking down the engine for overhauling we found that the magneto was advanced three teeth of the timing gear, and would ask whether it should be necessary to do this with an engine of this size which we should suppose would have all the power and speed necessary without. Any information you can give me about this machine I would be very glad to receive.

E. Brookfield, Mass. B. M. S.

—Parts can be secured from J. Rosenfield, 521 Sixth street, South Boston, Mass., which will be quite handy for you. They can also be secured from the E. R. Thomas Motor Car Co., Buffalo, N. Y.

The timing for the magneto will be correct if you set it so that at full retard the spark occurs on upper dead center.

Wheels Pitched, Canted or Dished

Editor THE AUTOMOBILE:—To settle an argument, will you kindly tell us the proper term to use when speaking of tip in front wheels, that is, when they are farther apart measured at the top of the tires than they are at the bottom. A calls it cant, B calls it staggered, C calls it pitch, D calls it dished. Will you please explain the difference in these terms?

Worcester, Mass. J. B. D.

—The meaning of the word cant is the condition of having a sloping or slanted position. Therefore, this can be correctly used for that purpose. The word staggered, however, does not fit at all. Both pitch and dished are also correct.

Re-Silverizing Reflectors for Lamps

Editor THE AUTOMOBILE:—Can I silverize glass reflectors? Can an amateur do this work and if so what are the ingredients and in what proportions?

2—Is it possible to adjust the detachable rims on a 35 by 4 wheel so that a 36 by 4 1-2 tire can be put on? If not, what is the reason? The wheel at present will take a 34 by 3 1-2 or 35 by 4 tire.

3—What size of a carbureter will give the best results on a four-cylinder 4 by 4 1-2 engine?

Springside, Sask., Can. P. E. FERNIE.

—An amateur can silverize reflectors but it is very difficult to get a good job. The method by which this work has been carried out is as follows: First, fasten to a block of wood the finest possible grade of emery cloth. With this the reflector is smoothed down to a fine finish. It is next necessary to have a melting pot and a thermometer which is capable of measuring more than 212 degrees. Two ounces of lead, 2 ounces of tin and 4 ounces of chemically pure bismuth are melted together. Eight ounces of mercury are added at 212 degrees Fahrenheit and mixed with the melted mixture. This is applied while warm with a smooth camel's hair brush.

2—A 36 by 4 1-2 tire can be put on a 35 by 4 rim because this is the oversize for that tire. It cannot however be put on a 34 by 3 1-2 rim as the oversize for this is the 35 by 4 and not 36 by 4 1-2.

3—For a four-cylinder 4 by 4.5 motor use a 1 1-4-inch carbureter.

Ford Abandoned Six for Four

Editor THE AUTOMOBILE:—Will you kindly tell me in THE AUTOMOBILE why the manufacture of Ford six-cylinder cars was discontinued?

2—What year were they made in?

3—Were they practical, and if not, why?

Ellington, Conn. E. A. BRACE, M. D.

—The manufacture of Ford six-cylinder cars was discontinued because it was decided to concentrate the entire attention of the plant upon one model and that a low-priced car. It was not considered practical to undertake the building of both fours and sixes under the policy outlined by this concern.

2—These cars were manufactured during 1906.

3—A large percentage of the Ford sixes are still in active service and the machine was only discontinued for the reason stated above.

Finds Knock When Running Idle

Editor THE AUTOMOBILE:—I have a Ford engine and would like to know what causes a dull knock when engine is running slowly when idle. With both throttles retarded, the valves in good shape, and the connecting-rods tight, this knock seems to be in the fore part of engine.

Ellwood City, Pa. LEROY HAZEN.

—The knock is due to some loose part which must be found by process of elimination, as it is impossible to determine where it is from the data which you have furnished. The probability is that you will find this knock by examining the main bearings for looseness, the flywheel connection, and the crankshaft which may have become flattened. If the pistons are worn so that they have become loose a knock of this kind may also be given by the slapping of the pistons against the cylinder walls.

Systems of Electric Ignition Defined

Editor THE AUTOMOBILE:—Will you please explain the difference between the dual, double, single, two-point and duplex electric ignition systems?

Landinville, Pa. H. T. H.

—The differences between these systems of ignition can be understood more clearly by diagrammatic explanation than by a descriptive. Referring to Figs. 3 and 4, the differences between these systems are clearly brought out. To sum up: The dual system employs two independent sources of current but uses a common set of spark plugs and a common high-tension distributer. The double system employs two independent systems throughout with two sets of spark plugs, two sources of ignition, two coils and two distributers. The single ignition system has but one source of current, one transforming system, one distributer and one set of plugs. Two point ignition is where two sparks occur at the same time in the cylinder. It must of necessity, therefore, involve two sets of plugs and synchronized distributers.

Duplex ignition is that in which both a battery and magneto current source are used but in which the battery is connected with the magneto armature in such a way that it can produce a high-tension spark by means of the secondary winding of the magneto or aid the primary at low motor speeds.

Long Wheelbase Consumes Less Power

Editor THE AUTOMOBILE:—Will you please advise us if it takes any more power to operate a long wheelbase car than it does to operate a short wheelbase car, provided the weight of the cars is the same, or in other words, does a gasoline engine lose power in transmitting it to the rear axle system if the driveshaft is a long one.

Huntington, W. Va. MOTOR SALES CO.

—For a car of the same weight and all other conditions being the same it will not take any more power to operate a long wheelbase car than it does a short wheelbase as there is no loss of power through the solid shaft. In fact, the advantage would be in favor of the long wheelbase because the angle of the shaft would be less and it would nearer approach a straight line drive which is the most efficient. Another point which is in favor of the long wheelbase is that for the same weight a shorter car would be higher and hence the wind resistance would be greater.

Gearbox Probably Out of Line

Editor THE AUTOMOBILE:—I have a 1909 Cadillac 30 on which a universal joint is used between engine and transmission, this universal consisting of a cross floating in the yokes of clutch and shaft; the assembly, unless kept carefully adjusted, is noisy, and its construction does not permit of oiling so as to retain oil for any length of time, as centrifugal force throws off oil or grease, although this eventually finds its way out, and is thrown off, making a dirty mess of the floor boards. I have noted from time to time in the columns of THE AUTOMOBILE descriptions of different leather universals, designed for same use as the universal on the 1909 Cadillac, but these, unfortunately, have been lacking in details, so have been unable to attempt the application of them to my car.

Denver, Colo. WILLIAM A. WEIGELE.

—The joint between the engine and gearbox is designed to take up any misalignment between the clutch and the gearshift, but it very often happens that the gearbox drops throwing the shaft out of alignment to such an extent that the drive becomes noisy and this is probably the cause of your trouble.

It is doubtful if the fitting of a leather universal would be wise, because although it would silence the drive, it would take care of the misalignment, the noise which shows that there is a faulty alignment would be gone and there would be no warning to enable you to know when to correct this. It occasionally happens that a sudden jolt will cause a drop in the level of the gearbox due to a looseness in the bolts which hold it in position. This can be corrected by restoring the gearbox to its proper alignment.

It is also very probable that the rear axle gears are badly out of adjustment and that the vibration produced as a result of this is transmitted to the joint between the engine and gearbox and given off at that point.

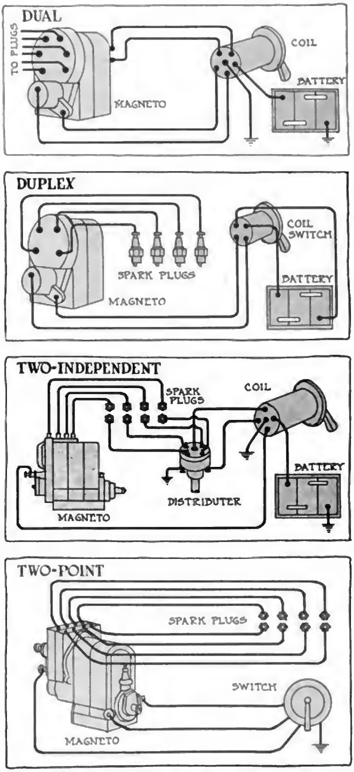


Fig. 4—Diagrams showing the differences between the dual, duplex, two-independent and two-point ignition systems

The Period of Oscillation—Its Relation to Flexibility and Strength

Defining Spring Properties by: — DF = nL : (10 ± m)

(The Improvement of Spring Systems—X)

By M. C. K.

IT was the upshot of article IX that the figuring of a time schedule for the movements of springs, vehicle body and running-gear after a single sharp knock led to certain incongruities unless the figuring could be done with strict reference to the period of oscillation of the springs, and that for this reason, mainly, the chart of these movements presented in Fig. 23 could not pretend to be accurate in the time values, even if it presents the sequence of the movements nearly in accordance with actual conditions and admits a number of fairly safe inferences for the particular condition to which it refers. As the time in which the spring acts against the load or against the running-gear is one of the most important elements for determining severity of shocks and degrees of comfort, ranking second only to vehicle speed and gravitation, it is found necessary for further progress with the subject to arrive at a definite understanding of the manner in which the period of oscillation influences results and how it must be taken into account in the figuring.

Period Differently Understood

It is first noted that the period of oscillation is a term which in practice is only vaguely defined. When it is commonly held that the period should not be shorter than 3/5 of a second, or at the rate of 100 oscillations per minute, the reference is seemingly to the whole set of conditions under which the spring operates in the completed vehicle, as the rule is derived from a practical estimate of the riding qualities obtained and from diagrams automatically produced by recording instruments showing the number of oscillations per minute. But vehicle conditions include many forms of friction in addition to the friction of the spring leaves, and the aggregate of the work thereby imposed on the springs retards their action and lengthens the period. If spring dampers are used, it is for the specific object of lengthening the period or that portion of it which applies to the spring rebound, and to that extent producing one of the desirable effects which are secured by using long and flexible springs without being troubled with the amplitude of the oscillations of such springs or with the cost and incumbrance which go with their length. To become a useful term for characterizing the properties of a spring, the idea of the period of oscillation must of course be dissociated from these complications, or else a new term should be introduced to indicate the spring properties which affect the duration of the period, and the old term may then be used in referring to the results obtained in vehicle practice. To use the term in both ways, as is now loosely done, naturally leads to confusion, especially when it is one of the principal objects of an inquiry to arrive at conclusions with regard to the best methods for interfering with the natural spring oscillations with a view to greater comfort and security.

A brief examination of the term and the factors it stands for discloses the remarkable need of a term of this nature, in some form, for describing definitely the most important properties of springs. That is, a term which will give in one breath an adequate idea of the combination of flexibility, strength and working capacity of a spring for a given set of working conditions is one of the very first requirements for being able to compare spring values, both as to their efficiency and their cost, and for overcoming the popular tendency to assume that strength or static carrying capacity and flexibility are the only mechanical factors to which a specification of leaf springs need to refer.

T a Function of Suitable Dimensions

An unloaded spring comes to rest very quickly after a shock, as its mass is insufficient to carry the momentum for producing a large oscillation after the spring has returned to its initial position. Likewise a heavily loaded spring comes to rest quickly, because the spring energy is rapidly exhausted by the increased friction and inertia. At both extremes spring oscillation is reduced in amplitude, while the oscillation period is reduced in the first case and lengthened in the other. From these considerations alone it is clear that the period of spring oscillation must be a factor related largely to the load and the capacity of the spring for handling its load. A numerical value for the period therefore expresses this relation, and herein lies its practical value. Combined with a numerical value for the flexibility it expresses all the dynamic properties which are of interest. ("Life" in one sense relates to prompt resilience and in that sense is identified with the period of oscillation. In its other sense, referring to durability or stability of properties, it is an economical term.)

It may therefore be defined as an object at the outset to find a simple expression for "dynamic flexibility"—coining this term for want of a better or recognized one—in which the value of the period of oscillation shall be incorporated in such a manner that it, and also the values for flexibility proper and for beam-strength proper, can readily be separated from the combination term; while the question of "life" must probably remain a compound one in which not only the working capacity of the spring in relation to its work but also the metallurgical properties are involved.

The theoretical value for the period of oscillation of a spring is formulated (without regard to its weight) on purely kinetic principles and equals THAT OF A SIMPLE PENDULUM WHOSE LENGTH IS EQUAL TO THE DEFLECTION f CAUSED BY THE LOAD P WHICH IS THE ADMISSIBLE LOAD OF THE SPRING. This is correct, because the admissible load is the same as the load limit within which the analogy of the pendulum holds good.

From this we have: T (the period in seconds) $= \pi\sqrt{\frac{f}{g}}$ (in feet)

The admissible load of a spring must therefore be determined before the period can be figured, and the admissible load is figured according to formulas which are to some extent empiric and in regard to which no complete agreement exists. The extraordinary working capacity demanded of automobile springs and the properties of the alloy steels which have been developed to meet these demands must also result in an eventual revision of the admissible load limits. The latitude which under these conditions exists in theory merely relates to the difficulty of representing actual conditions by few and simple mathematical symbols. In reality the admissible load of a definite spring is definite, though it may be unknown.

What Is Admissible Load?

The standard American formula for admissible load makes it a function of the tensile strength of the spring material, while the revised formula recognized in the *Hütte* (the engineering manual of the *Verein Deutscher Ingenieure*) makes it the same function of the admissible bending tension of the spring material (not of any given leaf spring). The different numerical values of the units employed—inches, centimeters, etc.—come somewhere near equalizing the results obtained from the two formulas. While the German formula is the more logical one, it has the great disadvantage that the admissible bending tension of a material in general, calculated from unit dimensions, is much more difficult to ascertain than the tensile strength of a standardized test piece. It also varies for static, suddenly applied and alternating stresses. While for ordinary hardened spring steel it is figured as not necessarily exceeding 4,800 kilograms per square centimeter, it is given as 6,500 kilograms for the grade of steel required for railway car springs, with allowance of a play in practice up to 8,600 kilograms. As the play required for automobile springs is much greater and weight is an important factor, it would probably be a matter calling for extensive experimental work to fix a suitable value for the admissible bending tension for automobile spring material, though a tentative scale might be established running from 6,500 kilograms per square centimeter upward to 8,000 or 9,000 kilograms, according to the grade of steel it is contemplated to use in any given case. The relation of the tensile strength of a material to the resilience or the admissible bending tension of leaf springs made of this material, which is taken for granted in the standard America formula, is doubtless much less safe to figure with now, if fine alloy spring steels are used, than it was formerly, since the strength of these steels varies considerably according to the direction of the pull.

The difficulties which arise by using either of the formulas may be illustrated by applying them to a concrete case. Let it be the object to find the admissible load of a spring, semi-elliptic, 36 inches long, 6 leaves, 2.67 inches wide, leaves uniformly 0.25 inch thick and made from a material giving a tensile strength of 200,000 pounds per square inch from a standard test specimen duly hardened to compare with its condition in the spring.

The American basic formula for one-half of a semi-elliptic spring, is:

$$P \text{ (safe load)} = \frac{n}{6} \cdot \frac{bt^2}{l} \cdot S$$

in which n is the number of leaves, b width, t thickness, l length and S tensile strength.

The German formula is $P = \frac{n}{6} \cdot \frac{bt^2}{l} \cdot k_b$,

in which kilograms take the place of pounds and centimeters of inches, while k_b is the admissible bending tension in kilograms per square centimeter.

To apply to semi-elliptic springs, where l is twice as large, results should be multiplied by 4.

It is noticed that for otherwise equal conditions P is inversely proportionate with l, the length, and this applies to all springs whose deflections are proportionate to the loads; a condition which is rarely found to be accurately materialized in springs in which the main leaves are double or thicker than the others, though it is nearly always aimed at.

Inserting the numerical values, one gets the following from the American formula:

$$P = \frac{6}{6} \cdot \frac{2.67 \times 0.25^2}{36} \times 200{,}000 = \frac{0.166875}{36} \times 200{,}000 = \frac{33375}{36}$$

$= 927.1$ pounds

or an admissible load of $927.1 \times 4 = 3708.4$ pounds.

Converting the inches into centimeters and choosing a trial value of 8,000 kilograms per square centimeter for the admissible bending stress k_b one gets

$$P = \frac{6}{6} \cdot \frac{6.8 \times 0.635^2}{91.44} \times 8{,}000 = \frac{6.8 \times 0.403}{91.44} \times 8{,}000 = \frac{91.44}{21923.20}$$

$= 239.7$ kilograms or 527.6 pounds.

This makes the admissibic load only 2110.4 pounds, which is more nearly in accordance with the loads which would be admitted in practice for a spring of the dimensions mentioned and of first-class material. The same result would be obtained from the American formula if the tensile strength were taken as 110,000 pounds instead of 200,000 pounds.

The utility of the formulas is plainly dependent upon havhaving reliable tabulated values worked up for the different grades of steel which come into question and, in case the American formula is preferred, basing the S values on actual spring tests rather than on an assumed relation between the tensile strength and the spring strength, since this assumed relation is in reality a relic of a conception according to which the laws relating to beams of a narrowly limited elasticity were applied to determine the strength of springs and the figures for tensile strength were assumed to be represented in pro rata figures for bending, while the matter of shock and alternation of stresses was ignored.

Until these data have been brought into existence and subjected to verification, THE ADMISSIBLE LOAD OF A SPRING FOR AUTOMOBILES OR MOTOR TRUCKS IS PROBABLY BEST DETERMINED FROM A PRACTICAL ESTIMATE BASED UPON THE MAXIMUM DEFLECTION DEMANDED OF THE SPRING IN PRACTICE, AND TAKING AS THE ADMISSIBLE LOAD THE STATIC LOAD WHICH PRODUCES THIS DEFLECTION. In conjunction with the data which makers of automobile springs possess for the materials they use and the springs they make, it should be possible to devise a provisional formula in which P remains a function of $nbt^2 : l$, while the factor $S : 6$ or $k_b : 6$ is revised to correspond to automobile or motor truck conditions.

It seems almost evident that the unusual demands made upon automobile springs should warrant the adoption of special and generally recognized coefficients for determining the loads which they are fit to support. These coefficients would still be subject to tabulated variations according to the materials used and perhaps to a division into two classes according to the intended speed of the vehicles.

The Relations of T

Reverting now to the formula for the period of oscillation, $T = \pi \sqrt{\frac{f}{g}}$, it is perhaps first notable that it is strictly theoretical to the extent of leaving the friction of spring leaves out of consideration. In fact, it is applicable to coil springs as well as to leaf springs. But this makes it so much more fundamental and useful, as the friction of leaf springs varies, increasing with n and decreasing with b, t and l for any given combination of strength and flexibility, while it can also be varied by special expedients, such as anti-friction films of oil or metal between the leaves, and necessarily is higher for highly curved springs than for straight ones, as the curved spring in action undergoes greater relative changes of the effective spans of the different leaves. The progressively increasing friction of the straight spring is one of its advantages if progressive resistance is not produced by other means.

As compared with the complete formula for pendulums (the development of which can be found in all complete textbooks on physical science) a minor variable factor is omitted, but this factor is negligible in the case of pendulums if the oscillations do not exceed 8 degrees. In autombile springs the limit of 8 degrees is considerably exceeded, and for large oscillations the formula value of T is therefore a little short, apart from the question of friction. With this exception, the period T is constant according to the abbreviated formula, since f is a constant, being the deflection caused by the admissible load P; that is, a large oscillation takes no longer than a short one, and this agrees with the results observed in practice. All important modifications of this condition must be effected by arranging friction, in any of its forms, so as to increase or decrease with the amplitude of the oscillation.

But while f is constant for any given spring, it is a function of P. If d is the deflection, in feet, for any given load P_1, smaller than the permissible maximum load P, then $f : P = d : P_1$ and $f = Pd : P_1$.

As $d : P_1$ is the coefficient of flexibility when P_1 equals 100 pounds, the formula for T may be revised by substituting for f, meaning the deflection caused by maximum admissible load, Pf : meaning by f now the coefficient of flexibility.

The reversed term for flexibility $F = \frac{P_1}{d}$ in which d equals 1 inch and P_1 is the load causing this deflection can be used, if preferred, being often handler for figuring, and, as $F = 1 : f$, the change can easily be made. If this is done, it is more convenient, perhaps, to figure in inches than in fractions of a foot, which of course can be done if also $g = 32.2$, the factor of acceleration by gravity, is multiplied by 12.

With the changed meaning of f, one has

$$T = \pi\sqrt{\frac{Pf}{g}} \text{ or } T = \pi\sqrt{\frac{P}{12Fg}} = \pi\sqrt{\frac{P}{F.386.4}}$$

The period T is thus plainly shown to involve all the fundamental elements of a spring; depending, as it does, on the safe load, which is in the form of $Z.nbt^2:6l$, and also upon the coefficient of flexibility, f, and the acceleration factor g of gravitation.

Groping for a System

It may be noted that while Z is a factor for determining P which is yet to be ascertained for the materials used for automobile springs and the work demanded of them, the errors which would be made by employing the normal figure of 80,000 to 100,000 pounds for the tensile strength of the material might not be very large in the case of the spring steels of the highest grade—whose tensile strength is not quite parallel with their spring qualities—as L should increase with the better quality of material but, on the other hand, should decrease with the severity of the work. These influences may nearly offset one another. Some spring makers figure with slide-rules operating on different standard formulas for the different kinds of springs and make empiric, not to say haphazard, allowances for the grade of the material, while taking as the safe load one 50 to 100 per cent. higher than the load actually to be carried, thereby allowing for the speed of automobiles and the hard spring work resulting from it. But the prevalence of auxiliary coil springs to give the suspension a flexibility which it would not have without them, tends to indicate that serious efforts to fit the leaf spring to automobile work with a minimum of complication is uncommon, other considerations having the first call. While the reasons for this industrial condition may be wholly sufficient, both mechanically and economically, it is also possible that a more definite knowledge of the best means for getting suitable action from simple leaf springs, with dampers, would result in more divided opinions and less experimental improvement of the spring suspension by the vehicle user. The burden of such improvement cannot indefinitely be thrown upon him.

In brief, the industrial demands in spring design may be said to swing more or less rationally under three influences: (1) conventionality, which refuses to depart from leaf springs, (2) cost and convenience of construction, which militate in favor of the shortest possible leaf springs, and (3) the necessity for relatively slow oscillation to produce comfort and avoid spring accidents, and this requirement—in conflict with No. 2—accounts for the willingness to have the public try all sorts of auxiliary devices by which the reduction in amplitude and speed of the oscillations may be obtained.

Good Logic of Practice

As the long spring which gives a suitable period of oscillations does not reduce their amplitude, but must be checked for this purpose, and as the auxiliary coil spring gives a very rapid rebound for small shocks—which is generally believed to be an advantage and may actually be so for cobblestones and similar road surfaces—the preference for trying to accomplishe results by coupling short leaf springs with other elements which will increase the flexibility at one end of the action and increase the resistance and the oscillation period at the other end, is in reality very logical. The groping manner in which it is done is the only objectionable feature.

It may in fact also be contended that the large working capacity of leaf springs which are long enough to give the desired period of oscillation represents a waste of material if the peak of the shock-loads can be absorbed in the same auxiliary devices which serve to lengthen T, the period of oscillation. In weighing all these matters, considerable assistance is obtained from an analysis of the formula for T.

To get acceptable results in practice, it is understood that the T obtained in practice should be not less than 0.6 second. But this is a T lengthened by leaf and vehicle friction. Experience is wanted for determining the theoretical T which can be made to give corresponding results by the amount of leaf and vehicle friction which the vehicle construction in each case must involve. It is known that shaft drive produces considerably more friction to lengthen T than chain drive. Cantilever springs are credited with slower oscillation than semi-elliptic springs of the same load capacity and probably follow a different formula that should be evolved and considered separately.

Pending the establishment of a good average value for the theoretical T, one may be assumed, with a value somewhat lower than 0.6 second, for example 0.5 second. By inserting this value, subject to revision by experience, in the T formula, interesting relations are disclosed.

It gives, from $T^2 = \pi^2 Pf : g$, when f is isolated to find the flexibility wanted to give the desired T without assistance of special devices, other than leaf and vehicle friction:

$$(0.25 \times 32) : (3.14^2 \times P) = f = 0.81 : P \text{ or } P = 0.81 : f.$$

Here f is in feet. If it is taken in inches, one has $f = 10 : P$.

Similarly, from the other version of the formula, expressing flexibility by the number of pounds producing a 1 inch deflection, one has:

$$T^2F = \pi^2P : 386.4, \text{ which with } T = 0.5 \text{ gives } F = 0.1\ P.$$

Dynamic Flexibility—DF

The difficulty experienced in securing suitable spring suspension for light vehicles is at once illustrated by these relations. One-tenth of the admissible load P must give a 1-inch deflection. But the actual static load must not compress the spring unduly. Assume an actual load of 300 pounds, a maximum admissible deflection of 6 inches in addition to the initial compression, and the latter not to exceed 3 inches. F is then 100, and the value of P has to be 10 times larger, or 1,000 pounds, to bring T to 0.5 second. In other words, P must be taken at 100 pounds higher than would be determined by the maximum deflection. The spring of the required flexibility must be figured to a safe load of 1,000 pounds, which makes it long and heavy. The alternative is to make it equally flexible but lighter, weaker and shorter and to absorb shocks and lengthen T by spring dampers. The heavier spring would, however, require at least a rebound check to moderate oscillations.

The desired term for "dynamic flexibility" may be obtained by considering both the flexibility and admissible load required for getting the right T (provisionally 0.5 second) and the relation of P to the actual load L. We have 10 F = P. Calling 10 F the "dynamic flexibility," we have 10 F = 3 L or 10 F = 2 L or 10 F = 2.5 L. If it is then said of a spring that it has a dynamic flexibility of, say, 2 L, and the actual load on the spring is 1,000 pounds, it will be known that its ordinary flexibility, F, is at the rate of 2,000:10 = 200 pounds to cause a 1-inch deflection (which would involve a set of 5 inches by the static load alone); that the maximum shock or overload deflection for which it is figured is 5 inches (making a total of 10 inches from equilibrium); that it will work within these limits without requiring a damper to moderate the rapidity of oscillations (though it may require a rebound check).

Conceived in this manner, the term "dynamic flexibility" assumes that the flexibility has been made to correspond with the admissible load P, so as to make T right for comfort without interference, and when this has not been done the term would be inapplicable. It can be improved, so as to describe a spring which does not produce a suitable T without assistance. T decreases when F increases, for a given P. For rapid oscillations, requiring damping action, we therefore have $P < 10 F$. Now, calling F the dynamic flexibility under the symbol DF, we have DF = 3 L : 10 if T is right, but if T is short the value for DF may become 3 L : 8 or 2 L : 9 or, in general, $DF = nL : (10 \pm m)$. The difference between the divisor and 10 will then indicate the need of a damping action or of auxiliary springs, while all the other properties of the spring can be deduced in analogy with the above.

One of the incidental conclusions which may be developed from the term DF is that the use of friction shock absorbers acting uniformly for compression as well as for extension is more rational than has usually lately been assumed, provided the vehicle springs to which they are applied come under the description: $DF = nL : (10 + m)$, with n smaller than needed for the range of the spring's work. The friction then protects the spring's working capacity while also adding to the value of T. But that an action better than uniform friction can be provided is perhaps equally plain.

Discussion on "The Improvement of Spring Systems"

Question Is Raised: Must Axles Be Turned Askew To Cushion One-Wheel Shocks Horizontally? And, If So, Is It Safe?

AMONG the conditions which have systematically been left over for separate consideration in the articles on The Improvement of Spring Systems, so as not to complicate the subject with constructive requirements at the outset, that relating to shocks which directly affect only one of a pair of wheels is perhaps the most important, because it occurs so frequently. It was briefly referred to in article VI in connection with the need of two universals on the driving shaft in case the axle is permitted to be turned in the horizontal plane by the action of such a shock on a horizontally acting spring. One of the engineers in the industry considers that the conceivable effects of one-sided shocks in turning the axles momentarily, if horizontal springing is used, are better looked into at once and sends the following communication:

Editor of THE AUTOMOBILE:—I have read your articles on Spring Suspensions with very great interest, especially those dealing with the necessity for cushioning the horizontal components of the road shocks. I have often in driving noted the effect of this lack of horizontal springing.

It is perfectly obvious, though I have never seen it stated in just this way, that, the greater the obstacle the greater is the horizontal component of its shock to the car, and with present spring suspensions the greater the horizontal component the less able is the car to cushion it.

Which means, the larger the obstacle, and the more a spring is needed, the less spring there is to work.

So the shock to the car would seem to increase as some function of the square of the height of the obstacle. And when the limit is reached and the obstacle is as high as the hub of the wheel, then, as the shock is purely horizontal, the ability to cushion it with present spring suspensions is zero. This last, of course, is only theoretical, but clearly shows the trend toward uselessness of the springs as the size of the obstacle increases, and the need of a spring becomes greater and greater.

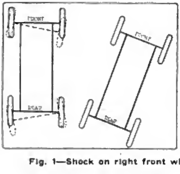
I believe, that a comprehensive study of the amount of energy lost under different conditions of wheel sizes and sizes of obstacles, and a plotting of the results might show some interesting facts, and I would like to see something like that published.

From actual experience, in common with most men who have driven cars much in rough country, I am thoroughly convinced of the great loss of energy due to the horizontal shocks. It is quite a common thing to have to shift to a lower gear for no other reason than striking a rock ledge or going through a chuck hole on a hill: the reduction in speed is generally quite noticeable, and though the hill often might be taken without shifting if it were smooth, the horizontal or backward shock received slows the car up enough to require the shift. This is a very easy thing for anyone to try by digging a chuck hole on a hill leaving room to go around it, so that the same hill and road conditions may be obtained with and without the chuck hole. With a chuck hole of sufficient size to give a good per cent. of horizontal shock, any one will soon become convinced, by this comparative test, that cushioning the horizontal shocks is of great importance from the standpoint of conservation of energy alone, even without considering comfort or the life of the car.

But there is one drawback which is very important and should be carefully considered; and that is the roadability of a car whose axles may move horizontally.

If both wheels strike an obstacle at the same instant the axle will move backwards and will stay square with the road, and no harm will be done.

But if only one wheel strikes an obstacle, that wheel alone will be retarded, and this will throw the axle out of square with the road, and if the car does not leave the road as a consequence, it will at least make steering very difficult. And at high speeds it will probably be impossible to twist the wheel quick enough to keep the car running straight.



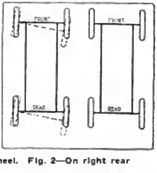


Fig. 1—Shock on right front wheel. Fig. 2—On right rear

And what makes this condition all the worse is the fact that the retardation of one wheel on the front axle has the reverse effect to that produced by the retardation of one wheel on the rear axle.

An obstacle striking on the right front wheel will retard it, turn the axle slightly across the road and steer the car to the right—Fig. 1.

(*Continued on page* 599)

Sheet Steel for Motor Parts

New Able Engine for Small Cars Has Crankcase Bent Up from Single Piece—Other Unique Features

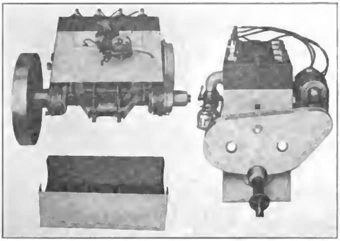


Fig. 1—Able light car motor showing crankshaft mounting

A NEW motor 2 5-8 inches bore and 4 inches stroke, with four cylinders has been prepared for manufacturing by the Able Motor Co., New York City, the basic idea of the design being to turn out an engine that will suit users who want small power for a very low price. Light weight has also been desired and a reasonable amount of power in proportion to the cylinder dimensions. Rated at 17 horsepower, we are informed that the power obtained from the first experimental motor has reached 22, which is moderately good for a piston displacement of 86 cubic inches.

Only One Heavy Piece

Everything has been done to eliminate work on the parts, and there is only one heavy piece, this being the cylinder block. This is shown in Fig. 1 and contains all the cast iron in the engine; in fact, there are only two other cast parts, barring the pistons. To support the two-bearing crankshaft, malleable brackets are bolted to the cylinders by a pair of bolts each, this being lighter and cheaper than casting hangers and cylinders in one piece—lighter because the malleable is stronger than plain cast iron, and cheaper because the machining of the cylinders and the hangers is rendered easier by the separation of parts.

Simple to Assemble

For the crank a drop forging in a good steel, with tensile strength of 80,000 pounds, is used and the two bearings are Hyatt rollers of the self-contained journal pattern. Each bearing is pushed on the crankshaft and the housing placed over it before the bolting to the cylinders takes place. Also the rear end bearing and hanger are mounted before the flywheel is put on, since the latter is merely a tight fit on the crank and is not held in any other way. The two camshafts are carried in the crankshaft hangers and assemble with the crank.

The illustrations make clear the way in which the whole of the crankcase is bent up from a single piece of sheet steel, with the oil trough pressed out in a separate piece pushed inside. The oil pump is a simple barrel containing a spring backed plunger, and since the barrel has a collar at the foot it has merely to be pushed up into the hole drilled for it in the cylinder foot, and the pressure of the actuating cam then keeps the barrel in place as well as holding up the plunger, thus eliminating any screws. Pressed sheet steel is used for the timing gear cover, the two pieces being overlapped just as the crankcase overlaps the cylinder block, and it is claimed that the width of the lap in each case is enough to retain all lubricant without any packing or gaskets.

There are only two thumb screws to secure the lower part of the crankcase, and the upper portion is held on by a small

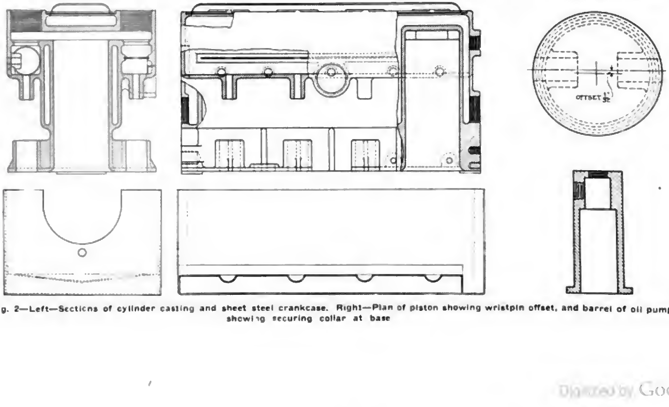


Fig. 2—Left—Sections of cylinder casting and sheet steel crankcase. Right—Plan of piston showing wristpin offset, and barrel of oil pump showing securing collar at base

number of screws, seen in the photographic illustration. For mounting the motor in the chassis, brackets of any kind can be bolted to either end of the cylinders. For ignition the standard fitting is a timer placed horizontally at the front end of one camshaft, but a special front hanger is made with an extra pinion carriage, so that a magneto can be mounted as shown.

There are light connecting-rods, and the pistons are also low in weight, while they have a feature claimed to eliminate slap. In the sketch of the piston head it can be seen that the wristpin is offset relative to the piston center line. This is done so that the explosion pressure may tend to tilt the piston in a direction opposite to that in which the angularity of the connecting-rod tries to force it.

A feature worthy of notice, though having little to do with the general scheme, is the intake arrangement. Referring to the drawing of the cylinders, the intake passage is divided horizontally by a steel plate which is cast in position, the ends of the plate are clear of the ends of the passage, the carbureter feeds to the middle of the passage, beneath the dividing plate, and the valve ports open to the passage above the plate. The effect is the provision of a continuous, or circulating, intake passage and the gas passes to the valves round either end of the plate. This construction gives a very short carbureter connection and provides a good body of well-warmed gas to draw from.

Another point of ingenuity is the way the top of the cylinders is filled in, the water head being pressed from sheet steel and dropped in place, after which solder is run round the edge and makes the top integral with the casting.

Rotary Valve Makes Slow Progress

Many Designs Have Been Tried, But Only One European Maker of Repute Now Uses Rotary Valve Motor as Standard

FOR many years past the patent office returns of every civilized country have shown that inventors in the automobile field have been fascinated greatly by the idea of rotary valve systems for motors. Rotary motion is always a better form than oscillating or reciprocating motion. Some day we shall have turbine—or truly rotary—automobile motors, but it is likely that rotary valve mechanisms will become usual long before the turbine ideal is attained. It is rather curious that considering the number of inventions, so little active progress has been made with rotary valves, for there is only one manufacturer in the world of any large reputation that has really taken up a rotary valve motor seriously, this being the Itala company of Turin, Italy. The motor used on their car has a single rotary valve serving each pair of cylinders and running at one-fourth crankshaft speed; it serves both intake and exhaust, is water cooled and well lubricated. There is no question but that this motor is a success but it is costly to make and the design is not very simple. Perhaps its good operation may be traced to the slow speed and ample cooling of the valve.

Darracq Rotary Abandoned

Another well known concern, which tried a rotary valve, only to abandon it afterwards, was the Darracq Co., but this motor was of a very different kind from the Itala, having a single barrel running lengthwise of the cylinders. The trouble with this was to keep it compression tight, and to prevent it cutting and scoring, while the motor never produced a power commensurate with its size.

In America probably the Mead motor has made most headway, this having two barrel valves, one on each side of the cylinders, controlling intake and exhaust respectively, but this engine has never been adopted by a firm making large quantities of cars so it is difficult to get a wide view of its effectiveness.

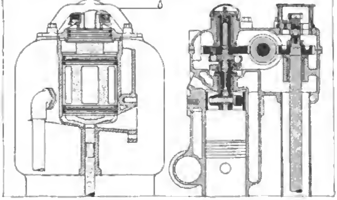
The most popular idea among rotary valve inventors is to use a barrel valve located above the cylinders somewhat after the fashion of the Bournonville motor described on page 1156 of The Automobile for December 24, 1914. In 1912 a small firm in Carlisle, England, claimed to have cornered the master patents for this class of gasoline engine. Since that time, however, nothing more has been heard of this claim so it is safe to assume that it was found to be incapable of being upheld.

A quite different kind of rotary mechanism was that expressed in the Renold motor which came from Detroit and had a flat disk located in each cylinder head; a port of segmental shape was cut in the valve and two such ports in the head of each cylinder. Apparently the trouble was that the disks only operated well when the motor pressures were light and the speed low. The motor was tried out in a six-cylinder form in a chassis by one of the big manufacturers in Detroit but it never appeared on any of his regular product.

French Designs Numerous

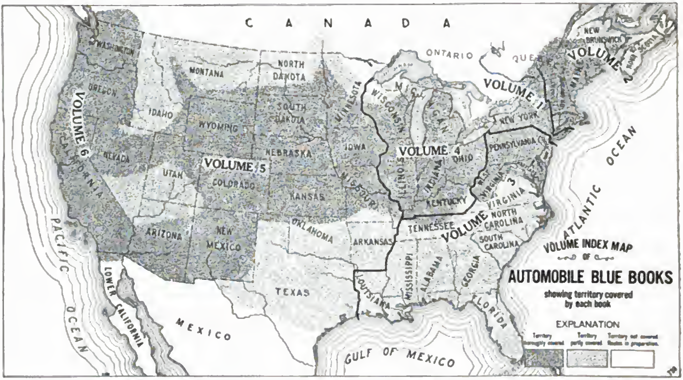
Yet another scheme was the French Cid motor which had a ring shaped valve in the cylinder head about 2 inches deep. This valve was shaped like a cuff and split like a piston ring so that its own natural expansion kept it tight pressed against the cylinder wall, and it had a port cut in it which registered with first an intake and then an exhaust port in the cylinder as the valve revolved. It was tried out for a long time and was to have been used in one of the 1913 races in France, but it never came to the starting line and its sponsors have never put it on the market.

French engineers seem to have been particularly keen on the rotary valve and for many years past each succeeding Paris show has revealed fresh attempts to solve the problem. It yet remains, however, for any one of these to make a big mark—even the Itala can hardly be said to have done that, and considering the progress made with other automobile problems, it does seem curious that the rotary valve is so long in making its way forward.



Left—Itala rotary valve which is the most successful commercially of all rotary types. It runs at quarter crankshaft speed and each valve serves both intake and exhaust for two adjacent cylinders. Right—The French C. I. D. motor as made originally and shown in Paris in 1910

Sixth Volume Added to Blue Books



Map showing how all parts of North America where automobile touring is possible are covered by the Automobile Blue Book

Covers California, Oregon, Washington and British Columbia—Entire Touring Area of United States Now Included

COMPLETING the survey of North America where touring is possible, a sixth volume, covering the states of California, Oregon and Washington and also the province of British Columbia, has been added to the edition of the Automobile Blue Book for 1915.

Another feature is the continuation and amplification of the Blue Book Touring Bureau, which was founded last year to meet the demands of an ever-increasing number of pleasure tourists. The Touring Bureau exceeded all expectations last year and looks for a greatly increased membership in 1915. It furnishes gratis to any Blue Book user all the varied kinds of information which he desires to amplify and supplement that contained in his Blue Book. This service has for years been rendered, in an individual way, by numerous enterprising automobile clubs scattered throughout the United States, but until 1914 no one association or organization has been able to make the service a nation-wide affair, largely owing to the fact that the expense of gathering the information, codifying and distributing it, would have rendered the cost prohibitive. The Automobile Blue Book Publishing Co. is, by the very nature of its organization, adequately equipped to render this service, and its endeavors in the past year, if continued on the same or larger scale, will easily double the intrinsic value of their publication, and so add largely to the pleasure of automobile touring.

War, Exposition and Good Roads Factors

Three factors—two of them new—contribute largely to the incentive which has made the publishers of the Blue Book expend unusual energy upon bringing the editorial matter to a state of perfection hitherto unattained. These factors are the war in Europe, which, by keeping Americans home, will naturally stimulate pleasure touring to a degree as yet unheard of; the California Expositions, whose lure will induce many motorists to attempt the transcontinental journey who never before had contemplated any such thing; and thirdly the culmination or completion of a year of the most extensive road work ever before attempted anywhere on the globe, which means a mileage of newly completed or newly improved highways such as no year in the past has ever seen accomplished.

The five older volumes divide the rest of the country in the customary way as follows: Volume 1—New York State and contiguous Canada; Volume 2—New England, Quebec and Maritime Provinces; Volume 3—New Jersey, Pennsylvania and the Southeast; Volume 4—The Middle West; Volume 5—The Mississippi River to the Pacific Coast.

Taking up the volumes in turn, we briefly summarize what we conceive to be the salient features of each.

New York and Canada—New Features

Volume 1—New York State and Canada. Upon opening this book the first thing that strikes the eye is a set of detailed maps covering the entire State of New York, maps on a scale so large—about 3 miles to the inch—that they may be used in conjunction with the route matter to an extent never before possible. It is, of course, impossible in a road guide dedicated to a survey of the trunk-lines in its particular territory to give a detailed description of all the many side-roads which may be suitable for automobile travel. The Empire State, more than any other in the country, is blessed with a tremendous mileage of state, county and other highways, and the many millions of dollars which have been raised for the improvement of this network of roads have created and stimulated an amount of tourist travel quite out of proportion to the area of the state itself.

In addition to nearly 200 pages given over to this elaborate system of maps, one notices a comprehensive rearrangement of the route matter given in the text. So many new trunk-lines have been opened to traffic, and so extensive has been the relocation of the highways best suited to through travel, that the entire book seems to have been rewritten to meet changed conditions. A less important, though equally pleasing, feature of Volume 1 is the addition of numerous attractive photographs of beautiful scenery along the various highways.

New England—Pilot Maps Added

The six northeasternmost states of the Union have so long been famous for the excellence of their roads that very little change might be expected in Volume 2, describing New England. Yet here again the Blue Book has kept pace with the promised increase in touring by the inclusion of a complete set of detailed pilot maps, similar to those found in Volume 1. The stability which comes with age has, of course, made itself felt in New England, and few, if any, changes have been made in the route matter, but by the addition of these pilot maps hundreds upon hundreds of attractive side-trips, which limitation of space has hitherto prevented the publishers from including in the route matter, are now shown in graphic form, so that "he who runs may read." In Volume 2, also, the novel feature of the inclusion of photographic views adds greatly to the appearance of its twelve-hundred-odd pages.

West Virginia Added to Volume 3

Most conspicuous of the changes in Volume 3, covering Pennsylvania and Maryland, is the inclusion of the State of West Virginia. Highway conditions in that mountainous state are, to be sure, not altogether perfect, but the authorities have at last waked up to the immeasurable benefits accruing from the stimulation of touring within their frontiers, and they are putting their house in order with a lively zest. Even where the roads are rough and hilly the superb scenery in the mountains will compensate one for the necessity of shifting gears and driving with circumspection. Nevertheless, there are several exceptionally good mountain roads leading across the state; one of the best of these starts from White Sulphur Springs and runs by way of Hot Springs and Monterey, Va., up through Elkins to Clarksburg and thence to Wheeling. This road traverses some of the most beautiful country to be found in the whole Appalachian chain, and the view from the top of Cheat Mountain is perhaps unsurpassed east of the Rockies. Another highway which will be found invaluable runs from Lexington, Va., through Covington to White Sulphur Springs, thence west along the valley of the Kanawha into Charleston, W. Va., from which point a good connection may be had to Portsmouth, O., or a fair dry-weather connection to Gallipolis—another Ohio town on the river of the same name.

Pennsylvania and Maryland Gain

Nowhere east of the Ohio River have road conditions improved with such giant strides as in the neighboring commonwealths of Pennsylvania and Maryland, and knowing this, the publishers of the Blue Book have strained every effort to cover as much territory in those two states as was possible during the summer and autumn of 1914. A number of very important through east and west trunk-lines have been included, among them the following: From Binghamton to Jamestown and Erie via the Southern Tier of New York State; an almost completely new highway from Harrisburg west to Pittsburgh by way of Altoona; and a brand new continuous thoroughfare from Baltimore to Pittsburgh by way of Bedford Springs; these, in addition to completely new surveys of the regular trunk-lines from Philadelphia to Pittsburgh via the Lancaster and Chambersburg Pikes, and from Baltimore to Wheeling via the Old National Road.

Perhaps the most important feature of highway construction in the territory embraced within the covers of Volume 3 is the practical completion of the Old National Road from tidewater at Baltimore to the Ohio River at Wheeling. This fine old national thoroughfare, which was originally started in 1808, or thereabouts, is now practically an uninterrupted line of macadam from the Maryland metropolis to Wheeling, where it connects with the state roads leading into all portions of the Buckeye State.

The addition of these many new continuous thoroughfares to the choice hitherto offered the tourist will make for the relieving of congestion along the several highways hitherto available for through traffic to and from the west. The traveler may now pick and choose from a copious selection of routes, each of which has its particular charms and advantages. This means a great advance in every respect, and will

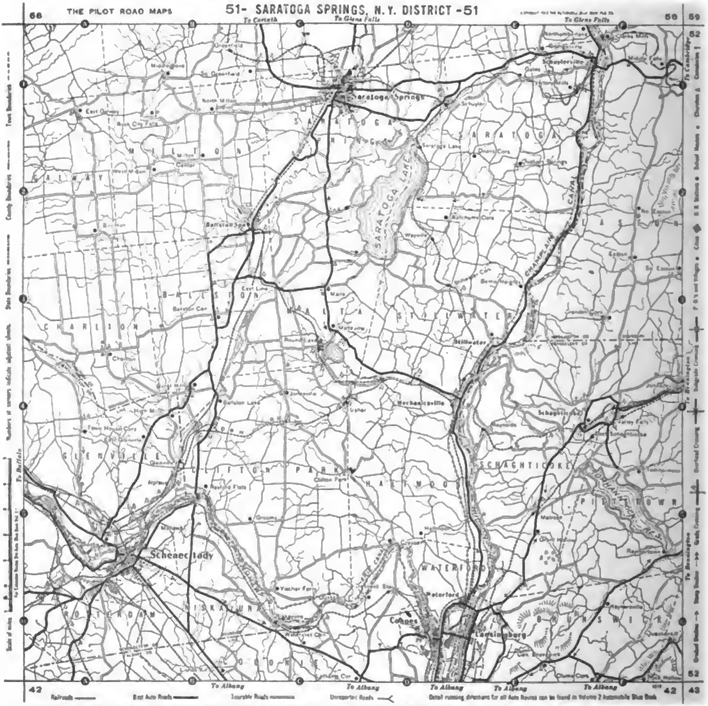
Index map as used in Automobile Blue Books for indicating route numbers in the text have the effect of stimulating automobile travel in this section of the country to an extent unthought of in the past.

Now that the value of improved roads is admitted generally it may seem of no particular significance to make this the keynote in speaking of the territory covered by Volume 4, namely, Illinois, Indiana, Kentucky, Michigan, Ohio and Wisconsin. Its importance is easily appreciated, however, when we remember that in five of the six states embraced in Volume 4 the present highway law for road improvement is only about 2 years old, which means that last summer the good results just began to make a real showing. To keep pace with this improvement the Blue Book cars were sent over every main line covering this territory gathering new road draftings and in addition adding numerous important connections not shown in any previous editions. Of the 58,000 miles of route directions shown in this volume 40,000 are given from absolutely new notes. All index maps are new and the territory covered by detail route maps materially extended.

By far the larger percentage of car owners living in the central states have been prone to believe that all the beautiful touring sections were in other states, but within the last year a constantly growing number began to appreciate that between the Ohio River and the Great Lakes are some of the most attractive spots in the United States. In these sections the Blue Book cars spent many weeks during the summer of 1914, especially in the beautiful lake districts of Michigan and Wisconsin and the hill country of the Ohio Valley. Road work was under way in all these parts, giving ample assurance of greatly improved conditions.

From the Mississippi to the Pacific

In view of the fact that the demand for route information on trips to the Coast this summer began early last year there was no alternative left the publishers in preparing for the 1915 edition. In order to prepare for the rush westward it was necessary to have two road surveyors in the Far West for over 3 months and every line of text on all the main transcontinental lines across the western territory was pro-



In Volumes 1 and 2 there are nearly 200 of these detail pilot maps printed on special stock in order to render it easy to find them cured by them working separately between the middle of August and January 1. The work was prolonged in some sections until the snow in the mountains made further work impossible. Four complete and distinct routes between the Mississippi and the Coast were re-mapped, in addition to many short options, especially in the Rocky Mountain States, where the attractions of the Southwest with its historic and scenic interest vie with the grandeur of the snow-capped peaks, deep canyon roads and the magnificent glaciers of the higher peaks of the Rockies farther north.

The road improvement during the last year in the western states is truly phenomenal when one considers the relatively small population. In the West, however, every one is not only interested in good roads, but is working hard for them; and, what is of great importance to the tourist, most of them are anxious to increase the automobile tourist travel their way and have the traveler leave full of enthusiasm for the West, and, above all, for the particular section each one is interested in. This sort of spirit means not only the keenest kind of competition in road improvement but in the hospitality of the people; so it is safe to say that all motorists will receive a royal welcome in the West.

Discussion on "The Improvement of Spring Systems"

(*Continued from page 593.*)

An obstacle striking the right rear wheel will retard it, turn the axle slightly across the road, steering the rear of the car to the right; but as soon as the obstacle is passed and the retarded wheel again assumes its normal position the car will be steered to the left, as the front has not been turned off the road while the rear has gone to the right—Fig. 2.

Should it happen, as it most certainly would at times, that the right front wheel and the left rear wheel both strike obstacles at the same instant, the front of the car would be turned to the right and the rear of the car would go to the left till the obstacle was passed; then the entire car would be pointed to the right at just twice the angle that would be produced had only one wheel at a time been retarded—Fig. 3.

Should the right front wheel and the right rear wheel both strike obstacles at the same instant both right wheels would be retarded till the obstacle was passed, the car meantime moving sidewise; and when both axles have straightened up the car would still be pointed straight down the road, but it would be at one side of its original course—Fig. 4. This assumes that the obstacles have all been of the same size. But in actual road work this would of course seldom happen. All possible gradations would be met with, and all possible combinations.

A large obstacle striking the right front wheel at the same instant that a small one strikes the left rear wheel would result in the car going to the right less than if both were large obstacles, but more than if only the front obstacle were struck.

Different sized obstacles striking front and rear wheels on the same side would translate the car sidewise, but the end that struck the larger obstacle would go the farther from the road, so that when the axles straightened up the car would point to the right or left of its original course, depending upon which obstacle were the larger.

A different effect is obtained, in other words, from each different combination of obstacles, so that the readjustment of the steering wheel would have to depend upon each particular combination of obstacles.

At high speed it would be impossible to keep the car on a rough road and it would probably be a very hard job to do so on any ordinary road.

All this can probably be overcome, but it is well at the outset to recognize the importance of this problem of roadability if we are finally to have the horizontal road shock cushioned.

Detroit, March 24, 1915. W. M. E.

For the very high speeds which W. M. E. apparently has chiefly in mind, since it is the safety of the steering in which he is concerned, air tires are of course the preferable equipment at present, and they are likely to remain so the more rubber is developed into one of the large and staple crops of the tropics. And when air tires are used there is perhaps no need of turning the axle, even if they are supplemented by horizontal springing, as it may be preferable to guide the front end of the torsion tube (with a minimum of friction) to prevent such turning, thereby dividing the one-sided shock and forcing it to take effect on both sides. So far as commercial vehicles are concerned the writer is rather inclined to believe that, with their lower speeds, steering will remain safe enough even if the axles are turned somewhat, as a shock sharp enough to have a marked effect in this respect is also of very short duration, so that the axles return rapidly to the square position. The constructive complication arising from the need of protecting the ordinary vehicle springs from twisting looks more formidable to the writer, though it is taken care of in French cars in which the drive is taken through the springs. Until these constructive questions can be taken up more thoroughly, this and several other points on which opinion and judgment vary may perhaps be allowed to simmer. Meanwhile W. M. E. has placed it fairly before the public, and his statement that "all this can probably be overcome" is taken as an omen that he himself will contribute a solution in detail on the points on which he is in doubt.—M. C. K.

Volunteer Automobile Corps for Swedish Army

WHEN the Swedish army, shortly after the outbreak of the great war, was partly mobilized, the absence of a military automobile corps made itself keenly felt. As the news from the battlefields of Europe still further accentuated the great usefulness and importance of motor cars in warfare, some patriotic citizens of Stockholm undertook the organization of a Volunteer Automobile Corps. About fifty experienced motorists enlisted immediately, and the number has increased steadily, ever since. The enthusiasm for the project displayed all over the country has caused the establishment of branches of the corps in several other localities. It is expected that by April 1, when a general review is to be held, every army division will have as its adjunct one of these motor corps. Regular courses of instruction and drill practice will then commence.

One of the new organization's primary aims will be to promote the improvement of the Swedish roads and the building of new ones, principally with a view to military use, but also for the benefit of motorists in general. In this work the Volunteer Automobile Corps will co-operate with the Swedish Road Assn.

F. W. Taylor, Efficiency Expert, Dies

PHILADELPHIA, PA., March 26—Frederick Winslow Taylor, father of the Taylor system and originator of modern scientific management systems, died here Sunday from pneumonia. He was 59 years of age, a member of the American Society of Mechanical Engineers and was noted not only for his manufacturing systems but also for his numerous inventions and discoveries. One of the most noted of these is the Taylor-White method of treating modern high-speed tools. He was the author of many articles on scientific efficiency and installed his systems in many large industrial concerns, a number of which are devoted to the manufacture of automobiles.

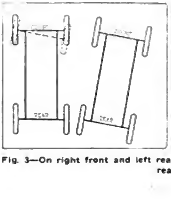


Fig. 3—On right front and left rear.

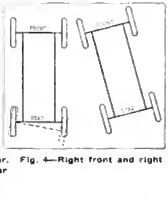


Fig. 4—Right front and right rear

The Automobile

PUBLISHED WEEKLY

Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, April 1, 1915 No. 13

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3202
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - - - - - Autoland, New York
Long Distance Telephone - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Imperative Efficiency

IT is a matter of efficiency or decline in these days of production, low cost and competition. A plant manufacturing a product in thousands must realize the necessity of a well-organized system yet there are many concerns that have failed to realize that the difficulties which they are encountering are due to internal sickness. They are between the Scylla of high manufacturing cost and the Charybdis of high prices. These concerns must realize that they can only do one of two things: They must either fall in line and submit their organization to the knife of the business surgeon or must take the other alternative—ultimate elimination.

The lesson must be brought home in every industry. It is not only common to the automobile, but in every field business men must realize that their concerns must be nearly 100 per cent. efficient if they will live. It is the money saved on production that creates dividends and what do we find as a result? The stocks of the high-efficiency, cheap-production concerns are soaring as never before. When a company finds that by writing seven orders in two writings it has replaced the work of writing seventeen separate orders in order to have the same work done, it is patent to that concern that something is wrong. If the time limit on a certain job can be cut from 43 minutes to 32 because the machine ran idle after finishing each job is it not better to increase the machine speed and put the $12,000 that would go for another machine into the pockets of the stockholders?

Obsolete methods must go. Unwieldy, haphazard production schemes form the rust that chokes the business machine. If it costs one house 30 cents to make an article that sells for 40 cents while another makes it for 20 and sells it for 30 cents, the answer as to which will survive is self-evident. This condition is not overdrawn. To exist a business must turn the X-ray upon its internal affairs and in their control make every hour worth a full 60 minutes.

The Jitney Necessity

TODAY the jitney movement is being more generally attacked than ever by the electric trolley interests, and unfortunately the sympathies of the public are being worked upon by the franchise argument. These attacks are striking home, in spite of the fact that our surface lines, our subways and our elevated lines are crowded to suffocation in the rush hours. What our city transportation systems require today is greater flexibility, which, in a measure, is possible with the jitney car and the jitney bus. Not only is jitney service much quicker than trolley service, but it offers a measure of flexibility, a condition which many of the old-world cities realized years ago when the motor bus was introduced and the trolley eliminated from restricted sections.

The public likes the jitney because it is quicker, often 10 to 12 minutes being saved on a 2-mile trip. The jitney movement, if it only relieves the inexcusable overcrowding of surface cars at rush hours, will have done a great good. It is up to the people, those who have to travel to and from work, to use their voice in seeing that plain justice is given the jitney movement in our various cities.

Tires in Storage

THERE are now thousands of motorists busy with their cars, getting ready to remove the dust of the garage to prepare for the far pleasanter dust of the road. Again and again these men have been urged to see to their tires before starting out on the first spring run, but the trouble seen on the road last Saturday and Sunday shows that there are still plenty of people who are satisfied to chance it. Rubber is stuff that is not really dead like steel; it grows stiff with the long winter rest and it needs a little getting back into form before it is put to work again. In almost every case the removal of the tires from a car that has stood all winter, even if it were on jacks, will disclose the inner tubes stuck to the casings, the rims slightly rusted and so on. Just taking off the tire, rubbing it well with chalk and repairing little cuts does not take long and it will save roadside delay sooner or later; also if there is a crack or unsuspected weak spot in the casing which means that the tire had better become a "spare" forthwith, then how much better to find it out comfortably at home than somewhere else when delay is inconvenience.

Metropolitan S.A.E. Reviews Boat Field

Differences in Practice Between Motor Boat and Automobile Construction—Little Standardization Possible in Boat Building

NEW YORK CITY, March 26—A motor boat evening was the feature of the monthly meeting of the Metropolitan Section of the Society of Automobile Engineers held here last night. An attendance of seventy members and guests showed that the interest of the automobile engineers in the twin field of motor boats is keen. The paper by C. F. Chapman, associate editor of Motor Boating, was entitled The Internal Combustion Engine in the Motor Boat.

Mr. Chapman gave an entire review of the motor boat industry in this country and brought out very clearly the reasons why the automobile engine cannot be directly substituted in a motor boat although most of the principles of construction apply to both. The primary reason that the automobile engine is not adapted for the motor boat is that in the latter it is required to run at full power all the time; in the automobile the motor only develops a small portion of its highest horsepower and it is only under conditions of extreme high speed, or hill climbing, that the maximum power is needed. Even at these times the maximum power is only required for a short time, whereas in motor boats the vessel is generally driven at its top speed from the moment that it leaves the dock until it returns.

Motor Boat Bearings More Rigid

This basic difference between the principle involved in motor boats and automobiles has resulted in numerous changes in the actual construction. For instance, in the crankshaft bearings of an automobile engine the minimum length and diameter is employed. In motor boat engines, on the other hand, the bearings are made much more rigid and crankshafts heavier to withstand the strains of continuous running at maximum power. Another great difference is that in the automobile there is a fan which draws the air through a radiator and hence aids considerably in cooling the motor by means of the forced gas. In the motor boat the engine is generally placed in some covered over portion of the boat far away from the cooling influence of a draught of wind and as a result the water jackets will have to be made larger to provide the added cooling effectiveness.

Salt Water Corrodes Jackets

The use of salt water in the cooling jackets of the motor boat engine causes corrosion of the metal. This is particularly true when the salt water becomes heated. This is a proposition which does not confront the automobile engine builder and hence furnishes another reason why automobile engine waterjackets are insufficient for motor boat practice. Another ill effect of salt water is the depositing of lime scale on the surface of the jackets, thus cutting down the cooling efficiency to a large degree. Besides these conditions there is no doubt but that the corrosive effect of the salt water on some of the zinc base die castings used for pump housings would be disastrous.

Little Standardization in Boat Industry

Mr. Chapman pointed out the great difference between the two industries as regards the output of the boat manufacturers and of the automobile manufacturers. He showed that whereas there are probably 300 or 400 representative passenger car manufacturers, at the very least there are more than 10,000 boat manufacturers. These builders of boats never know what engine is going to be placed in the boat that they are building until after they have received a definite order from the prospective owner; hence very little standardization is found in the motor boat industry.

Especially in the case of the builder of small two-cycle installations the different methods of handling the same problem are marked. For instance, if the buyer of the boat specifies a magneto the boat builder will hunt around and if he can find one in his shop he will put it in the box with the rest of the engine parts and attachments and ship it to the unfortunate buyer, leaving him to install it as best he may. Carbureter installations meet the same kind of rough treatment and, as a result, a startling lack of uniformity prevails throughout the industry.

Unusually Large Attendance

The meeting opened promptly at 8.30, and, according to previous announcements, closed at 10.30 p. m. sharp. As the paper took up practically the entire available 2 hours, discussion was short and, in fact, very little could be added to Mr. Chapman's comprehensive and well-illustrated paper. The departure from the more or less cut-and-dried topics brought out an unusually large attendance.

Houk Buys American Spoke Co. Plant

BUFFALO, N. Y., March 29—George W. Houk has purchased the plant of the American Spoke & Nipple Co., Detroit, Mich., for the Houk Mfg. Co., and will move all the machinery to the Buffalo plant. It has a capacity of 25,000 spokes and nipples per day. At the present time the Houk company is using 30,000 per day.

DETROIT, MICH., March 25—R. P. Spencer, who was one of the incorporators and director in charge of sales of the Denby Motor Truck Co., is no longer actively connected with that concern, but retains his stock holdings.

DETROIT, MICH., March 26—The first annual banquet of the Detroit section, Society of Automobile Engineers, was held yesterday evening at the Hotel Statler. There were 145 members present and W. H. Conant, formerly of New York and now acting secretary and treasurer of the local section, was toastmaster. He was introduced by E. T. Birdsall, chairman of the Detroit section. The speakers of the evening were Henry Souther, chairman of the membership committee of the S. A. E., who spoke on S. A. E., the Periscope of Automobiledom, and George W. Dunham, chief engineer of the Chalmers Motor Co., who spoke on The Automobile Engineer

Overland Orders Increase 1,300

Business from March 1 to 25 Exceeds Entire Record-Breaking Month of February

TOLEDO, O., March 29—Although February was the biggest month ever experienced by the Willys-Overland Co., up to that time the volume of business at the Toledo factory from March 1 to 25 exceeded that of the entire month of February.

Between March 1 and 25 more shipments were made than during the entire previous month and the number of orders received for cars exceeded those of February by more than 1,300. During this time orders for cars were received at the rate of 2,500 per week. The total number was exactly double that received during the same period of March, 1914.

In spite of the fact that more cars are being shipped daily from the Overland factory than ever before, orders have been showing a steady gain on shipments. In an effort to make the supply meet the demand the Overland plant is working at full capacity, employing 8,600 men and keeping many of the departments on a continuous 24 hour schedule.

On Monday, March 22, the first day following 7 weeks each of which was successively the largest in the history of the Overland company, 330 cars were shipped. The company first passed the 300-a-day mark just 5 weeks before.

J. I. Case 1914 Sales $14,395,384

RACINE, WIS., March 26—The largest gross sales in the history of the company are indicated by the annual reports of the J. I. Case T. M. Co., Racine, Wis., for the year 1914. The report, just issued, shows total sales of $14,395,384. Foreign sales amounted to $2,217,097 and domestic business was $12,178,286. The balance sheet does not enumerate the revenue from automobile business, but it is stated that it was an important factor and probably responsible for the decided increase. It is interesting to note that sales during the second half of 1914 exceeded those of the first 6 months, indicating a healthy improvement in business.

On December 1, 1914, the company redeemed and canceled $1,500,000 under the trust deed dated February 1, 1914, leaving $10,500,000 outstanding as of December 31, 1914. The high point of indebtedness on bonds and notes in the course of the year was reached July 5 with a total liability in bonds and notes of $16,785,000, liquidation of current assets being effected to the extent of $4,535,000 between that date and December 24, when the liability was reduced to its lowest point of the year, $12,250,000.

To Take Up General Motors Notes

NEW YORK CITY, March 31—Outstanding 6 per cent. first lien 5-year sinking fund gold notes of the General Motors Co., amounting to $7,852,000, and due October 1, will be redeemed at a price to yield 3 per cent. for the unexpired time. The price as of April 1, will be 101.455 and accrued interest; for April 15 it will be 101.342, and 101.213 for May 1. Payment will be made on presentation at the offices of J. W. Seligman & Co. and Lee, Higginson & Co.

These notes are the unredeemed part of a $15,000,000 issue. It was said that the management decided to pay them off at this time because of the liberal amount of cash in the treasury. After paying the notes, it was said, there would be remaining in the treasury between $6,000,000 and $7,000,000.

Kentucky Wagon to Build Hercules Cars

LOUISVILLE, KY., March 27—The Kentucky Wagon Mfg. Co., makers of the Urban and Old Hickory trucks, will immediately begin the manufacture of Hercules cars, an agreement to that effect having been made with the Hercules Sales Co., a new organization, which recently took over the patterns, blueprints, name of the car and output of Hercules Motor Car Co., New Albany, Ind.

The Hercules line consists of three models, a five-passenger touring car, $650; a roadster at the same price, and a town-car. The touring car formerly sold for $550 but a number of refinements and improvements, including the lengthening of the wheelbase from 104 to 110 inches and the addition of a gasoline tank, have been made.

The Hercules Sales Co. was organized January 12 with a capital stock of $100,000. Officers of the company are: A. H. Ross, Louisville, president; Charles Kelso, New Albany, vice-president; C. L. Caron, secretary and treasurer. W. E. Massey and J. R. Duffin, president of the Inter-Southern Life Insurance Co., both of Louisville, also are interested in the concern. No stock is for sale. The 400 agents of the Hercules Motor Car Co. will be supplied with cars by the Hercules Sales Co., which controls the selling rights of the Hercules car.

About 200 men will be added to the present working force of the Kentucky Wagon company. A lot of material and parts used in the manufacture of the Hercules which had been stored up in New Albany will be brought to Louisville immediately. About twenty-five cars a day will be the capacity at the start. According to President Ross, the output will later be increased to 100 cars a day.

Madison Motor Co. to Build 4 and 8

INDIANAPOLIS, IND., March 26—The Madison Motor Co., with plants at Anderson, Ind., and Berlin, Can., will be incorporated in the near future to manufacture a four-cylinder 30 horsepower car in the moderate-priced division, a car with a 112-inch wheelbase, that will market in the neighborhood of $750. It is also the intention of the company, beginning July 1, to build an eight-cylinder motor, preparations along these lines already having been taken.

Cecil Gibson, who has disposed of his interests in the Gibson Automobile Co. and the Empire Automobile Co., will assume the office of president and general manager of the company, which will be incorporated for $500,000. Associated with Mr. Gibson will be Henry Nyberg, W. E. Moore, C. F. Wood, of Washington, D. C., and Tom Forbes. Mr. Gibson is the largest stockholder.

New 7-Passenger Chandler Announced

NEW YORK CITY, March 29—A new touring model for seven passengers has been announced by the Chandler Motor Car Co., Cleveland, O., replacing the former five-passenger touring car, and, with a roadster built on the same chassis.

Market Reports for the Week

NEW YORK CITY, March 31—Market prices this week were generally steady. No changes occurred in the oils and lubricants market, while few occurred in the metals market. Tin was very erratic, its highest price being $54 per 100 pounds and its lowest $46. The closing price was $53 at a gain of $5. Both electrolytic and Lake coppers rose each $.00 3-8 a pound. Brass manufacturers continue to be the main sustaining force of the copper trade, and it is largely their purchases that cause a continued advance in the price of electrolytic and Lake copper here. Antimony is scarce and prices largely nominal around 21 cents a pound. In the rubber market offerings were light. Liberal arrivals of rubber were reported from Brazil, yesterday, but aside from this there was an absence of new developments as far as Fine Up-River is concerned. Scrap automobile rubber went down 1-4 cent.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.21½	.21½	.21½	.21½	.21½	.21½	......
Beams & Channels, 100 lbs.	1.26	1.26	1.26	1.26	1.26	1.26	
Bessemer Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	......
Copper, Elec., lb.	.15¼	.15¼	.15⅜	.15⅜	.15⅜	.15⅝	+.00⅜
Copper, Lake, lb.	.15⅜	.15⅜	.15½	.15½	.15½	.15¾	+.00⅜
Cottonseed Oil, bbl.	6.55	6.57	6.55	6.55	6.65	6.60	+.05
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	.92	......
Lead, 100 lbs.	4.15	4.15	4.15	4.15	4.15	4.15	......
Linseed Oil	.62	.62	.62	.62	.62	.62	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.40	1.40	1.40	1.40	1.40	1.40	......
Rapeseed Oil, refined	.75	.75	.75	.75	.75	.75	......
Rubber, Fine Up-River, Para	.58	.58	.58	.58	.58	.58	......
Silk, raw, Ital.	..	3.90	.	..	3.90	3.90	......
Silk, raw, Japan	..	3.50	..	..	3.55	3.52½	+.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	48.00	46.00	47.50	48.00	54.00	53.00	+5.00
Tire Scrap	.05	.05	.05	.05	.05	.04¾	−.00¼

forming the Chandler line. With either body the car sells for $1,295.

The new body has been made of ample size to accommodate its quota of passengers, and to accommodate it the wheelbase has been increased from 120 to 122 inches. There are two folding seats which, when not in use, fit snugly into recesses at the back of the front seat and are covered by flaps; when opened they are self-supporting and require no screws or other hand adjustments. There are no supports under them, which gives the maximum leg-room for the rear seat passengers.

Apart from lengthening, the chassis has undergone no change, the Chandler six-cylinder motor being used with L-head cylinders 3 3-8 by 5 cast in threes, Bosch magneto, Rayfield carbureter, Westinghouse starting-lighting, disk clutch, three-speed gearset, floating rear axle, left steer and center control and 34 by 4-inch tires.

ELMIRA, N. Y., March 26—The American-La France Fire Engine Co. has declared an initial dividend of 1 per cent. on its common stock, payable May 15 to stock of record May 10. The company also has declared the regular quarterly dividend of 1 3-4 per cent. on its preferred stock, payable April 1 to stock of record at the close today.

Gulf Co. To Test McAfee Process

AUSTIN, TEX., March 26—It is reported that the Gulf Refining Co. will build an oil refinery in Texas for the purpose of thoroughly testing the new McAfee process of extracting high grade oils from crude petroleum. Details of the new process have not as yet been given out but the reason given for the interest of the Gulf company is that the percentage of higher oils for a given quantity of crude is greatly increased.

The distilling of gasoline from natural gas promises to become a great industry in Texas. It is announced that the Magnolia Petroleum Co., the Texas Co., and the J. M. Duffy Petroleum Co. have under consideration the installing of large plants for this purpose. These companies are all operating in the natural gas districts of the state and claim yields of as high as 10 gallons of gasoline per 1,000 cubic feet of gas. Many of the natural gas wells have capacities ranging from 20,000,000 to 36,000,000 cubic feet per day, which will illustrate the possibilities of working this source on a large commercial scale.

INDIANAPOLIS, IND., March 27—The Cole Motor Co. has begun its eight-cylinder production and deliveries will start April 1. On April 15 the concern will run day and night shifts to properly take care of the orders.

Chicago To Have Half-Rate Taxicabs

CHICAGO, ILL., March 31—*Special Telegram*—Officers of the Walden W. Shaw Co. have announced the formation of the Yellow Cab Co., to operate taxicabs at 20 cents for the first mile, this being half the new legal rate determined by the city council Monday night when it reduced the standard charge from 50 to 40 cents for the first mile. The new company, which is incorporated for $100,000, will put in service at once 100 small cabs at all public stands to be operated at 20 cents for the first half-mile and 5 cents for each additional quarter mile. This will be in direct competition with the larger cabs of the Shaw company which will be operated on the new legal rate of 40 cents and 10 cents. The new cabs are only two-thirds as heavy as the present Shaw cab, have a four-passenger limousine body and 3 1-2-inch Continental motor; other features of the cars, which are built in the Shaw shops, are: thermo-syphon cooling, Bosch fixed ignition and Hotchkiss drive.

Automobile Securities Quotations

NEW YORK CITY, March 31—Strength and activity continued this week in the security quotations, especially in the tire and the automobile stocks. General Motors made a new high record, advancing 24 points to 124 and Maxwell Motors common, first and second preferred, advanced 4 1-2, 3, and 2 1-8 points respectively. International Motors stocks experienced a rise this week, the common gaining 6 1-2 points and the preferred, 14.

Kelly-Springfield Tire common was the strong feature of the curb market on March 29, advancing on vigorous buying to the new high of 122. The second preferred, which is convertible at par into common stock at any time within 10 years after July 1, 1914, was also higher, changing hands at 123. Goodyear common rose 5 points, while its preferred dropped 1 point. Goodrich common and preferred experienced fractional declines, the stocks, however, being quite steady. U. S. Rubber saw further gains this week when both its common and preferred went up 6 1-2 and 2 points respectively.

Several of the accessory securities gained, Aluminum Castings preferred rising 2 points and New Departure common and preferred, rising 6 and 1 points respectively. Texas oil stock rose 2 points.

In the Detroit Exchange, General Motors common showed the largest gain, that of 17 1-2 points. The automobile securities showed unusual strength, a majority of them showing substantial gains. Maxwell common and first preferred showed gains of 3 3-4 and 3 points respectively, while Packard common rose 2 points. Studebaker common gained 3 1-2 points and its preferred 1-2 point. Quotations from the inactive stocks show a large gain by the Canadian Ford, which rose 25 points. Kelsey Wheel stock rose 5 points.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com.	200	..	285	..	..
Ajax-Grieb Rubber Co. pfd.	98	102	100	..	..
Aluminum Castings pfd.	98	102	98	100	+2
J. I. Case pfd.	..	..	78	82	..
Chalmers Motor Company com.	77	†83	..	80	..
Chalmers Motor Company pfd.	92	94	90	92½	—1½
Electric Storage Battery Co.	..	..	49	50	..
Firestone Tire & Rubber Co. com.	285	292	398	404	+2
Firestone Tire & Rubber Co. pfd.	108	109	110	112	..
General Motors Company com.	75½	77	124	125	+24
General Motors Company pfd.	93½	94	99½	99¾	+ ½
B. F. Goodrich Company com.	22	22½	36¼	38	— ½
B. F. Goodrich Company pfd.	86	88	96¼	98½	—1¼
Goodyear Tire & Rubber Co. com.	175	180	195	198	+5
Goodyear Tire & Rubber Co. pfd.	94	95	103½	104½	—1
Gray & Davis Inc. pfd.	90	97	..	..	..
International Motor Co. com.	..	5	8	..	+6½
International Motor Co. pfd.	..	15	22	..	+14
Kelly-Springfield Tire Co. com.	58	60	117	118	+5½
Kelly-Springfield Tire Co. 1st pfd.	143	145	81	83	—2
Kelly-Springfield Tire Co. 2nd pfd.	..	..	123	125	+5
Maxwell Motor Company com.	7½	8	37	37½	+4½
Maxwell Motor Company 1st pfd.	33	34	78	78¼	+3
Maxwell Motor Company 2nd pfd.	11½	12½	32½	33	+2⅛
Miller Rubber Company com.	..	..	165	170	..
Miller Rubber Company pfd.	..	..	101	103	..
New Departure Mfg. Co. com.	..	..	134	135	+6
New Departure Mfg. Co. pfd.	..	..	106	109	+1
Packard Motor Car Co. com.	101	116	80	92	..
Packard Motor Car Co. pfd.	95	98	93¾	97½	..
Peerless Motor Car Co. com.	20	30	20	21	..
Peerless Motor Car Co. pfd.	..	80	..	55	..
Portage Rubber Co. com.	..	30	34	36	..
Portage Rubber Co. pfd.	..	85	85	95	..
*Reo Motor Truck Company	7	8	11½	12	..
*Reo Motor Car Company	18¾	†19¼	28¼	29	— ½
Splitdorf Electric Co. pfd.	..	..	..	..	..
Stewart-Warner Speed. Corp. com.	61½	62½	57	59	+1
Stewart-Warner Speed. Corp. pfd.	100	102	102½	105	+1
Studebaker Corporation com.	30	31	51	52	+3
Studebaker Corporation pfd.	85	86	93	95	—1
Swinehart Tire & Rubber Co.	60	67	74½	76	..
Texas Company	..	..	134	135	+2
U. S. Rubber Co. com.	61½	62	64	65	+6½
U. S. Rubber Co. pfd.	103½	104½	105	106	+2
Vacuum Oil Company	..	..	..	..	..
White Company pfd.	107	110	103	108	..
Willys-Overland Co. com.	64	66	120½	121½	+2½
Willys-Overland Co. pfd.	89	94	99	101	..

---

*Par value $10; all others $100 par value.

†Ex-dividend.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Chalmers Motor Co. com.	..	83	..	80	—1
Chalmers Motor Co. pfd.	90	94	90	92½	..
Continental Motor Co. com.	150	..	165	185	..
Continental Motor Co. pfd.	..	75	80	85	..
General Motors Co. com.	73	76½	123	127	+17½
General Motors Co. pfd.	93	95	99	100½	+ ½
Maxwell Motor Co. com.	6½	7½	35½	37	+3¾
Maxwell Motor Co. 1st pfd.	32	34	77	79	+3
Maxwell Motor Co. 2d pfd.	11	12½	32	33½	+1
Packard Motor Car Co. com.	102	116	80	92	+2
Packard Motor Car Co. pfd.	94	98	93¼	97½	..
*Reo Motor Car Co.	19½	19¾	28¼	29½	+ ¼
*Reo Motor Truck Co.	7⅜	8½	11	12	— ½
Studebaker Corporation com.	..	..	50	52	+3½
Studebaker Corporation pfd.	..	..	93	95	+ ½

INACTIVE STOCKS

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
*Atlas Drop Forge Co.	21	..	25	..	..
Ford Motor Co. of Canada	540	560	550	..	+25
Kelsey Wheel Co.	190	200	195	..	+5
*W. K. Prudden Co.	..	21	18½	20½	— ½
Regal Motor Car Co. pfd.	..	45	..	25	..

BONDS

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
General Motors, notes 6s, 1915	98	100	100⅛	100¼	..
Packard Motor Co. 5s, 1916	..	98	95	..	..

---

*Par value $10; all others $100 par value.

February Exports $4,807,812

1,502 Trucks Valued at $3,022,482 and 2,230 Cars Worth $1,785,330 Shipped —Nearly 100% Gain Over 1914

WASHINGTON, D. C., March 30—February exports show that 1,502 trucks, valued at $3,022,482, as against fifty-seven, valued at $83,461 in 1914, and 2,230 passenger cars, valued at $1,785,330, as against 2,837 in 1914, worth $2,378,494, were shipped abroad. During the 8 months' period ending February, the exports of trucks increased from 493 valued at $797,722 in 1914, to 4,974, valued at $14,411,924 in 1915. The passenger car exports decreased from 16,390, valued at $14,919,487 in 1914, to 9,134, valued at $7,593,429 in 1915.

The figures show that, while truck exports are increasing at a tremendous rate, the passenger car exports are rapidly declining on account of a possible lack of transportation facilities.

New Aluminum Alloy for Pistons

Los Angeles, Cal., March 24—A new aluminum alloy for pistons has been brought out by Harry A. Miller, inventor of the Master carbureter, under the name of Alloyanum. This material is stated to be a good bearing metal and has a specific gravity of 3.532 or about one-half that of cast iron. The tensile strength on the other hand is given as 49,600 pounds to the square inch which is more than double that of good cast iron. It is stated that the Peugeot driven by Dario Resta in the Vanderbilt cup and Grand Prize event was equipped with pistons of this material. Other drivers, including Bob Burman, Eddie Pullen and Louis Disbrow are stated to be using the new alloy. Miller worked out this alloy while getting up a light metal for a carbureter for aviation work. It has the characteristics of aluminum alloys in that it is strong, light and a good conductor of heat. Figures on the coefficient of expansion of the metal are not as yet available.

Firestone Adds Tire for Electrics

New York City, March 26—A new tire designed especially for use on electric pleasure cars has been developed by the Firestone Tire & Rubber Co., Akron, O., and was recently placed on the market.

The new pneumatic is built up with unusually heavy gum cushions between the layers of fabric to provide a high degree of resiliency; the construction is worked out with a view to obtaining the greatest possible economy of power, and the makers state that the result has been very satisfactory. But one type of tread is used—the Firestone dual tread, in which there is a central depression between two raised sections.

The prices, in some of the more popular electric car sizes, are as follows: 34 by 4, $34; 34 by 4 1-2, $40; 36 by 4 1-2, $43.

U-S-L To Sell Assets and Reorganize in July

Niagara Falls, N. Y., March 30—The U. S. Light & Heating Co., which has been operated under a receivership since last July, was authorized today to sell its assets, by an order from Judge Hazel of the Federal court, on the motion of Adolph Rebadow of Buffalo, counsel for the receivers of the company. No opposition was offered to the granting of the motion. The sale of assets will not take place until July when a reorganization of the company will be effected, when it is expected that those interested in the reorganization will purchase the assets.

The assets of the concern, including bills and accounts receivable, amount to $2,507,672.84, the total indebtedness being put at $754,602.47. J. Allan Smith, president of the firm, was appointed co-receiver with James O. Moore and James A. Roberts in February.

Pass Thorn Bill for Advance Payments

New York City, March 31—Presumably to meet the objection that the method of making payments under the New York Workmen's Compensation Law without the use of the Compensation Commission as an intermediary would result in considerable delays, both the Senate and Assembly have passed the Thorn bill, which provides for advance payments. It is expected that in a few days Governor Whitman will sign this measure as well as the previous measure, which makes direct payments by the employer to the employee possible.

The Thorn bill is intended to compel employers to make payments to injured workmen immediately after an agreement has been entered into and before injury claims have been officially passed by the Commission. Furthermore, the bill would permit employers to make advance payments even though no agreement had been entered into, such awards to be credited to any award which the commission might later decide upon. If it should develop that the employee were entitled to no compensation, however, the State would make no effort to assist the employer in recovering his advance.

Puritan Machine Buys Krit Parts

Detroit, Mich., March 27—Large quantities of the assets of the defunct Krit Motor Car Co., and the Krit Motor Sales Co. were purchased by the Puritan Machine Co. at auction last week. The Puritan company will continue the manufacture of parts for the Krit and will also build a limited number of complete cars. This makes something like sixty different makes of cars, no longer manufactured, for which the Puritan Machine Co. furnishes parts.

Boston, Mass., March 29—The offer in writing made by the joint stockholders' committee for the property of the Walpole Tire & Rubber Co. was filed in the United States district court today by the receiver. The offer states that in accordance with trust agreements on file with the State Street Trust Co., the Federal Trust Co. and the American Trust Co., the committee in the event of a resale of the property being ordered by the court, will bid not less than $800,000 for it.

Owing to the fact that the receivers' and creditors' committee which purchased the property for $780,000 had not been able to agree on the terms of the decree of sale, the hearing on the confirmation of the sale set for 2 p. m. today was postponed until April 6.

Warren Creditors Receive Final Dividend

Detroit, Mich., March 29—The liquidation of the affairs of the bankrupt Warren Motor Car Co. ended a few days ago and a final report has been mailed to the creditors and stockholders by the Detroit Trust Co., which acted as receiver. A final dividend of 2 1-8 per cent. was allowed paid by the court and is being sent now. The total dividend paid to the creditors is 22 1-8 per cent.

A rather unusual feature was that, while the appraised value of the assets of the company was $119,000, exclusive of mortgages, the receipts of the receiver, since its appointment, from liquidation of the various assets have amounted to $165,947.27 showing that $46,947.27 more had been obtained than at first estimated. Of this amount about $40,000 was spent to pay taxes and clear title to the company's real estate.

Speedwell Creditors May Get 10 Per Cent.

Toledo, O., March 26—Provided the proposition for a settlement of the affairs of the Speedwell Motor Car Co., Dayton, O., by means of liquidation outside of the courts, is accepted by all the interests concerned, general merchandise creditors of the company may get as much as 10 cents on the dollar on their claims.

Receiver Green has been authorized by the court to borrow $10,000 to repair certain parts of the factory and to properly guard it until it is again placed in operation. The merchandise claims total about $63,000.

It is considered probable that the Recording and Computing Machines Co., Dayton, of which W. I. Ohmer is president, will purchase or lease the plant of the Speedwell company. It is reported that the plant was offered for $150,000, the face value of the property, which is carried on the books for something over $200,000. It is also stated that the bondholders have likewise made a proposition to lease the plant to Mr. Ohmer on his assuming the interest on the bonds.

40 Cents per H. P. in California Bill

Sacramento, Cal., March 26—Annual state automobile license fees will be paid at the rate of 40 cents a horsepower under the conference automobile bill, introduced in the senate today by Senator Birdsall. Among its features are: that license plates need not be changed each year, but a small disk will be attached indicating the year. That speeders on a second conviction shall lose their licenses for 6 months.

One of the chief contests in the drafting of the bill was settled with the fixing of the S. A. E. formula for rating horsepower.

The tax on commercial vehicles is changed so that they are rated according to weight of the unloaded car, ranging from $5 up to 4,000 pounds to $20 for 8,000 or more pounds.

All automobiles formerly exempted from license fees, except Federal-owned cars, are included under the tax. Municipally-owned cars are the principal ones affected.

TRENTON, N. J., March 24—The House today passed the Senate bill amending the Seven Sisters anti-trust laws by permitting a corporation to buy the stock of another corporation for investment purposes, but not for voting power.

N. Y. Bill Gives Cities License Power

NEW YORK CITY, March 31—An automobile bill was introduced at Albany last week by Dwight Braman, president of the Law and Order League, which would amend the present automobile law by providing for the licensing of automobiles by the first class cities of New York, Buffalo and Rochester. All funds, however, are to go to the state. These city licenses will be good anywhere in the state and state licenses are to be good in the first-class cities.

Clero Hand-Operated Horn Reduced to $3.50

NEW HAVEN, CONN., March 27—The Fitzgerald Mfg. Co., Torrington, Conn., has reduced the price of its regular type hand-operated warning signal, the Clero, from $4.50 to $3.50. At the same time the price of the extra long projector has been reduced from $5 to $4. The regular model is finished in black with nickel bell and the extra long projector has black finish with the rim of the bell nickeled.

Both signals are of the type in which the operating lever is vertical, the signal being operated by pushing the levers down. Attachment is simple.

Clero hand horn selling for $3.50

Morton Receives $270,000 Truck Order

HARRISBURG, PA., March 27—An order for ninety-four commercial trucks for the British government at a possible cost of $270,000 was announced this week by Ross Morton of the Morton Truck and Tractor Co., following the receipt of a cablegram from R. L. Morton, who is now in London demonstrating with two armored trucks manufactured at the Harrisburg plant.

Work on the order will be started within the next 2 weeks and will provide for employment of additional men at the plant. The work will be started as soon as the contract for the machines is received. While they are being built work will be carried on day and night.

This is the second big contract received by this firm from the British government within the past month. The work on the trucks for the British government and the large tractor order for the Russian government will keep the plant busy for a number of months to come.

Duplex Enters Foreign Fields

CHARLOTTE, MICH., March 24—An order for 375 trucks has been received by the Duplex Power Car Co., of this city. These trucks have been sold to an exporting concern located in London, Paris, Petrograd, Buenos Aires, Johannesburg, South Africa, and points in Australia, Japan and China.

ST. PAUL, MINN., March 20—An order for thirty four-wheel-driven Ware trucks has just been received by the Ware Motor Vehicle Co. of this city. The trucks are for military service abroad and the price paid is said to be $3,500 apiece.

NEW YORK CITY, March 24—It is reported on good authority here today that the Bowling Green Motor Car Co., Bowling Green, O., has received an order for 1,000 trucks from the Wolseley Motors, Ltd., Birmingham, England, for military service.

DETROIT, MICH., March 30—J. C. Ayers, who has been in charge of the Detroit branch of the General Motors Truck Co., will become assistant sales manager at the factory in Pontiac. The Detroit factory branch will be discontinued April 1 when the sale of G. M. C. trucks will be taken over by the Standard Auto Co., which also has secured the agency for Republic trucks.

SEATTLE, WASH., March 27—A trainload of Case automobiles consigned to Vladivostok arrived in this city, last week, the same being part of a large order placed with the J. I. Case Co., by the Russian Government.

This trainload is the second consignment which has come through the port of Seattle bound for Siberia during the past month. Considerable secrecy surrounds this shipment, but it is estimated by the Case distributors in Seattle, Messrs. Sharp and Leader, that it contains approximately 168 automobiles. On each of the twenty-one flat cars are two boxes containing the parts for probably eight machines each. The value of the shipment is about $250,000.

The machines will be shipped from Seattle to Vladivostok on the Russian boat now making this port, and will be reshipped from there to Eastern Russia. Upon their arrival in Petrograd, they will be uncrated and assembled by a skilled crew of Case factory expert mechanics.

Duplex and Jeffery in Government Test

WASHINGTON, D. C., March 27—Before a board of officers of the army and marine corps a series of demonstrations was conducted this week with a 2-ton Duplex and a 1 1-2-ton Jeffery truck, both carrying 20 per cent. overload. The testing ground was in lower Potomac Park and the trucks were equipped with chains. The Duplex was the first to cross the field and had gone about 100 yards when the rear wheels began to sink down into the soft earth. Holes were dug around the wheels and as soon as suitable traction had been secured the truck pulled out of the holes under its own power.

The Jeffery truck was sent at good speed across the same field and, while turning, the rear wheels sunk out of sight while the front wheels went almost down to the hubs. The greater portion of the load of pig iron was removed and after traction had been secured the truck quickly extricated itself. Later demonstrations were conducted at Fort Myer in connection with the field artillery. The board conducting the tests consisted of Col. E. K. Cole, Maj. Robert Dunlop, Maj. H. L. Roosevelt and Capt. Robert Underwood. They have not yet completed their report of the tests.

LIMA, O., March 26—A new 500-pound light delivery vehicle is to be manufactured in this city by C. E. Miller and F. M. McGraw. The new vehicle is listed at $550, weighs 1,350 pounds and is provided with a 20-horsepower four-cylinder valve-in-the-head motor. Mr. McGraw was formerly a buyer for the McIntyre Mfg. Co., Auburn, Ind.

NEW YORK CITY, March 30—Invitations to attend the motor truck convention in Detroit on May 5 and 6 have been sent by the National Automobile Chamber of Commerce to all the active established manufacturers of commercial motor vehicles.

Arrangements for the convention were made last week by M. L. Pulcher, Wm. E. Metzger and Alfred Reeves. Get-acquainted buffet luncheons will be served each day in the banquet hall of the Statler hotel, and there will be an entertainment for convention delegates the first night. Among the papers to be read will be one on Advantages of Selling on Time Payments and How Such Sales Should Be Handled, by Windsor T. White, president of the White Co., and chairman of the Commercial Vehicle Committee of the N. A. C. C.

Street Railways Fight Jitney Development

Activity in New Bus Lines—Many Organizations

BOSTON, MASS., March 27—How the street railway interests of Massachusetts tried to legislate the jitneys out of existence just as they were born in the Bay State makes an interesting story. The Massachusetts Street Railway Assn. had received reports of the jitneys, and quietly went to work to stop them by filing a bill in the legislature last January, that for completeness was far ahead of anything the motor interests had ever seen.

The bill had so much in it that it was top heavy, and it was seen right away that it was an attack upon the jitney bus. But as many members of the legislature came from sections where the street railways gave no service or very poor service the committee on Mercantile Affairs was waiting for the street railway attorneys with "a brick in each hand." And the motorists were there to put in their side. The apparent attempt to legislate out of existence a transportation plan that had not even had a chance did not appeal to the members of the committee. There was also before it another bill with the same idea in view though not so bad, that called for depositing $3,000 in securities before anyone could operate a motor vehicle for hire. That was sent to roads and bridges committee where it was quickly thrown out and a new bill of very different character reported.

It contains only five sections. The first section does not say who shall or shall not engage in the business. It provides for first securing a permit from the municipal or town authorities, and the filing of a bond of $2,000 for each vehicle operated. Section 2 provides that persons injured may have action against such bond. Section 3 allows the city and town authorities to make special rules for the convenience and safety of the public. Section 4 provides a penalty of not more than $20 for violating the law. The new law goes into effect July 1, and does not apply to taxicabs, motor cars rented by the day or hour, with or without driver, or to motor vehicles performing a service similar to that performed by horse-drawn vehicles.

To Fight Texas Jitney Laws

AUSTIN, TEX., March 26—Several of the Texas towns have under consideration ordinances regulating the jitney transportation service. In Fort Worth and Houston ordinances that are alleged to be particularly drastic have been adopted. The constitutionality of the Fort Worth ordinance is to be tested in the courts. The case that is expected to determine to a more or less degree the standing of the jitney is that of ex parte I. W. Sullivan. Under the Fort Worth ordinance Sullivan was fined $10 annual tax for the privilege of operating a jitney car upon the streets of that city. He has taken an appeal to the State court of criminal appeals and the case was formally submitted to that tribunal on March 31. It is expected a decision will be handed down in a short time. The attorneys for Mr. Sullivan allege on his behalf that the ordinance is unconstitutional because it is class legislation, inasmuch as it fixes a tax on operators of jitneys in excess of that levied on hacks and buses, which is $3 per annum.

The Houston jitney ordinance requires a bond of $5,000, with one-half that sum as the maximum amount of recovery in case of injury. Jitneys are forbidden to pass street cars while the latter are taking on or discharging passengers. The ordinance also provides a license fee for each jitney and contains several other drastic provisions which are objected to by the operators of the cars. The measure will be tested in the courts, it is announced.

The two principal objectionable features of the Dallas jitney ordinance from the standpoint of the operators are that which requires them each to give a bond of $2,500 as a protection to passengers in case of injury and the one that prohibits them from carrying passengers on the running board of their cars.

Second New York City Jitney Application

NEW YORK CITY, March 25—The New York Central Transportation Co., Inc., has applied to the Board of Estimate and Apportionment for a franchise to operate a 5-cent bus line between the Grand Central and Pennsylvania railroad stations in this city. The only buses now running to and from the Pennsylvania terminal are those of the Fifth Avenue Coach Co., on which the fare is 10 cents.

The bus company offers to pay the city 3 per cent. of the net profits or 20 per cent. of the gross receipts for a franchise.

The People's 5-cent Bus Corp. also has an application before the board for a franchise to operate electric buses over certain of the city streets for a 5-cent fare which has not been acted upon as yet.

Chicago Considering Municipal Buses

CHICAGO, ILL., March 31—Plans to establish a system of motor buses in this city to be owned and operated by it, have been made. Commissioner of Public Service has made preliminary report to the city council favoring the project and designating twelve suitable routes together with estimates of the number of buses needed and the cost of installation.

If the city decides to adopt the buses, it will use for the purpose a fund of $3,000,000 derived from the city's share of the earnings of the traction companies, which are strongly opposed to the plan.

Baltimore-Washington Bus Line Planned

WASHINGTON, D. C., March 27—Application has been made to the public utilities commission by the Baltimore & Washington Boulevard Co. to operate a motor bus line between this city and Baltimore.

The proposed route is over the so-called Washington-Baltimore boulevard, a distance of 45 miles. Terminals will be established in the heart of the two cities and it is proposed to charge a fare of 75 cents each way. This is much lower than the fare charged by either the steam railroads or the electric line. It is proposed to operate 40-horsepower buses having a capacity for twenty-six passengers each and weighing 7,500 pounds. Management of the company will be by a board of directors consisting of J. M. Lehman, C. E. Trace, E. A. Reiner, F. J. Kenney, W. H. Laynor and F. B. Manns. It is expected the service will be inaugurated within the next 6 weeks.

SAN FRANCISCO, CAL., March 26—The San Francisco Jitney Bus Assn. has been in existence for about 2 months. It has 1,400 members already and is growing daily. A point of interest is that while the competition is the trolley system of the city, whether privately or municipally owned, the association does not run any jitneys upon the same street on which the municipal cars operate, rather selecting where possible a parallel route. The Pacific Coast Casualty Co. makes a special rate to them of $72 per year, payable $6 a month. This is equivalent to a bond and protects them against any accident.

Jitney Convention at Kansas City May 4

KANSAS CITY, MO., March 26—Kansas City jitney people have called for a national convention of all those interested in the jitney movement to be held in this city, May 4, 5 and 6 at which time an interchange of views on such points as legislation, insurance, safety in operation, licensing of drivers, equipment and every other question relative to the jitney movement can be discussed. The call for the convention has resulted from the many letters the Kansas City Jitney Assn., 1133 Grand avenue, has received.

SPRINGFIELD, MASS., March 27—The Studebaker agency in this city has started a jitney bus line between Carew street and Forest park during the rush hours, morning and night, and a 20-minute service for a 5-cent fare is in force. The bus in use carries twelve passengers and others with a larger capacity will be used later if business warrants it. This makes the second jitney bus line in Springfield.

PROVIDENCE, R. I., March 26—Two wagon loads of police in addition to the four on duty were needed to keep order at the City Hall last night when a hearing was given on plans to originate ordinances to govern the running of jitney buses in Providence. It was estimated that 1,500 people besieged the hall. The council chamber, lobbies, coatrooms and balconies were packed and several hundred more could not get in and had to stand in the hallways on the second and third floors and the broad staircases. Another large number could not get into the building at all. The hearing was overwhelmingly in favor of jitneys, of which 500 are in operation here.

NEW YORK CITY, March 29—The eighth annual Winton Motor Car Co. repair expense contest will start May 1 and end October 30. Cash prizes amounting to $3,500 will be paid the twenty-five chauffeurs making the best records. Also, the best record made by a "New-Size" six will win for its owner a brand-new car in even exchange for his old one.

If prior to October 30 any contestant has driven 12,500 miles, his effort ends at that point; he will not be required to continue. This is to equalize chances. First prize will be $500; second, $400; third, $300; and fourth, $200. Sixteen prizes of $100 each and five district prizes of $100 each will be awarded. District prizes will be awarded for the best remaining record in each of five sections, after the first twenty prizes have been awarded.

National Garage Assn. Holds Convention

CHICAGO, ILL., March 25—The National Garage Owners' Assn. met in its annual convention March 23 and 24 at the Great Northern hotel. About 150 members were present representing the 1,250 garages which belong to the association in sixteen different states. The first Tuesday in October was set as the date for the Fall meeting.

W. N. Mitchell, chairman of the purchasing bureau of the association, aroused enthusiasm by his report of the success of the bureau in buying the oil supplies for the association direct from the refiners. Since January 1 all the oil sold by members of the association has been bought through this bureau at a considerable reduction over the prices which it has been necessary to pay previously.

Supplies of all sorts also are being purchased by the Central Bureau direct from the manufacturers at a distinct saving to the garage owners, through the fact that the bureau can obtain quantity rates on supplies which would not be available for the individual garageman. The object of this arrangement is to assist the garagemen in competing with the mail order houses.

Pacific Racing Assn. Organized

LOS ANGELES, CAL., March 29—*Special Telegram*—The Pacific Racing Assn. was organized here today and made formal application for affiliation with the Automobile Club of Southern California. The ostensible object of the association is the sanctioning and controlling of automobile racing in Southern California. This organization comes as an aftermath of the recent controversy in connection with racing on the coast. Up to the present time the Automobile Club of Southern California has enjoyed special privileges from the American Automobile Assn. Contest Board for the conducting of its own contests, but these were recently withdrawn, after which the club severed its affiliations with the A. A. A. and hence the new organization.

Two Sunbeam Racers for Chicago Meet

CHICAGO, ILL., March 29—A cable direct from the Sunbeam company of England nominates two cars for the Chicago speedway race, scheduled for June 19, the drivers named being Louis Coatalen, engineer of the company, and Porporato, a Spanish driver who at one time was considered among the top-notchers but who has not been very active in racing of late years. Inasmuch at Coatalen and Chassagne have been named for the Indianapolis race, fans are wondering if a switch in plans has been made and Porporato substituted for the holder of the world's hour record, who is now in the French army.

Coatalen promises to bring over two of the Sunbeams which were raced in the last French Grand Priz, stating that these cars really are racers whereas the Sunbeams that have been in American competition have been modified types of touring cars.

NEW YORK CITY, March 29—The Finley Robertson Porter Co., Port Jefferson, L. I., states that the three Porter-Knights which are being built for the 500-mile race at Indianapolis will be on the road by May 10. Good progress is being made in the construction of the motors and it is expected that the first one will be put on the block this week.

Mr. Porter has selected his drivers and he states that his pilots will be Hughey Hughes, Neil Whalen and Bruce Keene.

Tacoma Speedway to Be Planked

Track 50 Feet Wide—Asphalt Coating to Prevent Skidding—Other Racing News

TACOMA, WASH., March 25—Plans were adopted at a meeting of the directors of the Tacoma Speedway Assn. to make Tacoma's automobile speedway the fastest in the world. Wooden planks will be laid on the entire track, reducing resistance to a minimum and giving an amount of elasticity not found on dirt tracks. The planks will be covered with asphalt.

The question of plank pavement was taken up with the foremost drivers of the world by both George Dunn and I. N. Hague on their recent trip to San Francisco, and it was the opinion of the drivers that planks would make not only the fastest but the safest track.

Specifications call for the planks to be laid on edge at a width of 50 feet for the entire course. These planks will be laid with a space of 3-8 of an inch between them so that the present dish of the track will be maintained. A coating of asphalt will be given the surface to prevent the danger of cars skidding. The work of planking and surfacing the track will be completed by June 1.

International Motor Contest Assn. Formed

NEW YORK, March 31—The International Motor Contest Assn. has been organized and incorporated by the interests controlling State Fairs throughout the country for the purpose of conducting automobile races on mile and half-mile dirt tracks. This association intends to issue its own rules concerning races on these tracks, issue sanctions and, in general, to conduct such events.

This action was not unexpected by the American Automobile Assn. Contest Board which at present controls automobile racing, as some of the dirt track associations have been itching under the stringent regulations required by the Contest Board. The real cause of the present action dates to the placing of the Michigan State Fair track in the suspended list for conducting unsanctioned cyclecar races July 4, 1914, and the secretary of the Michigan State Fair Assn. is the leading mover in the new organization. Richard Kennerdell, Chairman of the Contest Board of the American Automobile Assn., does not view the new rival organization as a menace to properly organized and conducted automobile contests. The Contest Board has had stringent rules governing dirt track races requiring the removing of the fences at curves, removal of top rails, elimination of dust, and the proper safeguarding of spectators and contestants. Tracks have been required to register annually at a nominal fee and the Contest Board has been insistent in having its representatives at the various meets in order to insure enforcement of the rules.

Burman-Disbrow-Cooper Match Race

LOS ANGELES, CAL., March 24—Bob Burman, Louis Disbrow and Earl Cooper are to meet on the famous Ascot Park 1-mile dirt track in a three-cornered match race, April 4. Disbrow, driver of the Simplex Zip and Burman, pilot of the Peugeot, signed articles yesterday afternoon. Earl Cooper heard of the match race this morning and at once issued a challenge to the two drivers. Both Burman and Disbrow were willing to have Cooper and his Stutz admitted to the competition and the three-cornered race was immediately framed. The race will be sanctioned by the A. A. A. and promoted by Walter Hemple, who is hanging up a $3,000 purse on a winner-take-all basis.

INDIANAPOLIS, IND., March 29—The appointment of B. H. Miller of Indianapolis to superintend the construction of the automobile speedway at Sheepshead Bay, L. I., has been announced and Mr. Miller is now in the east, ready to begin work.

INDIANAPOLIS, IND., March 29—Under the auspices of the Business Men's Assn. of the city, a slow race for automobiles will be held at Alexandria, Ind., on April 14. Any car stopping or changing gears during the race will be disqualified.

Factory Miscellany

FRANKLIN'S Three-Story Addition—Plans are being prepared for a three-story addition to the plant of the H. H. Franklin Mfg. Co., Syracuse, N. Y., to be 100 feet in Gifford street and 53 feet deep. The construction work will cost $25,000 and the equipment of the building will bring the total expenditure up to $40,000. The structure will be used for the manufacture of die castings, this branch of the Franklin industry having outgrown its present quarters. Work will be started as early in April as it is possible. It will be so constructed that it can be enlarged at any time with little difficulty. The building is to be of fireproof construction, steel, concrete and brick being used. The Franklin factory reports an increase of sales since February 15 of 48 per cent. over the same period last year, while for the past 2 weeks the increase is 96 per cent.

Allen to Build—The Allen Motor Co. is contemplating the erection of a one-story $10,000 factory at Bethlehem, Pa.

Mayer Carbureter's New Plant—The Mayer Carbureter Co., 2673 Main street, Buffalo, will build a factory at Main and Amherst streets.

Packard's Storage Building—The Packard Motor Car Co., Detroit, Mich., is planning the erection of a 60 by 400-foot building for the storage of assembled parts.

Reo Working Full Time—Factories of the Reo Motor Car Co., Lansing, Mich., are working night and day, and the volume of business is running double that of a year ago.

To Build Bodies—It is reported that the Cruse-Crawford Mfg. Co., Birmingham, Ala., will establish a plant for the manufacture of automobile tops and wagon and buggy bodies.

Doehler Castings to Build—The Doehler Die Castings Co., Toledo, O., is having plans prepared for a factory containing 60,000 square feet of floor space. It will be located at the City Boulevard and Lake Shore Railroad.

Hoover Ball Adds—The Hoover Steel Ball Co., Ann Arbor, Mich., will erect a new factory building, 256 by 60 feet, which is now in course of construction. When completed there will be 230 men on the company's payroll as against less than ninety in 1913.

Start Work on Grant Plant—The Grant Motor Co., Findlay, O., has already commenced using the auxiliary plant in South Findlay that it recently leased. The chassis will be built in the North Findlay plant and the cars completed at the South Side plant.

Tire Plant for Mt. Clemens—The Auto Tire Armor Co., Mt. Clemens, Mich., has been incorporated with $10,000 capital stock to manufacture automobile tires. A factory has been purchased and equipment will be installed at once. Jay Baldwin and A. A. Bennett are the principal stockholders.

Willard Moves to Chippewa Falls—The Willard Mfg. Co. of Minneapolis, Minn., manufacturing electrical devices and specialties, is moving its plant and equipment to Chippewa Falls, Wis., which city has been selected as a permanent home. The name of the company will be changed to Chippewa-Willard Mfg. Co.

Roberts Brass Establishes Foundry—The Roberts Brass Co., Milwaukee, Wis., organized recently, has established a brass foundry and machine shop in the large factory building at 249-251 Lake street, and will manufacture an extensive line of brass specialties and parts for motor cars and railing, tubing, valves, etc.

Brown & Sharpe to Increase—The Brown & Sharpe Mfg. Co., Providence, R. I., has awarded the contract for greatly increasing its building known as No. 5. This structure is 49 by 146 feet, two stories high. Four additional stories will be built to bring it to the six-story addition, 64 by 109 feet, the estimated cost of which will be $75,000.

Cornelian's Production Schedule—The Blood Bros. Machine Co., Allegan, Mich., has laid out a production schedule which will enable it to build twenty-five Cornelian cars in April, 125 in May and 200 in June. The company has orders on file which will keep the shops going for many months. The working force will be gradually increased, this depending principally upon getting all the needed new machinery in place.

Regal Gives Second Motor Order.—The second contract for 1,000 motors for the Regal Motor Car Co., Detroit, Mich., has been received by the Port Huron Construction Co., Port Huron, Mich. The first order was given several weeks ago and was for 1,000 light, small, four-cylinder motors. The new order is for 1,000 eight-cylinder power plants. Both motors were designed by S. G. Jenks, general manager of the local company.

A. O. Smith Busy—The A. O. Smith Co., Milwaukee, Wis., pressed steel frames and parts, is again operating its big plant at full capacity, the number of employees on March 27 having reached more than 1,200. According to C. S. Smith, vice-president, business is brisk and the company's customers are making larger purchases than for a long time. Mr. Smith anticipates a maintenance of this demand throughout the summer and fall.

Studebaker Adds Machinery—A battery of new cylinder lapping machines has been installed in the plant of the Studebaker Corp., South Bend, Ind. These machines are just like those used for lapping the four-cylinder motors, except that each machine completes the work of one entire cylinder block of six cylinders in one operation. The block of cylinders is clamped on the machine upside down, and a set of master pistons of exact size work rapidly up and down in the cylinders. By keeping this up for several hours the cylinders become very accurate and are broken in.

Tank Co. Increases—Owing to the increase in business, David Israel, 300 West 48th street, New York City, engaged in the manufacture of gasoline tanks and fenders for the trade, has been compelled to take additional quarters for the manufacture of his line. This additional floor space will take in a stock room and a store room. The present working capacity of this concern is fifty tanks per day. When all alterations are completed the capacity will run anywhere from 100 to 150 tanks per day. This concern at the present time is building tanks for the Chevrolet cars and is prepared to take additional work from car manufacturers.

Auto-Light Co. in G. E. Plant—The Electric Auto-Lite Co., Toledo, O., will occupy the General Electric Co. plant on Champlain street, that city. The lease of the buildings is taken by the Willys-Overland Co., which subleases to the lamp company. There are two buildings, the larger one 304 by 85 feet, and four stories high. This will be used for manufacturing purposes while the other plant will be used for offices and the engineering department. An additional building will be erected for the press department. The company now occupies the old Dow & Snell building at the west end of the Cherry street bridge, affording 100,000 square feet of working space. The capacity of the present plant is 500 parts a day. The combined capacity of the two plants will be 1,200 pieces daily. Contracts have been signed which insure a daily output of 800 parts after August 1.

The Automobile Calendar

Mar. 30-April 2	Johnstown, Pa., Show, The Auditorium.
April	Calumet, Mich., Show, Coliseum.
April 3	Paterson, N. J., Show, Auditorium, R. A. Mitchell.
April 4	Los Angeles, Cal., Track Race.
April 5-10	DuBois, Pa., Show, Moose Hall.
April 7-10	Calumet, Mich., Show, Coliseum Rink.
April 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
April 20-22	Oklahoma City, Okla. Road Race, S. W. Auto Racing Assn.
May 15-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4-5	Tacoma, Wash., Road Race.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.

The Week in the Industry

Motor Men in New Roles

SPANISH Rep. Wants Accessories—In order to investigate American automobile manufacturing methods and equipment, as well as to effect selling arrangements for automobile parts and accessories, J. M. Vallet, representative of important Spanish automobile interests, is at present in this country and contemplates a tour of inspection. His headquarters are with Manuel Caragel & Son, 127 Water street, New York City.

Morehouse Resigns from Hudson—A. Morehouse has resigned as assistant chief engineer of the Hudson Motor Car Co., Detroit, Mich.

Sullivan Heads Overland Agency—A. P. Sullivan becomes head of the Overland Sales Co., Houston, Tex., C. W. Lindsay, former manager, having retired.

Histed Case N. Y. Mgr.—J. R. Histed has succeeded O. A. Lewellen as branch house manager for the New York City territory of the J. I. Case T. M. Co.

Smith Russel Axle Sales Mgr.—E. L. Smith, former Western representative of the R. I. V. Co., has been appointed sales manager of the Russel Motor Axle Co., North Detroit, Mich.

McDuffie Resigns—H. McDuffie has severed his connections with the Wm. R. Ruess Co , Los Angeles, and joined the forces of the J. W. Leavitt Co., coast distributors for the Overland.

Babcock Master Carbureter Agent—George Babcock, driver of one of the English Sunbeams in the recent Corona races, has returned to Hartford, Conn., and will represent the Master carbureter there.

Bowen Saxon Mgr.—The Saxon Motor Sales Co., Columbus, O., has been organized with C. N. Bowen as manager, located at 138 East Spring street, Columbus, O., to handle the Saxon and Hillier in central Ohio territory.

Dilger Advanced—A. C. Dilger has been advanced from the parts order department of the Studebaker Corp.'s factory at Detroit, Mich., to take charge of parts and claims at the New York City branch, effective April 1.

M. Siegfried King Production Mgr.—J. B. Siegfried, who until now had the title of purchasing agent of the King Motor Car Co., Detroit, Mich., has been appointed production manager and superintendent of purchases.

Hayes in Racine—H. T. Hayes, manager of the Mitchel Motor Co., Dallas, Tex., has been transferred to Racine, Wis., where he will look after the marketing of Mitchel automobiles in all states west of the Mississippi River.

Mahoney Chandler's Publicity Mgr.—J. J. Mahoney, press agent for the Boston Automobile Shows, has accepted a position with the Nettleton-Crittenden Co., Boston, Mass., New England distributors of Chandler cars, to act as publicity man.

Wells Transferred to Baltimore—C. E. Wells, former manager of the automobile department of the John Deere Plow Co., Dallas, Tex., has been transferred to Baltimore, where he becomes manager of the Baltimore house of the John Deere Co.

Markee District Manager—F. D. Markee has been appointed district manager of the New England branch of the Mitchell Motor Car Co., of New York, and will make his headquarters with F. H. Lucas, who has the Mitchell line in Boston, Mass.

Whaley Heads New Haven Chevrolet—J. H. Whaley, head salesman of the Hartford Buick Co., Hartford, Conn., has severed his connection with that concern and has been appointed manager of the New Haven Chevrolet branch. He assumed his new duties April 1.

Everett Resigns from Mitchell—W. W. Everett, for the past 8½ years in charge of the repair department for the Mitchell-Lewis Motor Co., Racine, Wis., has resigned to take a position as sales manager for the Racine branch of the Wisconsin Gas & Elec. Co.

Prewitt Resigns—J. L. Prewitt, for several years connected with the Chalmers and Palmer-Singer factories and for the past 2 years sales manager for J. W. Mason, Newark, N. J., has resigned to open a wholesale and retail automobile supply store to be known as the Essex Auto Supply, at 453 Main street, East Orange, N. J.

Andresa Chase Division Mgr.—H. D. Andress, until recently in charge of transportation problems for the Pennsylvania Railroad, has been appointed division manager for the Chase Motor Truck Co., Syracuse, N. Y., in a territory including Ohio, Indiana, Kentucky and part of West Virginia. He has established his headquarters in Cleveland, O.

Garage and Dealers' Field

Republic Tire Moves—The Republic Tire Co., Grand Rapids, Mich., has moved to 44 Murray Building.

Lippard-Stewart Makes Lease—The Lippard-Stewart Motor Sales Co., New York City, has leased a store at 136 to 146 West 52d street.

Gets Wire Wheel Agency—F. S. Boyd, who handles accessories in Boston, Mass., has taken on the agency for Rudge-Whitworth wire wheels.

Detroit Supply Co. Moves—The United States Auto Supply Co. has moved from 182 Grand River avenue, Detroit, Mich., to 851 Woodward avenue.

Auto Spray Offices Moved—The offices of the Auto Spray Co. have been moved from 86 East Lafayette avenue, Detroit, Mich., to 1231 Woodward avenue.

Takes Saginaw Empire Tire Agency—The Popp & Wolf Hardware Co., Saginaw, Mich., has taken the agency for northern Michigan for the Empire tires.

Firestone's New Branch—The Firestone Tire and Rubber Co. has opened a branch house in East Dallas, Tex. This company now has three houses in Dallas.

Silver Makes Newark Lease—The C. T. Silver Motor Car Co., of New York City, has leased a store at 738 Broad street, Newark, N. J. The store bas a frontage of 35 feet.

Michelin Branch in Des Moines—R. B. Tracy, general manager for the Michelin Tire Co., Milltown, N. J., has opened a branch at 1109 Walnut street, Des Moines, Ia.

Overland Agency Installs Paint Dept.—An automobile paint department has been installed at the Grand Rapids, Mich., headquarters of the Grand Rapids Overland Co., with service manager R. Richards in charge.

Opens New Salesroom—Tho Paige-Detroit Co., of New York City, has opened a Broadway salesroom at 63d street and Broadway. The new store will be run in addition to the general headquarters of the Paige company, in 58th street, just east of Broadway.

Mitchell Opens Detroit Station.—H. A. Mitchell, who was chief engineer of the Krit Motor Car Co., has opened a service station at 940 Jefferson avenue, East, Detroit, Mich. Krit car owners will find there a complete stock of parts for the different Krit models.

Fire Destroys Fifty Cars—Fire on March 27 in the building of the Collings Carriage and Auto Body Co., Camden, N. J., caused a damage of $150,000. Fifty automobiles, valued at $100,000, are included in the loss. Fifty cars on the first floor, ready for delivery, were saved.

New Detroit Accessory Firm—Automobile accessories are being handled by the Advance Sales Co., Detroit, Mich., which recently opened for business at 864 Woodward avenue. This company was formed by W. F. Nick and J. J. Grady, both formerly connected with the Maxwell Motor Co.

Montreal Dealers Form Assn.—The accessories dealers in Montreal, Que., are forming a protective association in conjunction with the parent association, the Montreal Automobile Trade Assn., to regulate the prices of accessories. The sale of accessories has assumed the nature of an abuse latterly and it has long been felt that stringent steps should be taken to protect the trade.

Newark's Automobile Pageant—The Newark (N. J.) automobile dealers will have an automobile pageant on April 10. The parade is to be made up of six sections, including passenger cars, municipal vehicles, commercial cars, motorcycles and floats. Prizes consisting of silver cups, trophies and accessories are offered in the various divisions. Headquarters are 845 Broad street, in care of C. E. Holgate, secretary.

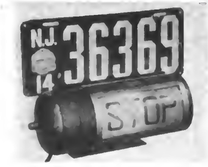
In New Quarters—A. M. Spear, Jr., agent for the Dodge cars at Portland, Me., has moved into the old Spear Auto Co. quarters, 92 Cross street. C. E. Hill, manager of the King agency at Portland, has opened the new salesrooms at 17 Forest avenue, where the car is being handled through the Cape Cottage Garage Company. The United States Tire Co. has opened a branch at Portland, at 16 Forest avenue, to serve all Maine, Coos County, N. H., and Essex County, Vt. The Kelly-Springfield Tire Co. has closed an agency with M. B. Mank.

ACCESSORIES

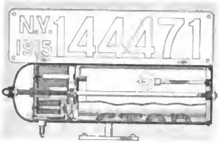
Direction Indicator

THE external appearance of this device is made clear by the photograph, which also shows its size, by comparison with the standard number plate. The outer case is brass, and inside there is a glass cylinder divided into four sections, one bearing the word "Stop," another colored plain red, and the other two labelled "Turn," bearing arrows pointing to right and left respectively. At the end of the case there are three magnets which can be caused to pull around an armature and turn the glass cylinder more or less according to which magnet is energized. In the section this armature is shown hanging in the bottom position, to which it returns by gravity when the magnets are deenergized. The lamp is accessible from the end of the case, and there is a long, narrow window along the top of the case through which a shaft of light illuminates the registration plate.

It is recommended that the control be both by finger-operated switch and by connection to the brake pedal for bringing the "Stop" signal into play. Normally, when there is no current in any magnet and the armature lies at the bottom, it is the plain red section of the glass cylinder that is opposite the rear window, and this acts as a tail light. A bell forms the left end of the outer case, as can be seen in the cut, and this is arranged to ring every time the signal is operated.—Samuel T. Warner, New York City.



Exterior of Warner rear signal



Warner signal in section, showing construction and scheme of magnets

Combined Horn Button and Dimmer

This little fitting is designed to take the place of the ordinary horn button and is suitable for attachment to any convenient place. In the center is the usual button which operates the horn in the ordinary manner, and a second knob which can be slid across in a concealed slot is situated beside the middle button. A slide forward puts on the lamps bright, and pulling the knob backwards and to the left throws in the dimming coil. One more wire is called for than is needed by an ordinary horn push, and the switch is catalogued at $3.—Kent Electric Co., Grand Rapids, Mich.

Gearset Lock

There is no more effective way of locking a car than by rendering it impossible to engage a gear. The Commercial lock is a specially designed padlock which hooks into the center of the change speed gate and is secured there by a turn of the key. It is made to suit thirty-seven different makes of car and possesses the advantage that it needs no fitting whatever; just put it in place and turn the key. It is sold by the makers for $2, and they claim that the lock cannot be broken while in position.—Commercial Mfg. Co., Cleveland, O.

Towing Line and Car Lock

Every long-distance tourist knows the Basline Autowline that coils up small and yet will pull any car, for it is the sort of aid to getting out from bad places that just suits the needs of the case. The makers have just applied the same material for locking a car or for attaching spare tires in such a way that they cannot be removed. It is claimed that the strength of the Basline strands is such that no ordinary nippers can cut through them, the eyes are spliced in a way which makes it very difficult to attack that part of the device, and the lock itself is a strong bronze casting. Price is $2. The line is covered with a special fabric, which, it is claimed, will not fray or collect dirt.—Broderick & Bascom Rope Co., St. Louis, Mo.

Basline Autowline used as a tire lock

Unbreakable Ammeter

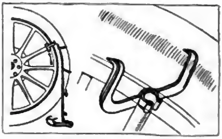
This pocket meter is all metal and contains no delicate parts or glass, so it can be thrown in amongst a jumbled tool kit without fear. The bottom point is insulated by a plug of ebonite, completely protected by the outer case and the second terminal can be removed by sliding off the clip. The only care necessary is to hold the meter upright while using it and the tongue which projects to show the current sinks down inside when out of use; placing on the cap then makes the meter watertight as well as damage-proof. It sells for $1.—Benford Mfg. Co., Mt. Vernon, N. Y.

Tire Chain Attaching Tool

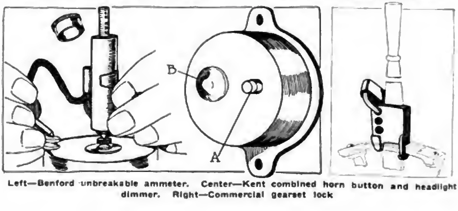
Under some conditions it is not too pleasant a task to fit the essential tire chain, but those who have not the knack of doing this quickly and easily should find the "Alcemo" tool of assistance to them. The sketch shows how it holds one end of the chain while the wheel is revolved, and the other end can then be hooked on the free end of the tool. The price is $1 a pair, or the clips can be bought singly for half this sum.—Alcemo Mfg. Co., Newark, N. J.

Tire Chain Protector

This is a short length of chain which is designed to link the tire chain to the hub cap and so prevent the loss of the chain should the latter come off the wheel through any mischance.—Bodenstein Bros., Rochester, N. Y.



Alcemo tool for attaching tire chains



Left—Benford unbreakable ammeter. Center—Kent combined horn button and headlight dimmer. Right—Commercial gearset lock

A GREAT PLUG

A GREAT QUALITY A GREAT SERVICE

V-Ray

Spark Plugs loom head and shoulders above anything else in the way of quality plugs today. The conscientious dealer swears by V-Ray because he knows that

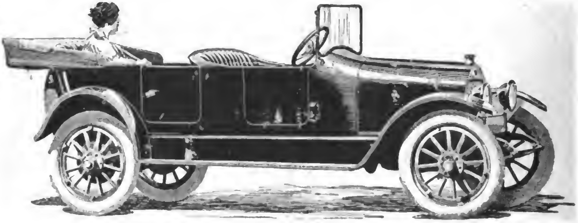
THE CUSTOMER COMES BACK —THE V-RAY NEVER

Whenever you weary of the commonplace in plugs, whenever you tire of breakage and constant cleaning; whenever you want to make it a case of FIRST COST IS LAST COST—Then is the time to displace the "PER-HAPS PLUG with the PER-FORMANCE PLUG"—The V-Ray.

ALL JOBBERS The Price is the same $1.00. Why take less? ALL DEALERS

The V-Ray Co., Marshalltown, Iowa

The Thomas B. Jeffery Company
Jeffery
Kenosha, Wis. U.S.A.



Quality

Where others leave off Jeffery begins. Compared with other cars of the same price class using materials and equipment that are "good enough," Jeffery pays the additional cost for the best.

Motor starter—$35 more on the Sixes.
$90 more on the Light Four.
Ignition—$15 more for Bosch.
Transmission—$35 more for four speeds.
Tops—$10 more for finish and materials.
Upholstery—$25 more for quality, leather and real curled hair.
Worm drive—$50 more for the most advanced design.

These are only a few points. They apply in equal proportion throughout Jeffery construction.

In quality, beauty, workmanship, comfort and economy Jeffery leads.

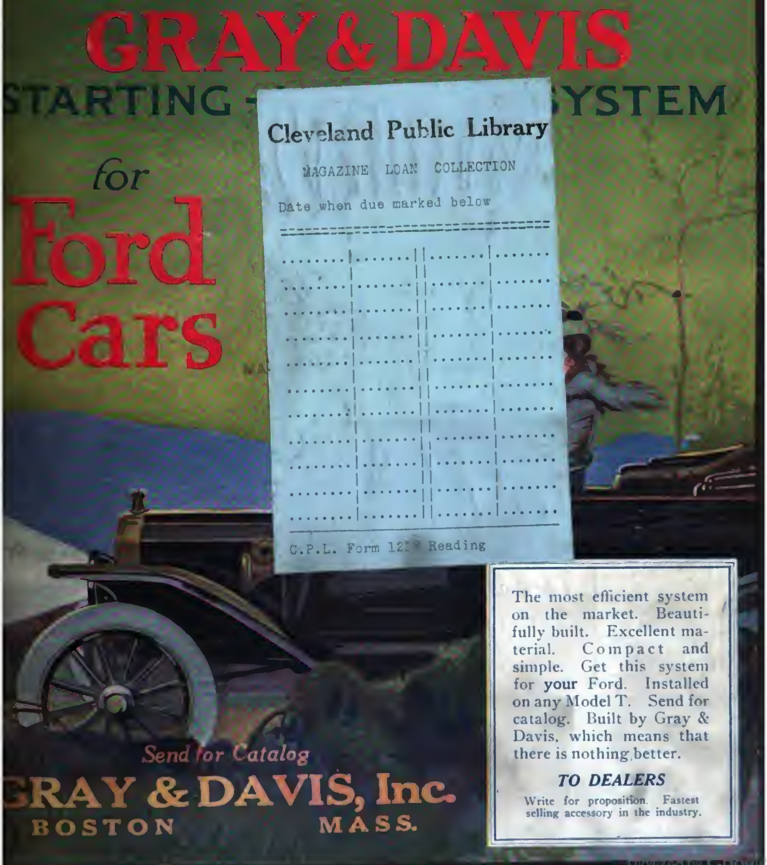
The Thomas B. Jeffery Company
Main Office and Works, Kenosha, Wisconsin

pril 8, 1915

10 cents a Copy

The AUTOMOBILE

MAGAZINE LOAN COLLECTION



GRAY & DAVIS
STARTING –
SYSTEM
for
Ford
Cars

The most efficient system on the market. Beautifully built. Excellent material. Compact and simple. Get this system for **your** Ford. Installed on any Model T. Send for catalog. Built by Gray & Davis, which means that there is nothing better.

TO DEALERS

Write for proposition. Fastest selling accessory in the industry.

Send for Catalog

GRAY & DAVIS, Inc.
BOSTON MASS.

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 12[illegible] Reading

A GOOD TRADE

When a dealer sells AC plugs to a car owner he is justifying the above caption and making a good trade. The trade is good because both sides are well satisfied; the dealer making a fair margin of profit and the user getting service and absolute satisfaction. A reliable dealer will safeguard his customers' interests and at the same time look after his own by recommending AC plugs, thereby following the judgment of the leading automobile engineers in the country.

The reason AC-TITAN and CICO plugs are used for regular equipment by a majority of the leading manufacturers is that they are the most efficient. Our new manufacturing process has made spark plug troubles a thing of the past.

We manufacture only AC-TITAN and CICO plugs. Do not be misled by a similarity of names.

These are the firms that equip with AC Plugs:

Buick
Cadillac
Cartercar
Chalmers
Chase
Chevrolet
Cole
Commerce
Dodge Bros.
Dort
Federal
Ferro
G M C
Haynes
Harley-Davidson
Hudson
Hupp
Jackson

These are the firms that equip with AC Plugs:

Knox
Lambert
Lexington-Howard
Moline Knight
Monroe
Moon
National
Oakland
Olds
Packard
Peerless
Paige
Reo
Saxon
Stearns
Stutz
Touraine
Velie
Wilcox Truck

CHAMPION IGNITION Co.

FLINT · MICHIGAN · U · S · A

Vol. XXXII New York—Thursday, April 8, 1915—Chicago No. 14

The AUTOMOBILE

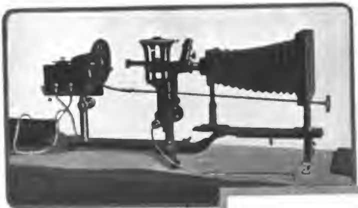
Microscopic study of tissue reveals the uses of medical and surgical agencies in correcting impurities in the human system

Steel—Its Pathology

Part 1—Iron, Carbon, Manganese and Impurities Always Present

By J. Edward Schipper

Part I—Original Composition
Part II—Alloys for Special Work
Part III—Heat Treatment
Part IV—Practical Selection



Microphotographs of steel specimens reveals the uses of alloys and heat treatment in strengthening structure of steel

IN the dim recesses of the pathological laboratory the scientist carefully focusing his microscope on a film of human tissue strikes at the very root of the reason for all medical practice. It is his research that guides the surgeon's knife, the practitioner's prescription book and leads the student to a comprehensive knowledge of what can be done to cure the human being of his ills and to lengthen his stay upon the earth.

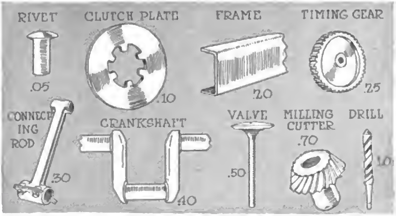
In the laboratory of the metallurgist the microscopic study of the structure of steel brought into concrete form by the use of the micro-photograph which shows the metal magnified, from ten to 1,200 times, exactly parallels the work of the pathological scientist in its far-reaching effect upon the use of materials. The metallurgist's prescription book has to do with the vitality and fitness of the metals used in our big industries in the same way that the prescription book, or the surgeon's knife, has to do with the health, strength and vitality of the human race.

The doctor of medicine knows what elements will build up human tissue, he knows what will purify the blood, what will stimulate and what will deaden the activities of the human organs. The athlete, training for a gruelling contest, knows that certain foods will give him stamina and endurance. The uses of starchy food and sugar develop fat, iron is a blood purifier and so on through the list. People of the far north live on fats such as blubber. It gives them the heat to withstand the intense cold. People at the equator live largely on fruits and other foods which do not product heat.

With steel it is the same. For the steel used in the crankshaft of a motor we need the characteristics of rigidity and the ability to withstand great torsional stress. In the valves we need steel that will withstand the effects of high temper-

Materia Medica

Iron	The basis of steel
Carbon	The determinative
Sulphur	A strength sapper
Phosphorus	The weak link
Oxygen	A strength destroyer
Manganese	A purifying medicine
Nickel	For strength and hardness
Tungsten	Hardener and heat resister
Chromium	For resisting shocks
Vanadium	The fatigue resister
Silicon	Impurity and hardener
Titanium	Removes nitrogen and oxygen
Molybdenum	Hardener and heat resister
Aluminum	Kills or deoxidizes steel



Parts made from steel having different carbon percentages showing, by practical examples, how the increase in carbon gives a decrease in the welding ability of the metal and an increase in its hardness

atures and the constant hammering on the valve seat. For gear wheels we need steel that will endure the continued engagement of tooth upon tooth in the transmission of the heavy loads due to the propulsion of the automobile. Then again we have the steel used for such purposes as the magnets on a magneto. This metal has no stresses to endure but must on the other hand retain the magnetism in order to permit the instrument to generate its current of electricity.

In all metallic ores there are impurities. In the human being certain medicinal treatments neutralize or remove impurities; in metallurgy we have corresponding medicines that destroy the harmful effects of the impurities inherent with a particular metal, these are added, not for the purpose of giving additional strength through their own properties, but to increase its strength and purity by transforming the impurities into compounds that will not harm the metal.

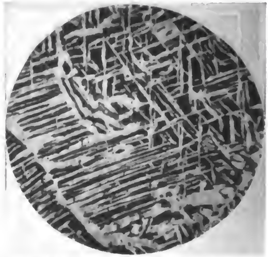
Steel, like all other matter, regardless whether it be in the form of a human being, a tree, a piece of glass, earth or brick, is made up of molecules. A molecule is the smallest possible portion in which any given matter can exist. If we were to subdivide it further we would break it up into the elements of which it is composed. For instance, if we take water and continue to reduce its volume we would finally reach a point beyond which subdivision would be impossible. At that time we would have two particles of hydrogen and one of oxygen. These particles are called atoms. Thus a molecule of water is made up of two atoms of hydrogen and one of oxygen. Hydrogen and oxygen are elements and cannot be further subdivided.

Carbon and Iron Always Present

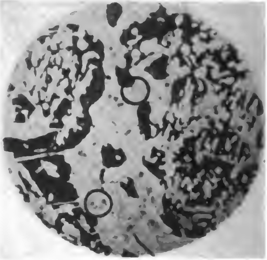
In a steel we have always the primary elements of carbon and iron. Iron is a metallic element. Carbon is a non-metallic element. The purest form of iron in a natural state is in the best Swedish ore. The purest form of carbon in a natural state is the diamond or graphite. The same matter, which in one form is the valuable diamond in another form is the black graphite. The only difference is that the carbon in the diamond is highly compressed. Carbon is a constituent of all animal and vegetable tissues, of coal and of petroleum. It also enters into the composition of many minerals and in combination with oxygen forms part of the atmosphere we breathe. Combined in certain proportions with hydrogen it forms acetylene gas used for headlights, and with the element silicon in an electric furnace it yields the hardest of abrasive materials.

By varying the carbon content of steel, the metallurgist varies the entire nature of the finished product. The percentage used, as a result, varies widely. As the carbon content of steel increases, the welding power decreases, thus as a general rule ductile and easy-welding steels must be as free from carbon as possible.

Again, as the carbon content of steel increases, its resistance to shocking stresses decreases. Thus the typical content of carbon for rivets would be .05 per cent. because in rivets a ductile material and one easily hammered into the desired shape is required. On the other hand, the content of carbon runs up to more than 1 per cent. for glass-hard tools,

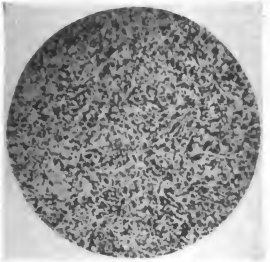


Microphotograph of steel as it is cast, showing the coarse structure which renders it brittle and unfit for usage in parts undergoing stresses—W. Campbell

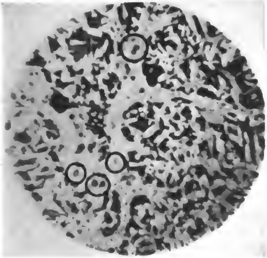


Open hearth steel casting before annealing, showing the metal as originally cast. The dark circles surround globules of manganese sulphide and represent weak spots in the casting—Iron Age

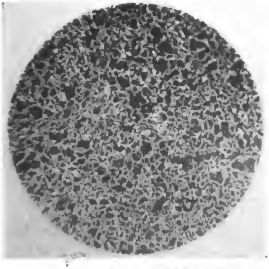
Manganese sulphide in a refined casting. This shows the tree-like formation often taken up by manganese sulphide and represents an area where the strength of the normal grains of iron and carbon combinations are weakened—W. Campbell



Microphotographs of same steel as shown on opposite page after it had been heated to 850 degrees centigrade and thus refined—W. Campbell



Same open-hearth steel casting as that shown on opposite page after annealing. As shown by the dark circles, the manganese sulphide is still present in its characteristic globules—Iron Age



Microphotograph showing the uniform grain of special steels in which strength is a requirement. This is a chrome-nickel steel in which the uniform composition and arrangement of the molecules will be noted—Iron Age

etc. For small drills the amount of carbon will sometimes be as high as 1.5 per cent. The higher the steel is in carbon the harder it becomes and thus we find that in order to present a hard and unyielding surface at points of wear it is very often necessary to carbonize the exterior shell of the metal forming a hard casing about the softer core. This process of carbonizing the exterior is known as case-hardening.

Case Hardening—Metal Callous

The case-hardening of a metal has its parallel in nature in the formation of callous skin on a part which is submitted to wear or abrasion, the difference being that in one case the hardening of the exterior portion submitted to wear is done deliberately, while in the other it is done by a natural process.

Examples where case-hardening is used in automobile work are extremely numerous, but, to give one or two good examples, the cams on an integral camshaft may be mentioned. Here we have a shaft, that, with the exception of the points where the cams bear on the followers, must only meet torsional and bending stresses. On the surface, the cams must meet the constant rubbing and wearing contact. It is evident that at the point where this wear takes place a glass-hard protecting skin over the surface of the metal is desirable and here the use of the case-hardening process finds one of its best uses.

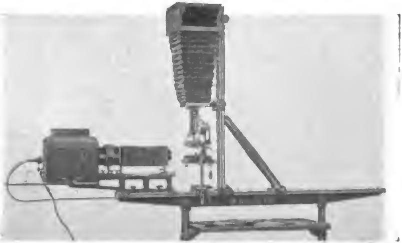
Other examples may be given practically without limit, but, to mention one other, the gear wheel may be cited. Here the tough steel necessary to perform the work of transmitting power is surrounded by a case-hardened shell to take the rubbing wear of tooth upon tooth, thus combining the advantages of the tough steel with that of the hard bearing surface.

We shall return to carbon, but let us leave it for a while to discuss the other elements which we find always present in all steels.

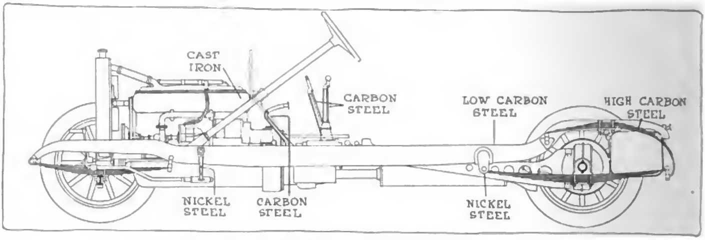
Manganese is one of these. In steel manganese is a medicine. Taken alone it decreases rather than increases the merit of the steel for all ordinary purposes. It reduces the malleability of the metal, but is added intentionally in quantities as high as 1.5 per cent. to palliate the evil effects of the two arch enemies of steel—sulphur and oxygen. What iron or sulphur is to the human blood, manganese is to steel. Therefore, when the doctor of metallurgy writes the prescription of a particular metal he does not neglect the manganese ingredient in order to counteract the poisons, sulphur and oxygen, which he knows will be present because they cannot be entirely separated from the iron in the refinement of the ore.

Sulphur Isolates Molecules

The action of sulphur comes back to the molecular construction which we considered at the beginning. Sulphur has the quality of incasing the molecules of iron and separating them from their neighbors, thus weakening the structure. When manganese is added, the sulphur for which it has a strong affinity combines with it in the form of a sulphide drawing together into minute globules (see page 612), which are practically harmless to the finished structure of the steel. In the refinement



Illustrating the apparatus made by the Bausch and Lomb Optical Works for making microphotographs



Chassis showing some of the different kinds of steels used for specific purposes

CARBON CONTENT IN PER CENT. OF VITAL STEEL PARTS

From Five Representative American Cars

Car	Conn. Rod	Crank Shaft	Valve Stem	Valve Head	Clutch Plate	Tim. Gears	Trans. Gears	Drive Shaft	Chassis Frame
a ...	.30	.40	.50	.50	.14	.30	.20	.30	.30
b ...	.25	.45	.20	Tungs.	.14	.20	—	.35	.25
c ...	.25	.47	Tungs.	Tungs.	.10	.25	.50	.40	.25
d ...	.25	.40	.50	.50	.14	.20	—	.40	.25
e ...	.35	.45	Tungs.	Tungs.	.85	.40	.25	.45	.20
Aver.	.28	.43	.40	.50	.27	.27	.31	.34	.25

of steel the sulphur percentage is rarely allowed to exceed .04, whereas in the pig iron the percentage of sulphur is quite frequently .10.

Oxygen an Impurity

The oxygen found in steel, which acts in the nature of an impurity, is generally in combination with the iron in a rust formation known as iron oxide. If a steel contains a given quantity of carbon, phosphorus and manganese a greater amount of oxygen will give the steel considerably less ductility with greater hardness; in other words it tends to make the steel brittle. When the manganese is added the oxygen combines with it as a manganous oxide which is less harmful to the general structure than the iron oxide. Carbon steel such as is in common use will generally run very close to .65 per cent. manganese.

Phosphorus, another impurity, is always found in steels.

Phosphorus is one of those elements necessary to human life but harmful to steel. It is necessary in members of the animal and vegetable kingdoms because it forms the bone and blood tissues of one and the fibrous foundation of the other. Originally the element was separated by distilling it from the bones of animals. It is a peculiar substance in that it is highly inflammable even in open air in which it blazes forth at a temperature of 34 degrees centigrade. When handled in its pure state it must be kept under water continually. In steel, however, it weakens the structure forming little areas which under the microscope look like small lakes and which in actual results are areas of weakness.

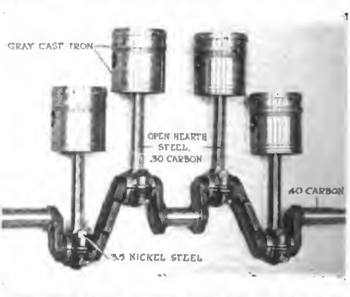
By careful refinement it is generally kept as low as .03 per cent. Instead of using a medicine for the neutralization of this impurity it is kept as low as possible in the refinement. It is removed from the metal, which comes from the blast furnace where the ore has had its primary purifying, by oxidizing, forming a gas which is blown away. In the Bessemer process the oxidizing is accomplished by blowing oxygen or atmospheric air through the molten mass. In the puddling process oxidizing is by stirring the oxygen contained in iron ore into the mass. In the open-hearth process both are done. These three methods are among the elementary distinctions which characterize the processes named. The slag which floats on top of the molten mass is most often a silico-phosphate which has been produced by the addition of iron oxide, lime or other strong base.

Other Impurities

Thus far, we have referred to carbon, manganese, sulphur and phosphorus. These are the elements always present in steel. In addition many traces of other impurities can be found, such as aluminum and silicon and others varying with the nature of the iron ore and the location of the mines.

In a nutshell, carbon is the nerve force of steel. It is a necessary component and the quantity in which it is present determines the nature of the finished material to the widest extent. Manganese is the medicinal agent which reduces the effect of sulphur and oxygen impurities. Sulphur is an impurity which has the poisonous effect of destroying the cohesion of the healthy molecules in the steel formation by surrounding them with a weak film; and phosphorus is also an impurity forming a weak link in the chain of strength.

The other elements to be considered are those which are added to give the steel the stamina it needs for one task, the rigidity for another, the elasticity for another and so on



Crankshaft and piston assembly, showing the use of different metals in different parts

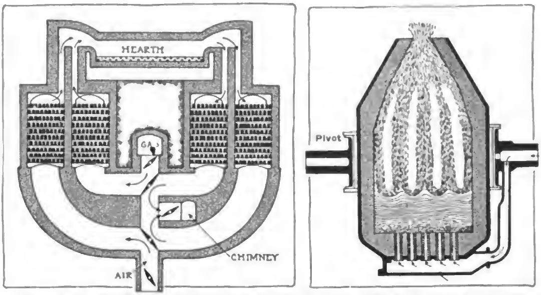


Diagram of a regenerative open-hearth furnace used for making steel by the open-hearth process. This shows the four regenerators, two for the air and two for the gas. The direction of flow of these intermingled gases is reversed every 20 minutes. Right—Diagram of the Bessemer converter for making steel by the Bessemer process. The steel is melted in this and poured by tilting the converter

throughout the gamut of requirements for special classes of work.

Exactly parallel is the practice of medicine. The physician finds in the human body certain components which he must work upon. If certain elements are found to excess he must introduce others to neutralize them. Thus as in steel if sulphur is found to excess manganese will help offset the evil influences of what cannot be removed. But he must go a step further. Besides the mere neutralizing of impurities it is necessary to add other elements to produce the requirements for the tasks that are to be met. As pointed out before if a man lives in the cold climates of the far north he must have heat-producing food. If he is indulging in arduous labor, muscle-building ingredients are necessary.

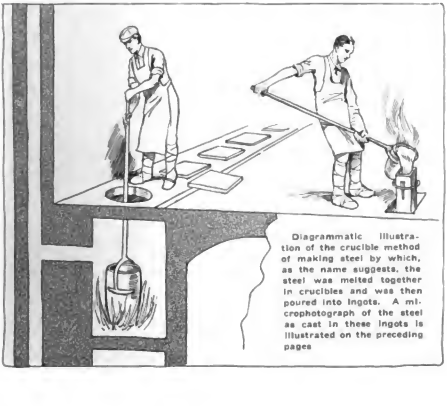
In steel work there are a great number of alloys covering a wide field of usefulness and which when used in the proper proportions and then submitted to the correct heat treatment will make the steel adapted exactly for the work for which it is going to be employed. It is evident that a stronger steel is needed for a gear wheel than for a gearshift lever, yet both are forgings and both may come from the same original source as regards the raw stock from which the two are made.

The entire art, however, can be brought down to the basis of certain definite qualities which must be created in the metal to give it the primary adaptation to the specific purpose to which it is to be put. These primary qualities may be classed as hardness, toughness, malleability, shock resisting and heat-resisting. These five qualities which a metal may have either singly or in combination, will meet the needs of all the material which are used for structural purposes. There are other secondary requirements which are used in specifying steel for purposes other than construction, such as, for example, retentivity of magnetism, small co-efficient of expansion, small co-efficient of friction, etc., but these qualities are not necessary in the metals which perform duties under the general head of structural work except under rare circumstances.

There are certain classes of steel which perform great labors as parts of heavy tools which would be absolutely unfit for use in the structural parts of an automobile where they must be worked and fitted to conform to the shape of parts to which they are attached. A typical example of this is in steels used for such purposes as rock-crushing machinery which are so hard that it is practically impossible to make any impression upon them with ordinary tools. A piece of steel of this kind could not possibly be used to form a rolled channel section for an automobile side member where malleability and easy-working qualities are desired. Nor could it be readily forged into the shape of a connecting-rod. For these structural purposes it is absolutely unfit and yet for the purpose for which it is used it is practically ideal. The study of the alloys and their use in special fields is of absorbing interest even for one who does not go into it deep enough to actually be able to perform the operation of mixing the metals, but who is only interested from the viewpoint of knowing what it means when one says a steel contains a definite alloy in given proportion.

Thus we have first the foundation consisting of iron, carbon, various impurities such as phosphorus, sulphur, etc., and manganese in every steel. After this are added the alloys to make it fit for special work, next the heat treatment for the specific work must be accorded and finally the proper material must be selected to do the work on the particular part in which it is used. The most expensive materials may not always be the best. It is a matter of selecting the proper specifications.

(To be continued)



Diagrammatic illustration of the crucible method of making steel by which, as the name suggests, the steel was melted together in crucibles and was then poured into ingots. A microphotograph of the steel as cast in these ingots is illustrated on the preceding pages

S.A.E. Standards Work Under New Rules

Summer Trip Itinerary Decided Upon—Two Steamers Required for Trip

Above—Steamship Noronic chartered by the Society of Automobile Engineers for the summer session in the waters of Georgian Bay

Left—The spacious interior of the steamship Noronic provides ample accommodations for the engineers and their families

NEW YORK CITY, April 3—The Standards Committee of the Society of Automobile Engineers will hold its spring meeting at the Detroit headquarters of the society in the Boyer building. The meeting of the committee as a whole will open at 10 o'clock April 22, but on the same day and for several days previous there will be meetings of the various divisions for the purpose of bringing matters up to date before presenting them in the form of reports to the Standards Committee.

The purpose of the meeting, which will continue throughout the day, is to hear interim reports from the divisions and the sub-committees and to take up any new business or new work that should be whipped into shape for the coming meeting of the society in June. Meetings of the Springs Division and the Miscellaneous Division have been held during March with a view towards having definite reports to submit to the committee meeting and reports are also expected from the Carbureter Fittings, Electric Vehicle, Iron and Steel and Research Divisions.

The meeting will be the first to be held under the new regulations which have been drawn up and approved by the Council of the society. The aim is to formally bring these meetings down to a standard basis and by this means to keep a definite record of the progress of the work of each division of the committee. The matters under advisement by the different divisions will now be under the direct supervision of the chairman of the entire committee. Chairman Zimmerscied will be assisted in this work by A. C. Woodbury, who will act in the capacity of recorder.

It is expected that the various divisions will have progress reports to make on a great number of various subjects, among which may be mentioned the folowing:

Curves and tables of physical properties of S. A. E. alloy steels Uniform license pads and mounting of same. Speedometer drive shaft ends. Exhaust manifold outlet for hot air carbureter connection. Dimensions of piston ring grooves. Distance between the cylinder boss and center of side outlet carbureters. Speed and mileage ratings for electric vehicles. Motor voltage of electric vehicles. Efficiency test of solid tires. Number of cells in standard battery vehicle equipment. Flat fan belt widths. Rubber hose and hose clamps for cooling systems. Cotter pin sizes. Nomenclature of cantilever springs. Test of parallelism of eyes and master leaf or

S. A. E. Summer Meeting

Detroit-Georgian Bay and Return

June 14-17

SCHEDULE

Leave Detroit, Monday, June 14, 2:00 p. m., Central Time, *S. S. Noronic.*

Arrive Midland, Tuesday, June 15, 2:00 p. m., Eastern Time, *S. S. Noronic.*

Leave Midland, Tuesday, June 15, 2:15 p. m., Eastern Time, *S. S. Waubic.*

Arrive Parry Sound, Tuesday, June 15, 6:00 p. m., Eastern Time, *S. S. Waubic.*

Leave Parry Sound, Wednesday, June 16, 9:00 a. m., Eastern Time, *S. S. Waubic.*

Arrive Point au Baril, Wednesday, June 16, noon, Eastern Time, *S. S. Waubic.*

Leave Point au Baril, Wednesday, June 16, 3:00 p. m., Eastern Time, *S. S. Waubic.*

Arrive Parry Sound, Wednesday, June 16, 6:00 p. m., Eastern Time, *S. S. Waubic.*

Leave Parry Sound, Wednesday, June 16, 6:15 p. m., Eastern Time, *S. S. Noronic.*

Arrive Detroit, Thursday, June 17, 5:00 p. m., Central Time, *S. S. Noronic.*

Members going East can leave Detroit at 6:10 p. m.

leaf springs. Modification of eye and bolt tolerance for leaf springs. Frame brackets for leaf springs. Offset of center bolts of leaf springs. Nuts for spring clips of leaf springs. Modification of center bolts standard for leaf springs. Width of springs for pleasure and commercial cars. Center bolt nuts of leaf springs. Length, opening, etc., of spring clips of leaf springs. Spacing of clips. Pressure blocks. Length of spring seat. Material between spring and spring seat. Concavity of leaf spring material. Standard inspection methods of physical tests of leaf springs. Standard tolerances as to height and load of completed springs.

The new regulations are digested herewith.

I. Origin and Functions

1. Standards Committee to have jurisdiction over all standards and recommended practices, also to make special investigations in the discretion of the counsel.

II. Organization

2. Standards Committee shall act under a chairman assisted by a recorder.

3. Whole committee to be subdivided into divisions and sub-divisions presided over by chairman.

III. Appointments

4. Appointments made annually by the council in conference with chairman of the Standards Committee, who is appointed annually by president of the Society.

5. The President and Secretary of the Society ex-officio members of Standards Committee and divisions.

IV. Procedure

6. Standards to originate in division covering properly that phase of work. Reports must be favored by a majority of voters of a quorum which consists of more than half a division.

7. No final action to be taken except at meeting called for that purpose.

8. Reports to consist of concise statements afterwards explained if necessary.

9. Division reports to be approved by Standards Committee, fifteen members of which comprise a quorum. Reports then forwarded to council for its approval.

10. After council approval reports are submitted to the Society for acceptance.

11. Reports may be passed on by letter ballots, a majority of ballots deciding the adoption.

V. Meetings

12. Standards Committee meetings day preceding or day of Society meeting and on second Thursday in April and October each year.

13. Division meetings on days of or preceding Committee Meetings. Special meetings on approval of Standards Committee chairman and Society secretary.

14. Division chairman to notify committee chairman regarding details of meeting.

VI. Committee Records

15. Recorder to keep full attendance records.

16. Division chairman to file progress reports at each Standards Committee meeting.

17. All correspondence to be filed with secretary of Society.

VII. Miscellaneous

18. Publicity must pass through regular Society channels.

19. Official stationery to be furnished by secretary of Society.

20. No obligations for expenditures other than postage are assumed by the Society except by authority of the council.

Summer Itinerary Announced

The full itinerary of the summer trip has been finally announced. The trip will include a voyage through the far-famed Thirty Thousand Islands where it is necessary to use a smaller steamer.

The Noronic will dock frequently at some of the interesting points, allowing plenty of time for shore visits and entertainment. It is expected that, in view of the success of the past summer meetings, a large number of ladies will participate in the trip. Chairman Lloyd of the Meetings Committee promises a technical program of value and the Standards Committee has several reports to submit which are also of great importance. The business and professional sessions will be held in the mornings and evenings, allowing the members to have the afternoon free for consultations and entertainment. The Standards Committee meeting will be held Monday afternoon and the first business and professional session on Monday evening. Others will be held Tuesday morning and evening, Wednesday evening and Thursday morning.

The fare for the complete trip on the Noronic and Waubic is $26 per person with berth and meals included.

An ideal space is provided on the steamship for the holding of the business and professional sessions. The arrangement of the program gives practically every afternoon for recreation, the business being carried on in the mornings and evenings

There should be no congestion in the dining hall of the Noronic. Note the broad aisles and large tables illumined by a modern system of indirect lighting. Excellent service and food is a part of the S. A. E. program

Overhead Valves in Theory and Practice

Difficulties of Valve-in-Head Design and Manufacture—Why Overhead Valves Are Unpopular

By A. Ludlow Clayden

THEORETICALLY the combustion space in an internal combustion engine should be spherical, because a sphere has more volume in proportion to surface than any other body. Since the energy of the gas burnt in a motor is derived from heat it is desirable to prevent any cooling of the gas till its work is done. It is necessary to cool the cylinder and piston so the less hot gas in contact with the comparatively cold walls surrounding it (comparative with the total volume of gas) the better the thermal efficiency of the motor.

Like many theories, however, it is not capable of being put into practice; even if the combustion space was spherical, it would cease to be so as soon as the piston started its downward travel, but by using overhead valves, or sleeve valves like the Knight, or disk valves, or any sort of valve that does not need a side pocket to work in, we can approximate to the spherical shape and obtain a better construction from the point of view of thermal efficiency, than can possibly be had with the ordinary kind of engine.

Also with the valves set in the cylinder head the gas flows directly into the middle of the combustion space, and it can escape as exhaust without having first to crowd its way through a narrow pocket space; there is a more free flow both in and out. These are all small matters dealing with fractions of heat units and fractions of volumetric efficiency, but we all know that the remarkably high general efficiency of the automobile is made up from consideration of infinite infinitesimals.

In heat theory the overhead valve or the sleeve valve has things all its own way, but when practice is taken into account we find that there are things which offset theory so that it is not easy to take advantage of theoretical qualities, even when money is no object. When it is—and that expresses the average case—then the valve-in-head motor cannot put up much of a fight since the pocket type of engine is unquestionably cheaper.

Valve Operation Difficult

Probably the chief trouble that faces the designer of an overhead valve motor is to devise a method for operating the valves that will meet all requirements. There are three main systems in use, that in which the camshaft is in the ordinary location and long push rods lead up to rockers on the top of the cylinder block, that in which there is one overhead camshaft operating the valves by rockers and that in which there are two overhead camshafts operating the valves directly, or through very short, straight push-rods. Compare any of these with the pocket style of valve layout, and it is obvious that there are more parts and consequently more expense is involved. Leaving cost on one side for a moment, we may consider the points in favor of and against each of the three systems enumerated, the last first, since it is the newest and has been claimed to be the best of all from the efficiency standpoint.

When the Peugeot company began to build racing cars seriously and to make a very big bid for the position they have succeeded in attaining, their engineers looked to the overhead valve to give them the maximum power for the displacement volume of the motor.

Operation by Two Camshafts

First they discarded the idea of using the usual location for the camshaft and long push rods because of the considerable weight of metal which this construction necessitates in the linkage between the cams and the valves themselves. The scheme that appealed to the Peugeot engineers was a single overhead camshaft with either a worm gear or a bevel drive through a vertical shaft. Accordingly, this was tried out, but severe trouble set in with the gears used for driving the shaft, both worms and bevels being unable to stand up to the stress imposed upon them. The writer has seen worm gears of fair size taken from one of these experimental engines with the teeth actually bent over in a hook shape, so hot had they become in running. The explanation for this was not obvious but it was thought to be somewhat as follows: in this explanation it must be remembered that it is only a suggestion and very likely not true.

Camshaft Drive Difficulties

It is a fact that the cylinders expand when heated and so it is also a fact that the camshaft and crankshaft get further apart as the motor warms up. Other facts are that both worm gears and bevel gears create a thrust, and with small gears such as are used for camshaft driving the thrust is quite heavy. If bearings are arranged to support a bevel or worm gear at each end of a vertical shaft and adjusted properly when the engine is cold they will not be correct when it is hot and *vice versa*. This means that even if we adjust the bearings when the cylinders are hot, we cannot be sure that the meshing of the gears is correct at any time. If it is incorrect then the gear will heat up. This seems to the writer an inadequate theory, but it was the explanation given for the adoption of a train of driving gears of spur type arranged one above the other all up the front of the motor.

Abandonment of Rockers

The next Peugeot development was the abandonment of the rocker construction with the single overhead camshaft, because trouble was experienced with the rockers themselves and with their bearings, while when it was decided to use four valves per cylinder, there was not too much room for the rockers and their fulcrum shaft. Using two camshafts to operate the sixteen valves enabled the push rods between cam and valve stem to be made very small and light so that the reciprocating mass for each valve was a minimum, and this assists accurate valve working at very high engine speeds. It may be added that the object in using four valves was to obtain the desired area of opening with the minimum valve weight, and that every automobile engineer agrees that the four-valve construction is the best for very high-powered engines.

Lessons of Racing

At the conclusion of the 1913 racing season in Europe, when Peugeot and Delage with very similar motors had swept the board, it was commonly thought among French and British engineers that the Peugeot construction was really an advance on any other. So great had been the Peugeot success that their competitors were ready to accept the explanation for the peculiar construction given above. But there were some who held to the courage of their own convictions and among these were the designers of the Mercedes. It would be difficult to imagine two engines more different than the Peugeot and the Mercedes used in the Grand Prix race in France last July; the former followed the previous year's design almost exactly, but the latter was an adapted aeronautical motor. Instead of cast iron cylinders in a block, it had pairs of cylinders all steel, made up from a combination of forgings and pressings welded together. It had four valves certainly, but they were not operated by two camshafts. On the contrary there was a rocker shaft, a fairly small bevel driven vertical shaft, and all the features of design which the Peugeot men had discarded. Neither Peugeot nor Mercedes had any valve trouble but the latter were slightly the faster car and their engines turned over more rapidly. Allowing for differences in tire size, the relative engine speeds at 100 miles per hour were 3,123 for the Mercedes and 2,620 for the Peugeot. These speeds do not, of course, represent the maximum revolutions attained on the lower gears when hill climbing, while both cars did much more than 100 miles an hour on the straights. The fact that the average engine speed of the Mercedes was higher than that of the Peugeot shows that it is possible to use rockers and a bevel driven overhead camshaft, but just why this succeeded on the German car and not on the French is difficult to guess. The obvious difference between the motors was in the cylinders and it has been suggested that while a block cast, iron cylinder must expand unequally the steel cylinders of the Mercedes being machined all over inside and out, could be relied upon to expand with complete regularity. This would perhaps, mean less stress on the valve mechanism. It seems more likely, however, that the Germans had discovered the best material for the bevels they used and that the Frenchmen had not done so.

With Normal Camshaft Location

If we except the Fiat design, the most popular form of overhead valve operation is certainly the long push rod with the camshaft situated in the crankcase as usual. This has been used very widely in Europe by all nationalities and many thousands of cars with this style of motor are produced each year in this country. Probably the output of the two leading American makers alone is almost equal to that of the rest of the world; if some of the very small motors are excluded it certainly is. Yet we find that the users of overhead valves here have had comparatively few imitators. Lately there has been renewed interest in this kind of motor, and this has undoubtedly received a stimulus from the supremacy of the overhead valve in European racing engines, but any who are considering a change over from the ordinary pattern would do well to think it over carefully.

First, the machining of a motor with overhead valves is more expensive. On the cylinder block there are the spaces to bore for the cages, there are the cages themselves to be made, there are the rockers to make, there is the rocker shaft and the mounting for it. Also we find that the encasement of the overhead mechanism calls for fresh parts. All this is *additional* to the requirements of the pocket type engine, for the camshaft is no cheaper and the lower end of the push rod system has to be almost exactly like that required for the operation of ordinary valves. Makers who have laid down plans for turning out this type can no doubt do it cheaply enough, it might not save them much to change over to the pocket motor, but people equipped for the standard form would certainly have to face increased expenditure.

Speed of Racing Motors

Next, racing experience—which is the ultimate test—has shown that extremely high power can be got from the cheaper form. It must be remembered that the immense power of racing engines is obtained from high speed of revolution. In the Grand Prix in France last year the drivers changed to a lower gear if the motor speed fell below 2,000, and did not change up till it was between 3,000 and 4,000 on a lower gear. At such speeds the free gas way given by the overhead valves and the better thermal efficiency of the system can tell, but motors of this sort are not needed for every-day automobiles. Quietness is much more important, and it is not easy to get with the long push rod scheme as we have the trouble of difference in the rate of expansion of the cast-iron cylinders which get fairly hot and the steel rod which keeps fairly cold. Perhaps it would be more correct to say that quietness with this type of motor is more difficult to maintain, rather than to obtain, since with care it is possible to adjust the clearances so as to give excellent results.

Again, as was pointed out in describing the Peugeot experiments, the push rod system is not the best to use when one wants very high motor power—at least in the opinion of many engineers who have tried it—so if we want the full benefit from the overhead valve we must go straight to the overhead camshaft, and it needs no elaboration of argument to show how expensive that is.

Accessibility

The outstanding advantage of the long push rod pattern of motor is that its valves are more accessible than those of any other kind of motor. It is easy to release the rocker, easy to extract the valve complete with its seating and so it is easy to keep the valves well ground in, and in an efficient condition. Often it is possible to scrape the carbon from the head of a motor of this kind without removing the cylinders, as sufficient room is given when the valve cages are out. These, rather than increased power, are the advantages of overhead valves as viewed by the average automobile owner.

In these days of freedom from valve trouble accessibility is not so important as it used to be so its provision is not worth a very heavy increase of cost in motor construction.

Lubrication Troubles

Another difficulty with overhead constructions is to arrange matters so that the rockers obtain efficient lubrication while protecting the valve stems and cages. It is important that there should be no leakage of oil into the valves themselves, as such will cause heavy carbon deposit in a place where it is especially troublesome. It is also equally important to properly lubricate the rockers, because otherwise noise troubles will be aggravated greatly. This is a difficulty that can be overcome, and it is only mentioned as showing that yet one more thing has to be thought of when laying out an overhead mechanism.

When we come to a revision of design forced by other circumstances there is more reason to consider overhead construction, and the present state of development of the eight-cylinder motor seems a great opportunity for obtaining the thermal efficiency advantage and the advantage of very much greater accessibility without a big increase of cost. With the eight most manufacturers are in the position of creating a new design altogether, they do not even use cylinders that will fit another motor. This cuts down the cost of using a new valve scheme enormously.

Also the eight is difficult to construct so that the valve push rod adjustment is really easy to get at, and with the smaller cylinders of the eight it is particularly important that the push rods are kept in proper condition; too much clearance may easily have a serious effect upon the power. Between the cylinder blocks seems to be the ideal place for the carbureter the ignition and even perhaps the generator and starting motor, so there is something to be gained on their account if the valves can be got away to another situation. It looks as though there were splendid opportunities to devise new schemes, even to arrange the crankcase as a permanent bed plate in the frame. It would be out of place to go into detail here, but the writer wishes to call attention to the fact that the automobile engineer whose designing ingenuity has for years past been held in check is now offered a chance to exercise his faculties freely.

Spring Brings Unprecedented Flood of Car Orders to Detroit Factories

Increasing Sales All Over the Country Reflect Improved Business Conditions—Eights, Sixes and Fours All Selling at Record-Breaking Rate—Plants Stepping Up Production—Some Working Night and Day

By L. V. Spencer

DETROIT, MICH., April 6—The sun is shining in Detroit on the automobile industry. The prediction for April is that orders will exceed the business of the same month a year ago, and then, too, practically every manufacturer expects April to be overshadowed by May and June—an outlook which was not entertained so strongly at this time last year.

Car Sales Reflect Improved Condition

To a keen analyst, the reasons for a startling picking up in the automobile business at this time are plain, and are but the logical outcome of conditions. People were hoarding money last fall when business conditions were uncertain, but now that general confidence is restored, they are letting go, and buying cars, many of them having planned to do so before, but hesitating until they were sure they wanted to spend the money.

Another reason for the rush, which has come within a few weeks, is that we have generally experienced a better spring than last year, the weather being brighter in most sections of the country, and this letting the roads get harder earlier. Several factories can cite direct results of this. They say that the dealers and salesmen are turning the cars over to buyers almost as soon as they arrive, in marked contrast to last year when the vehicles sometimes accumulated before they could be disposed of.

Several manufacturers who have big fields for their cars in such states as Kansas and Missouri say that these communities have not opened up as yet. These states have been under snow up to the present, but a few warm days are expected to open them up for a big trade.

Unexpected Production Activity

Asked as to production conditions, not every factory in Detroit will talk for publication, some being of an ultra-conservative turn of mind. But when assured that their data will not be published, they tell of striking activity, which they confess was not expected this year.

Eight-Cylinders Sell Well

The eight-cylinder contingent is very busy, and their outputs are meeting expectations. Cadillac, the pioneer, has marketed to date 6,100 of its eight-cylinder cars, more than 100 of them being in their home city. Before the close of the month, Cadillac expects to have stepped its production up to 125 cars a day. It is running considerably over the hundred mark. One day last week, the output was 117, to be specific. As an indication of the gait to which the Cadillac factories are operating now, the working force is about 8,100 men, as compared with a maximum of 7,000 to 7,500, which was the most it ever employed in the rosiest days of its four-cylinder cars.

The King company, second to come out with an eight, reports that the greater part of its average daily output of forty-five cars is of the eight-cylinder type. The ratio is about three fours in every ten cars shipped. On this basis, the February production was 280 cars; that of March was close to 400 cars. Quantity orders are reported; the English government the week before last was shipped thirty-eight eight-cylinder cars, these going to London to be distributed for war purposes. As late as last week, sixteen King eights went to Russia in one order.

While Claude S. Briggs, head of the Briggs-Detroiter company, another builder of eights, would give no figures as to production at this time, nevertheless he says that his company has, for the last 6 weeks, been working night and day, with Sundays no exception. The eight is pushing the four in his estimation, and business is about half of each type of car, although he predicts that before long the proportion will be 74 per cent. eights and 25 per cent. fours.

4,500 Orders on Hand

Naturally, much interest attaches to the doings of the Scripps-Booth Co., whose design of car and its lightness along with the best of appointments are somewhat of a new thing to automobiling. There can be no doubt that it is taking, for its shipments are now better than ten cars a day, with indications that production will get up to 100 cars a week in another week. It is purely a matter of production with this company as over 4,500 orders are actually on hand with some 500 of them for immediate shipment.

Orders Come by Wire

The Saxon Motor Co. is going to be successful with its six at $785, and President Harry Ford says that the concern is now turning out seventy-five cars a day, fifty of which are of the small four-cylinder design, and the balance the new six. This is rapid going on such a new car, as the first of them did not get out until several weeks ago. All told, the Saxon company received 2,059 orders for its cars—fours and sixes—during March. Since the first of this year, the enlarged Saxon plant has built and shipped some 3,000 cars. President Ford read us a telegram that will serve to show how things are moving. The Northwestern Automobile Co., Minneapolis, wired that the six demonstrator had arrived and wanted to know if it could have 1,000 of them during the next 3 months.

22 Per Cent. Ahead of Last Year

The Hupp Motor Car Co. is also in on the good work. March this year was 22 per cent. ahead of the same month a year ago. Just now the Hupp plant is working for a production of eighty cars a day—this has not quite been reached yet, but that will be the average day's output before the end of this week. It is about seventy-five a day now, and has been since the latter part of March. It is no small matter for a concern to step its production up even five cars a day.

In most motor departments Hupp is working a night shift to keep up. In March, there were 327 more immediate shipment cars than the plant could get out—that were carried over into April, but by Saturday, April 3, 320 of these had been filled. But on April 3, at the close of business, the books showed 594 immediate shipment orders to be filled—April business. Here are some figures showing orders received on the dates given: March 30, eighty-six; March 31, forty-five; April 1, 392; April 2, 161; April 3, fifty-eight. All of these were not for immediate shipment.

Paige is also in the van. The production here for January, February and March is about 700 cars ahead of the same period a year ago, this despite the fact that due to the cars being of higher price—the new six replacing the former lower-priced four now discontinued—the value of product was greater. Last year the April production was 1,400 cars, and J. F. Bourquin, general manager, states that the same output will be adhered to this April. He says further that it looks as if it will hold up for May and June also; that last year a dropping off was foreseen for the months following April, but this season such is not indicated. The Paige Company is turning out from forty-five to fifty cars a day, and there are about three sixes to every two fours.

5,000 Orders for Small Fours

The Regal company, also an eight-cylinder adherent, has not as yet commenced production on this type, its plant working on four-cylinder business, according to Fred Haines, president. This week the production is twenty cars a day, but he confidently expects to get this in shape for a fifty car-a-day output in the course of 2 weeks. This is on the basis of two-thirds small fours and one-third the larger four. There are over 5,000 orders on Regal's books for the small fours for immediate shipment, President Haines says, proving that the demand for this type is still very strong despite the eight.

Regal eights will begin to come through about April 15, and between that time and August 1, the concern expects to build 1,000 of them on a ten-a-day schedule. As an indication of how Regal is moving, some 1,600 letters were received today on car selling matters.

To Double Daily Production

Dodge Bros. are doing considerably better than 100 cars a day now. The intention is to put the production up to 200 cars a day and preparations are under way. One day not long ago, 139 were built, and this varies somewhat from day to day. There are now about 7,500 men on the Dodge pay-roll, as compared with about half this number in the days when Dodge Bros. were not car builders.

These statistical reports are not for every plant, as will be seen. Several of the big ones such as Maxwell, Packard, Studebaker, Chalmers and Hudson did not care to talk.

However, Maxwell, for instance, is doing big things. One day last week, the production was 429 cars, and the average is not far below that number. Studebaker is enjoying excellent business, as is Chalmers which is now engaged in its biggest shipments of the year. Likewise, Hudson is practically sold out, and Packard is "saying nothing, but sawing wood."

Just for variety, Ford has been forgotten for the moment. There is little use comparing its output with that of any other factory, because there is no plant in the world that can show up to advantage when we start out by saying what Ford is doing. The mammoth plant had the biggest month in its history during March. The production was 43,829 cars. March has 27 working days, so the average per day was 1,623 cars. It looks as though the Ford buyers will get the rebate promised if production reached 300,000 cars by August 1.

Statistics Sell Cars to Central Illinois Farmers

BLOOMINGTON, ILL., April 5—Illinois farmers are in a receptive mood when called upon by automobile salesmen this spring. Men who sell cars are agreed that never before in their experience, has it been so easy to interest the agriculturists, as this year. Here in Bloomington, which expects to win the record for the largest distribution of cars of any city in Illinois, outside of Chicago, the salesmen are taking grain quotations in one hand and a catalogue in another. They are pointing out to the farmers that it requires but 747 bushels of wheat to buy a $1,100 automobile this spring whereas a year ago, it required 1,155 bushels. They are also showing the farmers that this spring, it will require but 1,920 bushels of oats to secure a car while a year ago, 2,685 bushels were necessary. Then the prospect is informed that Bradstreet's report showed that in a recent week, 7,358,220 bushels of wheat were exported from the United States, while in the corresponding week a year ago, the figures were only 2,947,966. During the same week, this country exported 16,713,424 bushels of corn, while in the same week a year ago the exportations were but 1,963,352. These arguments are proving effective and can be utilized by any salesman in Illinois.

In the Central Illinois territory, 90 per cent. of the cars sold this spring are going into the hands of active or retired farmers. The men who till the soil, appear to be in a position to indulge in cars and most of them are not backward about doing so. It is pointed out without possibility of contradiction, that every farmer in central Illinois, owning a 100-acre tract and farming it with reasonable success, can afford to own a car when the price of grain is taken into consideration. Financial experts are confident that the farmers will be prosperous for the next few years at least. Even after the conclusion of hostilities in Europe, it will require a long time before the farms abroad can be restored, horses and implements replaced, and agriculture restored to the same footing as prior to the war. This means that the neutral countries must furnish the supply of grain temporarily at least and the United States promises to be in a position to supply the bulk of the demand.

$1,000 Is Maximum Price

While the rush is on for cars in central Illinois, all dealers are actively engaged in attracting patrons. It is apparent, however, that $1,000 is the maximum price that will be paid in this territory. The city buyers are friendly to the higher-priced cars but to the average farmer they are tabooed. The Ford, Maxwell, Dodge, Overland, Reo, Oakland and Studebaker, are the popular cars in central Illinois, and some of these lines are already reporting a shortage.

Truck Progress Slow

While, perhaps, ahead of the game in the number of passenger cars in service, central Illinois has been somewhat backward about investing in trucks. Progress has been slow, due largely to the road conditions and the knowledge that during a large proportion of the year, the highways are not passable to motor vehicles when loaded. In the smaller towns, without pavements, the motor wagons are an unknown quantity and probably will be for many years to come. Bloomington is gradually growing into the use of motor trucks and the leading bus line companies have displaced horses with motor baggage wagons and taxicabs.

Farm conditions in Illinois this spring, are ideal for the first time in many years. All of this means prosperity for the men who sell automobiles and they will reap alongside of the farmers in the harvest next fall.

Dairy Wealth Will Buy 20,000 Cars in Wisconsin for 1915

13,500 Farmers Out of 180,000 Own Cars—Great Market Just Opening—18,500 Cars Sold in the State for 1914—Money Plentiful and Conditions Improving

By Leonard E. Meyer

MILWAUKEE, WIS., April 3—The milch cow is responsible for the great wealth of the Badger State. It has given Wisconsin first rank among the commonwealths of America as a dairy state. It has made it possible for 13,500 farmers in Wisconsin to own automobiles. It will make possible in 1915 a sale in rural districts of not less than 5,000 cars out of the total of 20,000 machines which Wisconsin dealers expect to distribute in this state this year.

180,000 Prosperous Farmers

Because of their prosperous dairy business Wisconsin farmers, who number 180,000, will this year be one of the most prolific sources of business for the builder of motor vehicles. In the final reckoning by the factories and their dealers, the position of Wisconsin as the richest and most productive dairying state in the Union makes a conspicuous factor. To one who has studied the situation at first hand and with a raft of statistics at hand, it appears that the dealers do not reckon sufficiently high when they enumerate Wisconsin's rural absorption of 1915 cars at 5,000. Results may bear out an estimate of 7,500 or even 10,000.

Wisconsin Registrations and Fees for 3 Years

Vehicle	Fee	1912	1913	1914
Automobiles ..	$5	24,578	34,646	53,180
Motorcycles ..	$2	4,060	6,120	7,880
Dealers	$10	1,052	1,393	1,202
Total revenue....		$141,530	$199,400	$293,680

Wisconsin's Wealth—1911 Tax Statistics

Total tax levy.................	$32,610,975
Assessed valuation	4,718,108,684

Livestock Statistics for Wisconsin

Animals	Number	Value
Horses	678,000	$92,355,000
Mules	3,000	281,000
Milch cows........	1,626,000	96,747,000
Other cattle	1,216,000	33,683,000
Sheep	781,000	3,905,000
Swine	2,255,000	27,060,000
		$254,131,000

As well-posted men see the situation, Wisconsin will take not less than 20,000 cars in 1915, and approximately one-half of these will go on the farm because the city man's resources at this period do not begin to compare with the resources of the farmers of Wisconsin, due to the splendid crops of 1914 and the enormous dividend which the dairy industry has paid.

Wisconsin Car Registration and Population by Counties

County	1910, People	1914, Cars
Adams	8,604	105
Ashland	21,965	169
Barron	29,114	497
Bayfield	15,987	106
Brown	54,098	853
Buffalo	16,006	367
Burnett	9,026	118
Calumet	16,701	566
Chippewa	32,103	507
Clark	30,074	498
Columbia	31,129	853
Crawford	16,288	198
Dane	77,435	2,722
Dodge	47,436	1,498
Door	18,711	283
Douglas	47,422	424
Dunn	25,260	510
Eau Claire	32,721	572
Florence	3,381	52
Fond du Lac...............	51,610	1,588
Forest	6,782	44
Grant	39,007	1,270
Green	21,641	819
Green Lake	15,491	429
Iowa	22,497	602
Iron	8,306	34
Jackson	17,075	258
Jefferson	34,306	970
Juneau	19,569	196
Kenosha	32,929	746
Kewaunee	16,784	325
La Crosse	43,996	942
Lafayette	20,075	514
Langlade	17,062	205
Lincoln	19,064	226
Manitowoc	44,978	1,020
Marathon	55,054	704
Marinette	33,812	280
Marquette	10,741	242
Milwaukee	433,187	8,621
Monroe	28,881	402
Oconto	25,657	240
Oneida	11,433	89
Outagamie	49,102	868
Ozaukee	17,123	388
Pepin	7,577	149
Pierce	22,079	450
Polk	21,367	372
Portage	30,945	457
Price	13,795	99
Racine	57,424	1,425
Richland	18,809	586
Rock	55,538	1,770
Rusk	11,160	145
St. Croix	25,910	628
Sauk	32,869	1,019
Sawyer	6,227	87
Shawano	31,884	468
Sheboygan	54,888	1,401
Taylor	13,641	180
Trempealeau	22,928	429
Vernon	28,116	658
Vilas	6,019	37
Walworth	29,614	1,293
Washburn	8,196	87
Washington	23,784	797
Waukesha	37,100	1,235
Waupaca	32,872	761
Waushara	18,886	478
Winnebago	62,116	1,329
Wood	30,583	523
Total	2,333,860	53,180

Just Beginning to Buy Cars

Wisconsin farmers have hardly begun to buy motor cars. Alex J. Cobban of the secretary of state's office figures that 13,500 of the 53,180 cars registered in Wisconsin by private owners in 1914 belonged to farmers. He estimates that in 1913, about 6,750 of the 34,646 cars registered were on the farms. He says the comparatively richer state of the farmer as against the city dweller at this time means that the 100 per cent. increase in rural registrations will be exceeded, and that 7,000 to 8,000 cars owned by farmers can be expected to be added this year.

18,500 New Cars in 1914

Wisconsin took 18,534 new cars in 1914. The 1913 registration of private owners, amounting to 34,646, jumped to 53,180 in 1914, an increase of more than 50 per cent. And this in the face of one of the most depressing periods, industrially speaking, in the history of the state.

When the secretary of state of Wisconsin made his contract for 1914 license plates, the figure was 45,000, being based on a 34,646 registration in 1913. Before the year was half over the supply had run out and 8,161 additional sets of plates had to be purchased to supply the demand up to the close of activities. Last fall the secretary placed an order for 70,000 sets of plates, which means that he figures 16,839 new cars will be registered in 1915. If the secretary is as poor a guesser this time as he was last, the emergency supply being the same, Wisconsin's 1915 registration will be more than 75,000.

Why a Dairy State

Critics have often wondered why the state of Wisconsin, with its enormous agricultural and mineral resources, has only half as many cars as Iowa, or 14,000 less than Indiana, and less than other adjoining states. Without attempting to disparage in the least the characteristic tenacity and conservatism of the Teutonic race, it would seem that the answer can be found in this: Of the 2,500,000 people in Wisconsin today, approximately 1,000,000 are German born or of German origin. Thirty-three per cent. of the population of Wisconsin is native American stock. Forty per cent. is German. Twenty-nine per cent. is divided among Norwegians, Swiss, English, Canadians, Irish, Bohemian, Belgian, Austrian, Polish, Dutch, Finns, Danes and Italians.

The peculiar character of the population of the state, however, is a powerful factor in determining the cause of the immense dairy industry. Wherever a population map shows Germans, Swiss and Danes thickly settled, a dairy survey map shows a predominance of creameries and cheese factories. It is their inheritance. The fact that the Norwegians, who are second in number to the Germans, have not generally taken to dairying, but prefer to raise tobacco, indicates that dairying is not acquired as a result of Wisconsin influences.

47 People Per Car

Last year's registration of 53,180 shows exactly that number of cars distributed among approximately 2,500,000 people, or a ratio of about 1 to 47. A glance at the list of sparsely settled counties in the wilds of northern Wisconsin shows few automobiles. For 2 years a monumental effort has been under way to develop these sections, and the campaign is already bearing fruit. There are several counties having less than 100 cars and a few under 50. The splendid system of state aid highway construction in Wisconsin has reached these districts and just as sure as the automobile follows the good road, when it does not actually inspire good road work, so will these districts during 1915 and coming years increase their car population, and in a much greater proportion than the more thickly settled portions.

$260,000,000 in Livestock

State distributors who do business from Milwaukee are almost unanimous in predicting that 1915 sales will make their mark on the basis of farmer trade. The farmer has money; that is positively indicated by the vast gain in deposits shown by country bank reports this month. The farmer has been a good customer of the automobile builder, but only the surface has been scratched. The income from $260,000,000 worth of livestock this year and last will make expenditures of $500 to $1,200 for cars a drop in the bucket. The worth and value of mechanical appliances on the farm has long ago been demonstrated and with it an ever-growing estimate of the economy of the motor car on the farm inculcated. The college of agriculture of the University of Wisconsin, with its excellent extension service, has seen to that. Its bulletins even today concern themselves as much about the care, repair and maintenance of automobiles as about farm machinery.

Population of Wisconsin Cities Over 10,000

City	Population
Milwaukee	419,054
Racine	44,528
Superior	44,344
Oshkosh	35,097
La Crosse	31,367
Madison	29,468
Kenosha	29,062
Green Bay	28,064
Sheboygan	27,862
Fond du Lac	20,367
Eau Claire	18,647
Wausau	18,352
Appleton	17,492
Beloit	17,122
Marinette	14,610
Janesville	14,195
Manitowoc	13,562
Ashland	11,594
Total	834,789

Wisconsin was the center of the epidemic of foot-and-mouth disease during the past winter. But the losses occasioned by the wholesale slaughter of cattle are insignificant compared with the total value of all cattle owned in the state.

Unfortunately the state law providing for automobile registry does not give the secretary of state's office sufficient leeway to undertake a statistical digest of present registrations by names of makes. Naturally, the Ford predominates, both in city and country. Overland, Buick, Maxwell and Studebaker follow in the low-priced car sales. Case and Mitchell, Wisconsin products, make a surprising showing in the medium-priced car line. Rough estimates give an average value of $900 per car in Wisconsin.

33,575 Cars Registered

So far this year, or on March 31, to be exact, the Wisconsin registration is 33,575 with more coming at 800 per day. This is more than half of the entire 1914 registration. A year ago at this time the private owners' registry amounted to only 17,250.

Money Is Plentiful

The past winter has been ideal from the crop growers' standpoint; the banks are filled with farmers' money; the dairy herds are ready to produce a wealth greater than during last year, so it is reasonable to expect the farmer of Wisconsin to be the prime factor in car buying for 1915.

1 Car Per 39 People in Ohio—Registration by Counties

COLUMBUS, O., April 3—According to statistics compiled by State Registrar of Automobiles W. H. Walker, 120,296 automobiles and trucks are owned in the eighty-eight counties of Ohio, the total population as reported in the 1910 census being 4,696,861, or thirty-nine people for every car and truck owned in the state. The report of registrations by counties follows:

County	1910, People	1914, Cars
Adams	24,755	253
Allen	56,580	1,746
Ashland	22,975	820
Ashtabula	59,547	1,371
Athens	47,795	698
Auglaize	31,246	219
Belmont	76,856	968
Brown	24,832	349
Carroll	15,761	280
Champaign	26,351	694
Clark	66,435	1,556
Clermont	29,551	325
Clinton	23,680	687
Columbiana	76,619	1,658
Coshocton	20,121	537
Crawford	34,036	1,026
Darke	42,933	1,399
Cuyahoga	637,429	19,260
Defiance	24,498	861
Delaware	27,182	708
Erie	38,327	943
Fairfield	39,201	1,359
Fayette	21,744	627
Franklin	221,567	6,484
Fulton	23,914	1,036
Gallia	25,745	218
Geauga	14,670	366
Greene	29,733	764
Guernsey	42,716	631
Hamilton	460,732	7,542
Hancock	37,860	1,589
Hardin	20,407	1,078
Harrison	19,076	414
Henry	25,119	1,015
Highland	28,711	580
Hocking	22,650	347
Holmes	17,909	352
Huron	34,206	1,118
Jackson	30,791	242
Jefferson	65,423	1,024
Knox	30,181	863
Lake	22,927	856
Lawrence	39,488	334
Licking	55,590	1,552
Logan	30,084	722
Lorain	76,037	1,808
Lucas	192,728	5,425
Madison	19,902	692
Mahoning	116,151	3,721
Marion	33,971	1,181
Medina	23,598	725
Meigs	25,594	232
Mercer	27,536	821
Miami	45,047	1,295
Monroe	24,244	364
Montgomery	163,763	4,542
Morgan	16,097	172
Morrow	16,815	421
Muskingum	57,488	930
Noble	18,601	182
Ottawa	22,360	685
Paulding	22,730	747
Perry	35,396	685
Pickaway	26,158	863
Pike	15,723	135
Portage	30,307	779
Preble	23,834	1,051
Putnam	29,972	857
Richland	47,667	1,132
Ross	40,069	860
Sandusky	35,171	1,261
Scioto	48,463	698
Seneca	42,421	1,597
Shelby	24,663	808
Stark	122,987	2,440
Summit	102,253	3,951
Trumbull	52,766	1,289
Tuscarawas	57,035	1,113
Union	21,871	633
Van Wert	29,119	966
Vinton	13,096	71
Warren	24,497	562
Washington	45,422	560
Wayne	28,058	1,006
Williams	25,198	1,247
Wood	46,330	1,880
Wyandot	20,760	746
Total	4,696,861	120,296

The Engineers' Forum

Piston Ring Problems—Defends Compound Type—Eliminating Glare from Headlights

ST. LOUIS, MO.—Editor THE AUTOMOBILE:—The writer is much interested in the rather lengthy dissertation on piston rings which appeared in THE AUTOMOBILE for February 25. Some admissions by Mr. Enderbrock were very agreeable but the writer's experience in this branch of the automobile industry makes it necessary for him to take exception to some of Mr. Enderbrock's versions.

Mr. Enderbrock admits in the first few lines of his letter that the compound angular section ring is the most efficient and for that reason this type of ring was used, yet he winds up his paper with all his conclusions pointing to the older and most obsolete concentric single-piece ring as his ideal. Surely either Mr. Enderbrock, or the combined opinion of hundreds of automobile engineers of the present day, is wrong. There was a time when the single concentric ring was used almost universally but the irresistible process of elimination has relegated this construction to the background, to make way for the eccentric and even better construction—the compound angular section ring.

Uniform Radial Pressure Required

The first and most essential requirement in a piston ring is that it must exercise a uniform radial pressure from its center against the cylinder walls at every point in its circumference. This is impossible with a single concentric ring. It is useless to have a pressure acting on the cylinder wall at one point stronger than at another point, for if the pressure at the heavy point is correct, the pressure at the light point is not sufficient and, conversely, if the pressure at the light point is sufficient, there is a great loss of power in friction at the point where the pressure is heavier. It is further essential to have the rings fit, that is, to a very close limit to the bottom of the piston head groove so as to eliminate any large gap beneath the ring, thereby insuring an oil film behind the ring.

The concentric ring has one point to its credit, and that is, because of its concentric form it has the same thickness all around, which makes it possible to fit the ring very closely to the bottom of the piston head groove. It also has the advantage of a wide uniform bearing on the side of the piston grooves. The one great defect, however, which serves to disqualify it for use, is that at no point in its circumference does it have the same pressure against the cylinder walls, and the result of such ring action is obvious.

The Eccentric Construction

In the eccentric ring the above-mentioned defect is eliminated to a great extent by varying the thickness of the ring at different points, and, by doing so we vary the stresses at the different sections, so that the tension at these sections, which is proportional to the stresses, is uniform. Assuming that the eccentric ring gives us uniform tension at all points we sacrifice the broad uniform bearing on the sides of the groove and since this is a very important feature we cannot consider the eccentric ring the ideal construction.

Advantages of Concentric Rings

It can be clearly seen that the concentric ring has in its favor the wide uniform bearing on the sides of the slot but has the disadvantage of lacking uniform radial pressure. The eccentric ring has the advantage of a uniform radial pressure but fails with its bearing on the piston grooves, since eccentric construction necessitates a varying thickness throughout. If two concentric rings having equal sections are placed one within the other with the openings opposite or at 180 degrees, it matters not where the weakness is on either ring since the weak point of one ring being in contact with the strong point of the other and vice versa, the radial tension is bound to average up in a uniform manner. By this means a uniform radial tension is obtained and by the use of concentric construction in both rings, the wide uniform bearing on the sides of the groove is secured. This construction is indeed the last word in piston ring design and certainly proves its superiority in actual practice. Other details such as closing the slot and the like are only minor features and have no direct bearing on the fundamental features of an ideal ring.

Mr. Enderbrock mentions that if a compound ring is allowed to become rusty where the two halves intersect, the spring action is retarded due to friction between the corroded parts. This may be true, but the writer has never found a piston ring corroded or rusty where the engine has been run any length of time or any oil used at all. The carbon deposit which is often found behind and about rings has absolutely nothing to do with the piston ring itself. If a piston is improperly designed and poorly cooled, the small film of oil which is always present in and about a ring will surely be flashed into a gas and the remaining carbon deposited thereabout. If a piston is properly made and properly cooled one could keep the rings flooded in oil and never find any carbon as long as the oil did not get up into the firing chamber. Piston rings which have allowed oil to pass freely into the combustion chamber have been found to be absolutely free of carbon, and yet the combustion chamber and parts thereof were heavily coated with carbon.

A Question of Material

Mr. Enderbrock makes a statement that the compound ring gives wonderful results for a short time but that the efficiency decreases with age. That is a question of material and not of construction. If the proper material is used in a piston ring it should be just as efficient after it has been used for a time as it was when new, neglecting, of course, the slight wear which must be expected with any construction. There is also no reason why the double compound ring should wear any faster than the ordinary ring; it should not wear as fast, because even though the pressure may not be any greater than the ordinary ring, this pressure is uniformly distributed and the wear will also be better distributed.

A Test by Air Compressor

One of the largest manufacturers in the country ran an extensive test on the improved type eccentric and the compound angular section ring. He used a special air compressor for this test, his reason being that in a gas engine, if the rings have a slight leak each stroke, it is hard to determine it, since each cycle of a gas engine clears the boards for a new one and small leakage errors are hard to detect. In the special compressor, every loss, however small, is registered in the tank and at the end of 5,000 revolutions or more, all these little leaks which occurred at each stroke are summed up and show clearly on the tank gauge in their true light. Fig. 1 shows the results of the test.

This test shows clearly the superiority of the compound angular sectioned ring over its predecessor, the eccentric ring. The test was conducted independent of the writer or any ring manufacturer and was run for the users' own satisfaction.—A. J. MUMMERT, Engineer, McQuay, Norris Mfg. Co.

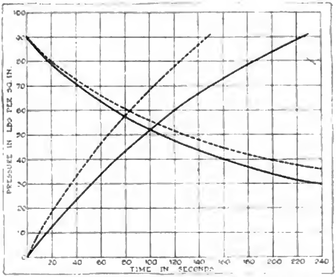


Fig. 1—Comparative pumping and leakage curves for plain eccentric piston rings, shown in black, and for compound angular, shown dotted

Bend Headlight Supports to Throw Glare on Road

DETROIT, MICH.—Editor THE AUTOMOBILE:—For some time the subject of over-brilliant automobile headlights has been agitated by the authorities. The points made against them in view of the dazzling effect on the eyes of the drivers in other cars are undoubtedly well taken, but the proposed remedy of either dimming or diffusing the light would only relieve the driver of the approaching vehicles and at the same time destroy their efficiency from a road lighting standpoint. Good illumination is certainly necessary on the side streets.

Brilliant and intense as the best headlights seem to an observer who is looking into them from another car, the aspect is entirely different from the driver's position behind them, and, even with the best ones, very careful watching is necessary to discern such objects as pedestrians, for example, or the unlighted horse vehicle so frequently encountered.

Mount Lamps at an Angle.

A complete remedy for the headlight nuisance, so simple and so obvious that to merely call attention to it would seem sufficient for its carrying out without compulsory laws, is the mounting of the lamps at a slight angle to deflect the rays downward.

As we all know, the principle of the parabolic reflector incorporated in the modern headlight is to cause the light to leave the lamp in parallel rays, resembling when viewed on a slightly foggy night a perfectly straight bar or long cylinder. The lamps being mounted at a point below the eye level of the pedestrian and still farther below the eye level of the car driver, it is perfectly evident that if this parallel bar of light were directed slightly downward that only a few scattering diffused rays would reach the eyes of the approaching individual.

The improvement is also very great to the man behind the lights so mounted, as it is perfectly evident it is the road he wishes to see, not the surrounding foliage, or even clouds in some cases, as one would be led to believe from the upslanting lights on some of the cars passed.

A heavy monkey wrench used on the bracket just below the lamp will serve to bend it. A little experiment will place the light on the road according to each driver's preference, as those that drive faster will naturally prefer less dip and longer reach of light than the more deliberate drivers, who will enjoy the intensely illuminated oval of light drawn close to the car by a somewhat greater extreme of angle, serving to reveal without eye strain the minutest chuck hole and show in ample time any obstacle which may appear.

Headlights Directed at Random.

Referring again to the present care-free way that the average car lights are directed, some skyward, some sideways, like a wall-eyed horse, and some a combination of both, the lights are certainly blinding to approaching drivers, and their usefulness curtailed to their own drivers to the same degree that they become a nuisance to the others.

A powerful headlight is one of the greatest factors towards safety in night driving, and to propose a remedy of dimming them instead of properly directing them is as absurd as to propose regulating a derelict machine with a broken steering gear by taking the engine out of it instead of repairing the steering gear.—CHAS. H. KIRBY, Chief Engineer Carbureter Division, Detroit Lubricator Co.

Thinks Oversize Tires Increase Comfort and Reduce Expense

NEW YORK CITY—Editor THE AUTOMOBILE:—There has been considerable discussion of the merits of oversize tires. We believe in their use principally for the following reasons:

Take, for instance, a 33 by 4 tire which fits on a 32 by 3 1-2 rim, in addition to having considerable more air capacity or cubical contents there is naturally a little more tread and the oversize tire is, generally speaking, of a heavier construction. The greater air capacity naturally makes more of a cushion, thus making the tire easier riding for the occupants, and, due to the advantages mentioned above due to the fact that the tire is of heavier construction and has a greater air capacity, it will throw off strains which a tire of similar diameter and circumference would not throw off.

In addition to the above, the circumference of the oversize tire in this instance is slightly over 3 inches more than the 32 by 3 1-2 which we are using for illustration. This additional running surface means, of course, that the tire will revolve fewer times in making a mile than the 32 by 3 1-2, which, everything being equal, should insure greater mileage than the smaller size tire.—R. R. DRAKE, Manager Service Department, United States Tire Co.

Ontario Favors License Reciprocity with U. S.

WINDSOR, ONT., April 3—The members of the board of trade of this city have gone on record as favoring reciprocity of automobile licenses with the United States. They also expressed their opinion that it would greatly interfere with the tourist traffic if a new horsepower tax on automobiles of non-residents is imposed.

Minneapolis Speeders to Lose Cars 1 Year

MINNEAPOLIS, MINN., April 3—Every Minneapolis automobilist who violates the traffic or automobile laws in the future will be deprived of the use of his machine for a full year, according to an edict issued by Police Judge Smith.

The Rostrum

Criticises Suggestions for Metric System

EDITOR THE AUTOMOBILE:—Your remarks on page 365 of THE AUTOMOBILE for February 11, on filtering gasoline are to the point, but should include catching lint which most gasoline contains in considerable quantity. This lint is derived from the cotton strainers through which the fluid is passed in its process of manufacture and traps will not catch it. It must be caught by fine screens or by chamois strainers. These screens in time clog and refuse to pass the fluid. On metal screens the layer of lint can be easily seen and lifted off. The most practical protection which I have ever used is a large tubular screen soldered to the tank outlet cock and sticking up into the tank. The flow into the carbureter being much slower than the movement of the contents of the tank under the motion of the vehicle permits the lint to be washed off the screen instead of collecting in a liquid tight layer thereon.

New Weight System Not Objectionable

Mr. Vivier's suggestions for introducing the metric system are faulty. While there is not so much objection to a new weight system, there is every objection to a new system of measures, and theory no matter how good looking, must take into consideration the facts or somebody suffers. Forcing people to do things the way some theorists think they should be done is not in accord with the freedom we are trying to maintain in this country.

In certain lines of work it is just as easy to use one measurement as the other and there is no objection to a new line of work making its measurements in that system which seems most world wide; but it is wrong to force any of us to fool with the metric system when we want a pane of glass for a window made 40 years ago or a new pipe fitting for the gas pipes in the same house. In short, measurements of length are tied to the past and no law can untie them. It would simply introduce another system where we have too many already. It would lengthen our troubles instead of shortening them. It would hamper our business instead of helping and we of America, trying to uphold higher wages and a higher form of civilization, need help from our law makers rather than hindrance. Every maker of any line of goods knows how disastrous a change in designs is, unless there is a decided gain of some kind. This gain is not to be found in the mere substitution of a measuring system. Most workmen today have metric tapes and scales in their possession but they do not use them. They are not so handy. They do not think in their terms. They mean less to them. To force their use would slow up production. "915 millimeters" (see table on page 365) is a mouthful as compared with 36 inches. No man can grasp the former dimension so easily as the latter. Nor can he speak it and write it so quickly. And its very existence is condemnatory. Why do its advocates say 700 millimeters instead of 70 centimeters or better still, 7 decimeters? Simply because it lacks much of practicability. Instead of introducing by law a new system we had much better wipe out some of the less used old ones such as apothecary's and troy weights, long tons, 112-pound hundred weights, nautical miles, several different ells still used abroad, 2 or 3 sizes of gallons, quarts, etc. We need uniformity in our own work and land much more than we need to fit our factories to an arbitrary system forced on the people of other lands. The bulk of our business is at home and such measurements as are needed for our goods in foreign markets can easily be supplied in makers' catalogs, without greatly changing the goods themselves. So long as a foreign buyer can get tires that fit his rims he does not worry about our specifying their size in inches. It would be a valuable thing to have our rims of such size but the metric system will not accomplish this. I use tires as an example because of the metric size table on the same pages as Mr. V's letter. In other words a world-wide adoption of standard sizes may be a valuable thing and we should work with other nations to this end. But that we should greatly inconvenience our production and handicap our manufacturers to no particular end is a totally different thing and should be fought by all interested in the commercial growth of our country. If Mr. V. will tell us how to stop people from saying penny when they mean cent, or bit, levy, etc., when they mean 12 1-2 cents, or shilling when they mean 25 cents, we will then believe that he could in time suppress the present measurements but who can measure the loss to the country in making such a change? Several generations would die before our people would think as readily in the new system as in the old. In fact they never would, because a yard is a much better unit than a meter. It is divisible into halves, quarters, thirds, sixths and twelfths without producing fractions while the meter is only divisible by 2 and a thousand apparently, since the use of decimeters and centimeters is not common. Try it yourself. How many people can read a scale marked into groups of five millimeters and figured every ten, as easily as a scale marked into sixteenths, eights, quarters and halves and figured every inch? Most people count by twos and threes, not by fives.

Philadelphia, Pa. CHARLES E. DURYEA.

Lapping Piston Rings Requires Experience

Editor THE AUTOMOBILE:—We have an Overland car model 60 T, one cylinder of which will not hold the compression very well. The cylinder is in good shape. I put two new rings in and I think they do not fit well enough yet as the car has only been run about 30 miles since they were put in. The compression was fairly good with the old rings.

Is there any way that they could be made to fit any tighter by using some kind of a grinding compound?

Do you think they will be tight after the car has been run 400 or 500 miles?

Napoleon, O. L. HUGHEY.

—In order to get the new rings to fit well at once they should be lapped in by means of a grinding compound. The cylinder is put on a bench and the piston worked out and in with a sort of irregular turning movement similar to that given in grinding a valve. This work can be done by an amateur but should not be attempted without first having observed carefully how it is done, because it is easy to spoil the piston and cylinder by unequal abrasion. The probabilities are that the new ring will wear in and the compression will be tighter after you have run another 200 or 300 miles, and altogether it would probably be better for you to wait and see that this does not happen unless you can get the services of an expert in lapping in the ring.

Slips Out of Second Gear

Editor THE AUTOMOBILE:—I have a 1915 Maxwell model 25 with which I have had some trouble in the way of slipping out of second speed. Is this trouble a common feature for this type of car or is it individual?

When I am going up a long hill in second speed the lever will slip back to neutral in spite of all that I can do. About every 50 or 75 yards I have to release the clutch and push the lever back into second.

2—What is the gear on high, intermediate and low?

Littleton, N. H. W. M. SILSHY.

—This complaint is exceptional with this car and not found generally among users. It is impossible to give exact information without the serial number of the car. It is probable that the second-speed sliding gear is badly worn, or the tension on the spring which holds the gear-shifting rod in place has been weakened. As this car is probably within its guaranteed period it would be best to take the matter up directly with the Maxwell Motor Sales Corp., which has field mechanics throughout the territory who will investigate the trouble.

2—High 3.58 to 1, intermediate, 6.21-1, low, 10.48-1.

Angularity of Connecting-Rod Explained

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for February 11 in the article on Engine Balance and Vibration it is stated that a piston covers more than half its travel on the last half of the upstroke and less on the first half, while in the issue for February 25, the article Light Pistons Make Smooth Motors says: "We have seen that a rising piston moves faster and faster during the first half of the upstroke and then slows down again as the crank comes toward the top."

As I study your articles on such subjects I would appreciate your explanation of the difference of opinion.

Ilion, N. Y. R. B. FISK.

—The article on engine balance and vibration analyzed the motion of the piston in detail and explained how, owing to the angularity of the connecting-rod, the piston does cover more than half the stroke during the second half of the upward crank movement, that is during the last quarter turn of the crank. In the article on light pistons the author was not considering the matter in such detail and merely wished to point out that the piston is stationary for an instant when the crank is at the bottom of the stroke and that it is similarly stationary at the top of the stroke. On the way up it is first accelerated and then retarded, the change from acceleration to retardation taking place at approximately half stroke.

Aeroplane Design Used for Racers

Editor THE AUTOMOBILE:—Can you advise me through THE AUTOMOBILE if aeroplane motors have been used in racing cars and, if so, what results were obtained?

2—About how many revolutions per minute will these motors turn up?

Katonah, N. Y. J. A. B.

—Motors designed for aeroplane work have been employed very successfully by the Mercedes company in its French Grand Prize cars. It will be remembered, however, that these were not purely aeronautical motors but were adaptations that borrowed suggestions from the aeroplane design as far as pistons, connecting-rods, etc., were concerned. In the automobile motors, however, four valves were used in order to run the rotative speeds up to a much higher degree than they were adapted for in the aeroplane stock job.

2—While the aeroplane motors could not revolve at more than 2,000 r.p.m. these racing automobile motors developed over 4,000 r.p.m.

Motor Knocks on Hard Pull

Editor THE AUTOMOBILE: I have always been bothered with motor knocking when throttle was opened on a hard pull necessitating my retarding the spark to the extreme limit, and that, of course, reduced power.

I have been told by several different garage men that it was caused by too high compression and they advise reducing compression by raising the cylinder and placing a plate beneath to make a larger compression space, Fig. 1. Do you think this would do any good? If given more space, would it not reduce power?

Kankakee, Ill. U. S. SHREFFLER.

—The high compression reason which has been assigned to your case is very possibly correct, although it might be that carbon trouble is at the bottom of the difficulty. If you have noticed that the knocking continues even after the motor has been cleaned of carbon, it is probably due to the high compression or to a loose connecting-rod, wristpin or crankshaft bearing or part. It is never a good idea to reduce compression until you are sure that it is too high and it will be better to have this measured by gauge and see what it really is before attempting to cut it down by means of a plate. A compression pressure of 70 pounds is sufficient and for ordinary purposes you should not have higher than this. If it is below this a reduction of compression will reduce the power correspondingly, as it influences the mean effective pressure in the cylinder.

Worn Parts Must Be Replaced

Editor THE AUTOMOBILE:—Please explain why the push rods on my 1912 E. M. F. back down. I have adjusted them tightly.

2—I also have trouble with the oil leaking out of the push rods.

3—How many miles should this car run on 1 gallon of heavy oil? I get 225 to 250 miles on a gallon.

4—Is there any way to inclose valves on this car so that inclosing parts could be taken off easily?

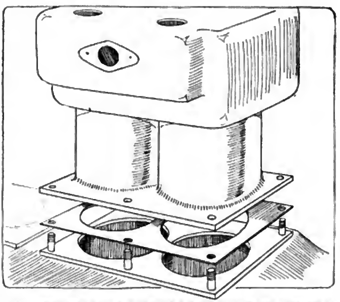


Fig. 1—Showing method of placing a plate beneath the cylinders to reduce the compression

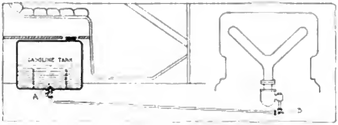


Fig. 2—Points in gravity feed which are likely to become clogged: A—At the point where the gasoline leaves the tank into the gasoline carbureter feed line; and B—the elbow or connection of the carbureter to the gasoline feed line

5—Where does the new Mercer car get its power with a bore of 3.75 rated at 22.5 horsepower?

Philadelphia, Pa. FREDERICK MUNZ.

—The probable reason that the push rod adjustment does not remain permanent is that the threads on the push rod adjusting screw or the lock nut are worn, necessitating the replacement of these parts.

2—The leakage of oil from the push rods can be attributed to worn push rods or push rod guides and in order to eliminate it the worn parts should be replaced.

3—If you secure 240 miles to the gallon of oil on this car, you are attaining a fair average, as at this rate your oil cost will be only about .25 cent per mile.

4—You could probably make up plates out of sheet tin or some other material easily cut and bent which would inclose the valves on this car. A method which has been used occasionally with success is to inclose the valves in individual tube housings of telescopic slotted design arranged in such a manner that the smaller portion can be slid into the larger, thus enabling the operator to reach the valve adjustment nut. If you use a housing which is fastened to the side of the motor be careful not to tap into any waterjacket material as this is thin and when once pierced it is difficult to maintain a tight connection.

5—The power of the Mercer is attained by high rotative speeds and long strokes. Although the S. A. E. rating of this motor is 22.5 horsepower the Mercer company claims 70 horsepower on the block. This at first would not seem logical but it must be remembered that the S. A. E. rating is based on a piston speed of 1,000 feet per minute whereas at full power the new Mercer motor develops far more than this speed.

Maxwell Company Making New Cars

Editor THE AUTOMOBILE:—Will you kindly tell me if the Maxwell company of today is the same as that originally started, or has that concern gone into bankruptcy?

2. Is the firm building the some cars today as a few years ago?

3. Is the same motor used? If a new motor is employed kindly give the bore and stroke of the old motor. Also the piston displacement.

4. Kindly give the specifications of the motor as now manufactured.

Isanti, Minn. EDWIN BOSTROM.

—The Maxwell company of today is an entirely separate concern from the original Maxwell, but is an outgrowth of the former in many ways. The present concern is handling the previous parts and is continuing the service work of the old Maxwell company.

2. The cars which it is building today are entirely different from those made a few years ago.

3. The same motor is not used. It is impossible to give you the bore and stroke of the old motor without knowing to which model Maxwell you refer. There were several of these, and if you will give the exact year to which you allude the full specifications can be furnished.

4. The Maxwell 25 which is now being built is a four-cylinder 3.625 by 4.5 design, having L-head cylinders cast in a single block. The valves are on the right and cooling is by thermo-syphon, oiling by splash and ignition by a dual system.

Gasoline Line Apparently Clogged

Editor THE AUTOMOBILE:—I own a 1912 Haynes model 20. On a level road or slight ascent, the car runs well, but on steeper grades it misses, chokes and backfires. I had new rings put in and the compression seems good. Stromberg carbureter was sent to maker recently and overhauled. The magneto seems to be O. K. Have tried different levels of float, but nothing helps. Sometimes it chokes on the level, but a momentary shifting to second or often opening air wide for a moment stops it.

Hazleton, Pa. J. H. D.

—From the information given, it would appear that the gasoline line between the carbureter and the tank is slightly clogged. The gasoline flows through rapidly enough to feed the car under conditions obtained on the level road or on a slight ascent, but on steeper grades the feed is not fast enough to do the work. If you will remove the pipe connecting the tank and the carbureter and clean it out thoroughly it will probably end the trouble. See Fig. 2.

Position of Spark Plug Is Important

Editor THE AUTOMOBILE:—In a gasoline engine do you get any more power from the explosion by having the spark plug directly in front of the piston rather than at one side in a boss or recess?

2—Can you clean the carbon out of the cylinders by burning it out, or is it as well to scrape it out by taking the cylinders out?

3—Does it harm a high-tension magneto, that is, where a car is run by one alone, to shut off the spark going down hill and brake with the gears? Is this the best thing to do on a steep hill? And could this harm the cylinders?

Strong, Me. L. T. HUNTER.

—There are two theories relative to the location of the spark plug in a recess within the cylinder. One is that by having the spark plug in such a recess, a spurt of flame enters the combustion space from the recess and as a result quickly ignites the charge. Another theory is that by having the spark plug directly in the center of the combustion, or, that is, so that the spark plug points project outward into the combustion space itself, the gas is quickly exploded because it gives the flame a chance to propagate itself in all directions. Practice favors a plug which merely has its points projecting into the combustion space, see Fig. 3.

2—Carbon can be very efficaciously burned out of the cylinders by the use of oxygen. It can also be taken out by scraping.

3—It does not harm a high-tension magneto to do this because there is a safety spark gap which provides the resistance to the current and gives it work to do other than breaking down the insulation. The practice of using the motor as a brake will not harm the cylinders but it is said to put considerable wear on the gears due to the reversed action of the reduction. That is, if the car should be geared 4 to 1 when the motor is acting as a brake, the reduction acts in an opposite direction and becomes 1 to 4.

Hot Air Apparatus Would Stop Trouble

Editor THE AUTOMOBILE:—My car is fitted with a model L Schebler carbureter. Last fall it began to skip every time the throttle was changed, and no amount of adjusting would stop it. This winter I had the car torn down and thoroughly overhauled but the carbureter is still troublesome.

It will run perfectly until the throttle is changed and then it does not seem to adjust itself for a number of revolutions, when it will take hold and run beautifully until the throttle is changed again. It will skip, spit back through the carbureter, fire in the muffler and, if on a hill, it will die. It always ends by throwing a lot of gasoline out of the carbureter and when the engine stops it will leak from a teaspoonful to a tablespoonful.

Clayton, Mich. M. R. S., M. D.

—The first test you should make is to ascertain whether or not you have any leaks around the intake manifold, that is, between the engine and the manifold and also between the manifold and the carbureter. When the car is running idle, see that there is no gasoline leaking.

Should you find that there are no leaks, it is advisable that you use an exhaust sleeve or drum around the exhaust manifold flexible tube running to the air bend in the carbureter, as by using this hot air you are able to keep the heavy gas from precipitating on the walls of the manifold and from running back to the carbureter when the car stops. With the extremely heavy gasoline which we are now getting, in order to assist in the vaporization and to hold this heavy gasoline in suspension, it is desirable to use hot air through the low-speed air opening. If these adjustments are followed and there are no leaks there should be no further trouble.

Battery Should Last 2 Years

Editor The Automobile:—Will you kindly tell me through the Rostrum how long a storage battery should last before becoming useless, provided it is given proper attention during its life?

Following are a few ideas which may be of interest to other readers:

1—To stop rattling of scissors-type shock absorbers, without tightening up the bolts until the car rides hard, I inserted two thin rubber disks, cut from an old tube, one each side of each wooden washer as furnished.

2—I rub the springs thoroughly each week with a rag soaked in kerosene and notice a surprising difference in riding qualities and also complete absence of spring squeaks.

3—As soon as a tire has gone 4,000 miles, I insert an inner liner around the tube and then use the tire until worn through. As a result, I have had no tire change on the road in a year and a half, about 12,000 miles, and have averaged nearly 10,000 miles per tire and tube, in spite of the fact that I keep but 40 pounds pressure in front and 50 pounds in rear tires, thus causing easy riding. I do not cement liner in tire but very little, as it is otherwise hard to remove.

4—I soften the leather of a cone clutch with kerosene every 2 weeks and have ideal clutch action.

5—I wash body myself with slightly warm water, and when dry, give well-rubbed-in application of liquid veneer with cheesecloth. As a result, body retains its gloss, although run practically every day for a year and a half in all kinds of weather.

Providence, R. I. W. B. Freeman.

—A storage battery which is serving a lighting and starting system has such a variable life owing to different degrees of good care and strenuosity of service, that it is impossible to fix a figure. It may be conservatively stated, however, that such a battery should have a life of 2 years or more.

Front Wheel Drive To Avert Skidding

Editor The Automobile:—It has occurred to me, when trying to negotiate slippery roads, that if the power was applied to the front instead of rear axle it would tend to obviate dangerous skidding. Kindly inform me if this method of applying power has been tried out on passenger cars, if so, is it practical and why has it not been adopted?

Conneautville, Pa. W. H. P.

—In 1906 Walter Christy of New York made a car in which the front wheels were used for both driving and steering. This was a development of the racing car in which the same scheme was employed and which managed to make a mile on a beach course in 35 1-5 seconds. In this car the motor which was a four-cylinder vertical design instead of being placed in the usual fore-and-aft position, was hung directly between the front wheels of the car with the crankshaft extending across. In fact, the crankcase of the motor, which was of manganese bronze, formed the front axle, and the drive was transmitted directly to the front wheels through suitable gearing and universal joints which permitted the wheels to swing on pivots for steering.

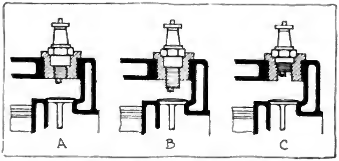


Fig. 3—A—Proper spark plug length. B—Spark plug too long. C—Spark plug too short

There was no differential used on this car and no driving sprockets on the rear axles or wheel. This permitted the body to be dropped very low and the car was of distinctive appearance for that time on this account. Owing to the placing of the motor at the front end of the car, the radiator was placed directly against the dash and the steering column passed through an opening in the radiator. This was a standard stock design and was regularly put on the market in September of 1906.

The drive is not practical owing to the complication of the driving and steering members and so has been abandoned.

Repair Parts for Warren Cars

Editor The Automobile:—Can you inform me what motor the Warren Motor Co. used in its 1913 six-cylinder car?

2—Also, kindly let me know where parts for the Warren car of 1913 design can be obtained.

3—What is the bore and stroke of the motor used in the 1913 six-cylinder model Warren? I am informed that the Warren Motor Co. is no longer an active concern.

Troy, N. Y. T. J. Quillinan.

—The motor used in this car was made by the Port Huron Construction Co., of Port Huron, Mich.

2—Parts for the Warren car including the 1910, 1911 and 1913 models 35, 30 and 40 and a large number of the six-cylinder parts can be obtained from the Puritan Machine Co., Detroit, Mich.

3—The 1913 Warren six had a bore of 4 inches and a stroke of 5 inches.

Wants Sizes of Fiat Racers

Editor The Automobile:—I have been puzzled on the size of racing cars and the engines therein. I believe that the Fiat people have in the past made the largest automobile racing motor. Is this correct?

2—Please give me the exact measurements of the largest Fiat ever built? Also the measurements of the Fiat.

Culver Military Academy, Culver, Ind. Duncan S. Nease.

—The largest Fiat of which we have record is that in which Nazzaro appeared in 1911 at Brooklands. The dimensions of this car were 9.4 by 12.59. This car was too hard to handle.

2—This is covered under question 1 as regards the first part. The Duray Fiat which was driven at Ostend is a four-cylinder 7.48 by 10.4.

Discussion of
"The Improvement of
Spring Systems"

Revised Figures by Fellowcraft on Forces of Road Shocks

By M. C. K.

ALL who read the valuable contribution by Fellowcraft in the issue of March 18 on the actual proportions between the destructive forces which are toned down by both springs and tires in motor vehicles and those which are endured without any other mitigation than that which air tires may afford, will be still more interested in the revised presentation of the same subject which follows and in which he sets forth with remarkable stringency and clearness such an application of physical science to the solution of the problem involved as must appeal to any capable engineer. When M. C. K. first called attention to the neglected values of the horizontal shocks, the first consideration was to open up the subject and make it accessible with a minimum of effort on the reader's part. It seemed more important to show approximate than accurate values, if at the same time those things could be included in the reasoning which eventually must be found important in practice but which at present are too indefinite or complicated for any readable academic treatment. One of these factors is the DURATION of a shock, as it is so strongly affected by even the slightest resilient element in the vehicle as to invalidate the intended comparison of the theoretically rigid vehicle with any automobile or truck actually built or to be built. For this reason the values were figured or estimated in terms of work, which leave the time element of the shock itself out but from which the destructive force of the shock can be figured in any given case when time and space both become reasonably well ascertained. In the following presentation of the subject Fellowcraft arrives at values in terms of work which agree near enough with those proposed by M. C. K. to satisfy the latter, but at a number of points it is believed that Fellowcraft's strict reasoning from premises is inapplicable, through the failure of the premises. These points can more conveniently be taken up in a separate article, which is to follow.

Fellowcraft's Second Letter on Shock Values

My Dear M. C. K.,

Nearly every problem in mechanics is open to several lines of attack for its solution: and for example, a particular problem might be correctly solved, with respect to the forces involved, or in terms of impulse or momentum, or likewise, in terms of energy or work.

The writer in criticising your figures relative to the necessary horizontal and vertical action of a spring, unfortunately chose to follow your line of attack in obtaining the solution in terms of work. The writer's mental picture of the results of impact with the obstacle encountered is clearly a picture of *force*, and it was due to the lack of mental agility, in forgetting the picture of force while solving in terms of work, that the error of compounding work values occurred.

The figures 1,975 and 3,180 foot-pounds, representing respectively the horizontal and vertical work values, is undoubtedly wrong, but the writer will attempt to show that the value of the ratio 1,975 : 3,180 when considered as the ratio of the horizontal to vertical shock, is still correct.

Since the stressing of the vehicle materials, the elements that make for destruction, and the bearing pressures, etc., are measured in terms of force, the problem will first be solved in consideration of the forces involved.

In Terms of Force

The kinetic energy of the car, due to its mass and velocity, is capable of being transformed into force only by the introduction of a resisting force. Referring to Fig. 1, when the obstacle A is encountered, a force, or more properly a reaction, is induced in the direction AB, making an angle a with the plane of N B or the direction of the kinetic energy of the car.

In the force triangle AHB, if AB represents the reaction in magnitude, AH and HB are respectively its horizontal and vertical components, and since action and reaction are equal, A'B of the force triangle A'H'B, is equal in magnitude to A B, also A'H' and H'B are respectively equal to AH and HB.

The maximum possible value of the reaction AB is unlimited, since it is supplied by the earth, but the value of the acting force A'B, is determined by the possible values of its components A'H' and H'B, and these in turn must bear a relationship to each other, that is a function of the angle a. It is evident then, that in order to check the momentum of the car, forces must be applied in the direction of A'H' and H'B and these forces must be in the relationship of A'H' = H'B cot a.

The force A'H' is supplied through the kinetic energy of the car, and its maximum possible value is easily determined.

$$\text{K. E.} = \frac{3{,}000 \times 50^2}{64} = 117{,}187 \text{ foot-pounds.}$$

$$\text{Space} = \frac{10.53}{12} \text{ feet.}$$

K. E. ÷ Space = average of the force = $117{,}187 \div \frac{10.53}{12}$ = 122,000 pounds.

Therefore the maximum possible mean value of A'H' = 122,000 pounds.

The force H'B is supplied by the inertia of the mass of the platform supported at B.

The static mass supported at B is known to be $\frac{1{,}000}{32}$.

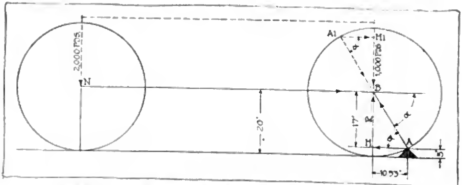


Fig. 1—Diagram by Fellowcraft of forces in front wheel road shock

The lineal velocity of the car is 50 feet per sec. = 600 inches per sec.

The time, t, required to mount the obstacle $= \frac{10.53}{600}$ sec. = .01755 sec.

If R denotes the mean vertical force in pounds, $R = ma$. where $m = \frac{1{,}000}{32}$ and $a =$ the mean vertical acceleration = space $\div 2t^2$

$$a = \frac{3}{2 \times 12 \times (.01755)^2} = \frac{.125}{.000308} = 405.5 \text{ ft. per sec. per sec.}$$

$R = \frac{1{,}000 \times 405.5}{32} = 12{,}676$ pounds. The maximum mean value of H'B is therefore 12,676 pounds, under the condition that the value of R was zero just previous to the impact.

Since the maximum possible value of A'H' is 122,000 lbs. and that of H'B is only 12,676 lbs., it is evident that the limiting value of A'B must be determined by the component H'B, and may be expressed by $A'B = \frac{H'B}{\sin a}$. The limiting value of A'H' is therefore H'B cot $a = 12{,}676 \times \frac{10.53}{17}$ = 7,875 pounds.

The ratio of the horizontal to vertical shock is expressed by the ratio 7,875 : 12,676 or 1 : 1.61.

The value of this ratio is less than unity for all values of a greater than 45 degrees, and is greater than unity for all values of a less than 45 degrees.

Figuring with Momentum

The problem might be solved in terms of impulse, since the time element T is the same for the action of both forces, and since terms of momentum or impulse may be compounded as are pure forces. It will be noted however that, since the time element is common to both forces, horizontal impulse : vertical impulse = horizontal force : vertical force = 1 : 1.61.

It does not appear to the writer that the solution can be successfully made in terms of work, since work is independent of time, and it is the time element that is all important where stresses of materials occur under impulsive loads.

The Work Values

A comparison of the work values may be interesting, however. The horizontal force acts through a space of $\frac{10.53}{12}$ feet, and the work done is $7{,}875 \times \frac{10.53}{12} \times 1$ ft. lb. = 6,925 foot-pounds. The vertical force of 12,676 pounds acts through a space of $\frac{3}{12}$ feet, and the work done is $12{,}676 \times \frac{3}{12} \times 1$ ft. lb. = 3,170 foot-pounds. The ratio of horizontal to vertical work done is 6,925 : 3,170 or 2.18 : 1 but the respective spaces covered in doing the work are in the ratio of 10.53" : 3" and the space-average of the forces is in the ratio of 1 : 1.61.

It was seen that the vertical work performed in mounting the obstacle amounted to 3,170 foot-pounds. Now consider a car whose weight upon the front axle is 12,676 pounds, and assume the car to be raised by a jack to the height of 3 inches. The work in so doing is $12{,}676 \times \frac{3}{12} \times 1$ ft. lb. = 3,170 foot-pounds.

The work done in both cases is the same, but while in the first case, with a front axle load of 1,000 pounds, a shock force of 12,676 pounds was developed, in the second case, with an axle load of 12,676 pounds, the shock force would practically be nil.

Is it fair then to draw conclusions regarding the practicability of springs in terms of work, when all the factors that make springs necessary are measured in terms of force?

An interesting comparison of horizontal force, space and work to vertical force, space and work, through all values of a from 80 degrees to 10 degrees, is shown in Fig. 2, where the curve A is the ratio of horizontal to vertical force, B the ratio of horizontal to vertical space, or the space traversed to the height raised, and C the ratio of horizontal to vertical work performed. Considering the values of a from 80 degrees to 45 degrees, as these are about the limits of the values in which we are particularly interested, it will be noted that while the force ratio varies from .176 : 1 or 1 : 5.68, the work ratio varies only from 2 : 2.41 or 1 : 1.205, and the question of whether work is the proper consideration for spring comparison becomes more insistent.

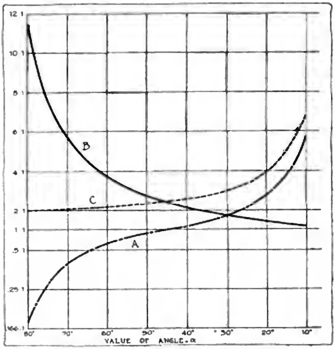


Fig. 2.—Diagram showing relations of essential factors at different angles of impact, according to Fellowcraft

Curve A shows ratio of horizontal to vertical force; plotted from AH = R cot a or AH: R = R cot a : R = cot a : 1

Curve B shows ratio of horizontal space to height raised; plotted from the ratio of horizontal to vertical space = cos a : versin a

Curve C shows ratio of horizontal to vertical work performed. It is the product of curves A and B, since curve A represents force and curve B the space through which it acts

A Point in Doubt

It is not just clear to the writer how the work values of the horizontal and vertical components of the shock force affect the spring action, but from experience it is commonly known that if a is large, as for example 80 degrees, making the height of the obstacle 3/10 of an inch, very little shock effect is noticeable in mounting this small obstruction. Still, the horizontal to vertical work ratio for this angle is 2 : 1. In what form does this work appear? Surely not in shock, for the corresponding force ratio is .176 : 1 or 1 part horizontal force to 5.68 parts vertical force.

When the angle a is reduced to 45 degrees, making the obstacle height 5.85 inches, the force ratio will have increased to 1 part horizontal force : 1 part vertical force, an increase of 5.68 per cent. The work ratio for an angle of 45 degrees is 2.41 parts horizontal to 1 part vertical work or an increase of 20.5 per cent. It is likewise a matter of common knowledge that an obstacle of this height would produce severe shocks, that are apparently out of proportion to the small increase in the work value.

In my letter of March 10, suggesting the solution of the ratio of the horizontal to vertical shock forces in terms of the inertia of the mass of the platform supported by the front axle, and a function of the angle a, you suggest that in doing so, the weight of the vehicle is ignored. Just what you mean by the "whole vehicle weight" is not clear. The static weight on the front axle is considered in figuring the vertical component or the value of R, while the kinetic energy of the car is considered in the horizontal component.

My solution does regard the kinetic energy as being potential and only capable of being transformed into force, as resisting force is applied. The application of the resistance is NOT in the plane of N B, but through the angle α. Then, as long as α has a value, the vertical component H'B has a value, and the force A'B is determined by the lesser of the limiting values of its components. If the momentum of the vehicle is sufficient to carry it over the obstacle the lesser component H'B must determine the values of A'B and A'H', and therefore that proportion of the total kinetic energy that may be transformed into horizontal force.

If the momentum of the vehicle is not sufficient to carry it over the obstacle, the component A'H' will determine the limiting value of A' B and H' B, and the vehicle will mount the obstacle to the point where the impulse of A H equals M V or the momentum of the car.

The components H'B and A'H' are therefore, two forces : one determined by the vehicle speed and the front axle load, and the other by some proportion of the kinetic energy of the car, being transformed into force : the proportion being such, that its force value when added geometrically to the first force, will produce a resultant acting in a plane passed through the wheel center and the point of impact.

The writer fails to see where any other element of "weight" enters into the problem.

In conclusion, the writer wishes to call your attention to a feature in your reasoning relative to Fig. 6 that may help to clear the atmosphere concerning the points in question.

If BA, whose value you show to be $\frac{10.53}{27.53} \times$ K. E., represents the energy spent in shaking the earth, it automatically admits of a force acting in the direction BA. The earth would, of course provide a reaction for this force. But BA, by your premise, is only one of the two components of the force whose direction is N B.

A FORCE CANNOT ACT ALONE: NEITHER CAN ONE OF ITS COMPONENTS ACT ALONE.

If there be a component acting in the direction of B A, there must also be a component acting in the direction B L. There being no resistance in the direction L B, the component whose direction is B L cannot act. Therefore the component whose direction is B A cannot act.

The force then which DOES act in the direction B A, is not a COMPONENT of the force whose direction is N B, but is a force WHOSE COMPONENTS act in the directions N B and B H.

A H and H B are thus shown to be components of the SAME force, and regardless of their origin, must combine in such proportions as to produce the resultant A B, and therefore must bear a fixed relationship to each other that is a function of the angle α.

This reasoning reduces the problem to the same solution given earlier in this letter. Is it not correct?

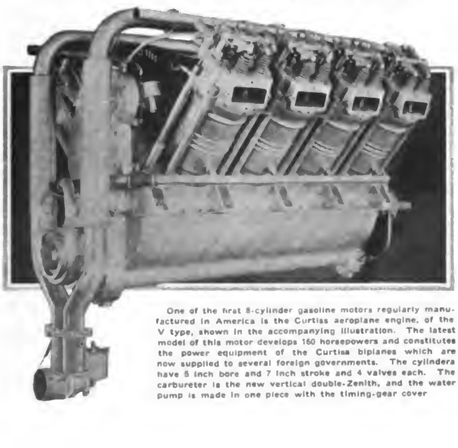
March 29, 1915. A. FELLOWCRAFT.

Back to the Main Subject

The practical importance of the question whether or not the relative magnitude of the horizontal component of road shocks is such as to call for special construction, in order to temper the effects of this component for motor vehicles in general and those operated with solid tires in particular, fully justifies the unabridged rendering of Fellowcraft's method for determining the shock values by an uncompromising application of the laws of physical science and a strict insistence on the scholastic use of its ideology. "Is it not correct?" he asks in conclusion. The writer would say here, in advance of a more complete reply, that in his opinion Fellowcraft's method requires to be supplemented by a closer consideration of actual shock conditions before it can become applicable and convincing. As it stands, it ignores the nature of the movement of the axle, by which the force values are strongly concentrated in the first portion of the shock space and which is one of the factors that made the writer prefer to try a short cut to applicable results. Fellowcraft's solution would apply with equal right to a shock from an obstacle affording gradual ascent of the wheel—the difference would be quantitative only and for this reason alone it does not seem to present a useful parallel for practical conditions until supplemented and modified. The writer did not wish to subordinate the practical interest to the convenience of a strict and final mathematical solution obtained by the sacrifice of facts in the situation. The correct vision of the problem must precede a "correct" solution.

As a discussion which drifts toward a slighting of the main practical question at issue and emphasis on the personal question of "property in truth" becomes lengthy and unsuited for publication, M. C. K. will leave points of this nature for the readers to decide and, while profiting by Fellowcraft's methods where they seem applicable, will take up the subject in his final reply strictly with reference to its practical bearings. The question can be put in this way: Are the high work values of horizontal components likely to be represented in high values of force and destruction, in practice?

Curtiss 8-Cylinder Aeroplane Motor



One of the first 8-cylinder gasoline motors regularly manufactured in America is the Curtiss aeroplane engine, of the V type, shown in the accompanying illustration. The latest model of this motor develops 160 horsepowers and constitutes the power equipment of the Curtiss biplanes which are now supplied to several foreign governments. The cylinders have 5 inch bore and 7 inch stroke and 4 valves each. The carbureter is the new vertical double-Zenith, and the water pump is made in one piece with the timing-gear cover

37,990 Michigan Licenses in 2 Months

More Than Number of Registrations for Entire Year of 1912—Complete Statistics of Makes Registered

By Marc Braun

DETROIT, MICH., April 3—There were 37,990 automobiles and trucks registered in Michigan during January and February, 1915, exclusive of licenses taken out by Canadians, automobile manufacturers and dealers. Total registration for the entire year 1912 was only 39,579 including these clases.

Of the total number registered in the first 2 months of this year 36,443 were gasoline cars and 1,494 were electrics. There were 36,420 passenger cars, 1,389 being electrics, while of the 1,547 commercial vehicles 105 were electric machines. These cars are the products of 297 manufacturers only nine of whom are European. The 288 American makes include many cars which are no longer built. The 483 passenger cars classed as miscellaneous include a large number of assembled, home-made and special types.

Ford registrations in January and February totaled 13,917 or 27.1 per cent. of the total registration. Buick has 2,211, Overland 1,852, Studebaker 1,768, Cadillac 1,594 and Reo 1,540. Of the electric passenger cars Detroit has 555, Rauch & Lang 143, Grinnell 123, and Baker 101. In the gasoline truck class the General Motors vehicles lead with 200, followed by Federal 185, Universal 120 and I. H. C. 121, while Detroit has 51 and Baker 22 among the commercial electrics. It should be noted that in the compilation of licenses no distinction is made between a passenger car and a commercial vehicle, all Ford, Overland, Studebaker, Buick, etc., cars being listed as passenger machines. Often where a license was issued to a business house the car was considered a commercial vehicle.

Michigan Car and Truck Registration for January and February, 1915

All Passenger and commercial cars	37,990
All gasoline passenger cars	35,055
All electric vehicles	1,494
American makes of all cars	288
Foreign makes of all cars	9
Makes of passenger gasoline cars	189
Makes of passenger electric vehicles	21
Makes of gasoline commercial vehicles	71
Makes of electric commercial vehicles	7
American passenger cars	35,031
Foreign passenger cars	23
Electric passenger vehicles	1,389
Commercial gasoline vehicles	1,412
Commercial electric vehicles	105
Manufacturers' licenses	122
Dealers' licenses	221
Manufacturers' and dealers' licenses	2
Total all licenses issued	38,335

The statistics appearing in the tables herewith do not constitute a definite criterion as to the actual total number of cars of the various makes in operation in Michigan. These are only the registrations during the first 2 months of the year and names which are credited with only a few cars at this time may be among those at the head of the list when the total registration records are compiled.

It must be remembered that at this time of the year there are a great many owners who have not yet taken their cars out of storage and hence have not registered. Of course, some types of cars are more likely to be found in operation than others during the winter months, while those in the northern part of the state are more probable to be late in registering than those in the southern section.

Registration of Cars and Trucks in Michigan During January and February, 1915

Gasoline Passenger Cars

Abbott	210
American	63
Apperson	23
Allen	4
Amplex	4
Austin	8
Anhut	8
Alter	11
Aerocar	4
Auburn	61
Alpena	14
Buick	2211
Brush	94
Briggs-Detroiter	162
Blomstrom	5
Briscoe	29
Badger	1
Baines	1
Benham	2
Brownell	1
Cadillac	1594
Chalmers	574
Cartercar	396
Columbia	16
Courier	11
Chandler	42
Cutting	94
Cole	149
Chevrolet	216
Cunningham	11
Crow	35
Case	19
Clark	11
Crescent	5
Carnation	4
Carhart	12
Colby	1
Cleveland	2
Consolidated	1
Corbin	1
Cooley	1
Campbell	1
Cameron	1
Dodge	48
Detroit-Dearborn	5
Davis	4
Day	1
Deal	3
Deere	1
DeTamble	6
Diamond T	1
E-M-F	234
Everitt	44
Empire	24
Marion	17
Marmon	15
Matheson	4
Miller	20
Moline	5
Mercer	10
Marquette	17
Mason	4
Marathon	9
Moon	7
Monarch	25
*Michigan Buggy	63
Metz	68
*Michigan Motor	48
Metzger	68
Mt. Pleasant	1
Marvel	1
*Michigan Auto	6
Monroe	5
*Motor Car	3
Meteor	1
McIntyre	4
Morn	1
McFarland	1
Midland	1
National	20
Northern	8
Norwalk	1
Northway	1
Northwestern	1
Nicholds	1
Oldsmobile	397
Oakland	738
Overland	1852
Owen	9
Orion	1
Orient	1
Packard	432
Paige	645
Paterson	164
Peerless	68
Pierce-Arrow	99
Premier	8
Pilot	3
Pratt	1
Pioneer	1
Pilgrim	1
Parry	2
Partin	2
Pullman	1
Palmer-Singer	1
Princess	1
Puritan	1
*Pope	46
Elmore	41
Elkhart	9
Ford	13,917
Franklin	79
Fuller Buggy	2
Grant	70
Gaylord	3
Great Western	2
Glide	10
Haynes	56
Hupmobile	709
Hudson	722
Herreshoff	65
Halladay	12
Henderson	8
Herff-Brooks	2
Havers	23
Henry	13
Holsman	1
Homer	1
Huron	2
Imperial	180
Interstate	9
Jackson	349
Jeffery	106
King	151
Krit	394
Kisselkar	71
Keeton	5
Kron	1
Lozier	138
Little	66
Lambert	26
Lion	39
L-P-C	1
Locomobile	35
Lexington Howard	1
Maxwell	822
Mitchell-Lewis	209
Reo	1540
R-C-H	217
Regal	285
Rainier	6
Royal	2
Read	11
Remington	1
Rider-Lewis	1
Studebaker	1768
Saxon	103
Stevens-Duryea	42
Stoddard-Dayton	51
Suburban	8
Stearns	5
Speedwell	9
Scripps-Booth	24
Stutz	10
Schacht	3
Stanley	9
Staver	1
Saltan	1
Simplex	4
Sterling	1
Selden	6
Thomas	30
Templeton	1
Vulcan	2
Velie	15
Valley	7
Warren	216
White	47
Welch	34
Wayne	18
Westcott	16
Wahl	4
Wolverine	1
Winton	180
Zimmerman	1
Miscl.	483
Total American passenger cars	35,031

Foreign Gasoline Cars

Benz	4
Daimler	1
Darracq	2
Fiat	3
Hispano-Suiza	1
Mercedes	1
Napier	1
Renault	9
Rolls-Royce	1
Total	23

Electric Passenger Cars

Argo	33
Babcock	8
Flanders	88
Grinnell	123
Borland	1
Broc	8
Baker	101
Colonial	1
Columbus Buggy	26
Century	72
Church Field	30
Detroit Electric	555
Fuller	3
Hupp-Yeats	45
Eagle	1
Ohio	40
Phipps-Grinnell	4
Rauch & Lang	143
Rex	3
Woods	88
Walker	15
Total	1,389

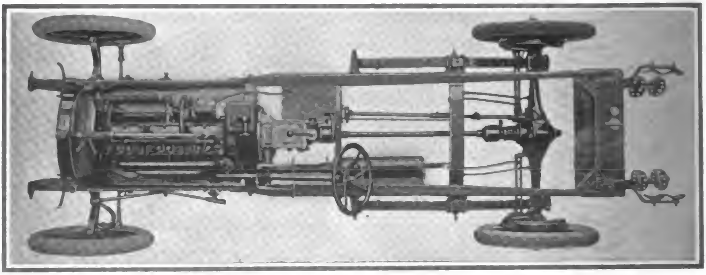
Commercial Gasoline Cars

Republic	54
Autocar	10
Sampson	31
Alco	1
Aetna	1
Best	2
Reynler	2
Commerce	82
Chase	25
Case	10
Commercial	3
Dayton	24
Duplex	3
Decatur	1
Dudley	1
Denby	2
Flint Wagon	23
Federal	185
Four Wheel Drive	1
G M C	200
Grabowsky	39
Gramm	11
Grand Rapids	3
Gaeth	1
Garford	7
Horner	26
Hewitt	1
Saurer	3
I. H. C	101
Kelly	31
Koehler	2
Knox	5
Kermath	5
Lauth-Juergens	2
Lippard-Stewart	2
Little Giant	14
Mais	1
Mogul	2
Menominee	10
Mack	2
Motor Wagon	1
O. K.	3
Oliver	8
Packard	98
Pierce-Arrow	17
Peerless	20
Parcel Post	8
Poss	20
Pull More	1
Standard	42
Sternberg	1
Stegeman	1
Sella	3
Signal	18
Star	24
Selden	3
Superior	1
Randolph	1
Rapid	21
Reliance	8
Reo	12
Universal	120
United	4
*U. S. Motor	9
U. S. Truck	5
Vim	3
Van Dyck	2
Vulcan	1
Wagenhals	9
White	19
Misc.	18
Total	1,442

Electric Commercial Vehicles

Baker	22
Champion	3
Couple Gear	7
Detroit Electric	51
M & P	3
Electric Vehicle	3
G. V.	15
Walker	1
Total	105

NOTE—Impossible to tell from registrations maker of various machines, cars of this name having been made by several concerns.



Plan view of chassis of six-cylinder, seven-passenger 50-horsepower Westcott

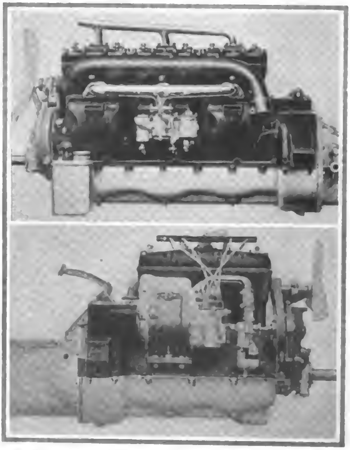
Comfort Is Feature of New Westcotts

Six and Four Chassis of Clean Design Take Four Body Types—Neat and Convenient Control

IN producing the two new chassis the engineer of the Westcott Motor Car Co., Richmond, Ind., has obviously given his close attention to a study of detail, so that the well known components used are given every opportunity to display their qualities. While the general lines of the six and four-cylinder chassis are similar, there are some points of difference, the most noticeable being that the six has a cantilever rear suspension while the four has three-quarter elliptic springs. The axles are different also, since a Weston-Mott is used on the four and a Timken on the six, the latter having spiral bevels and the former straight tooth gearing. Another difference appears in the transmission as the four has a single universal behind the gearset while the six has an open propeller shaft with two joints. In both cars the torque and drive are taken by the springs.

The motors are both standard Northways, the cylinder dimensions being 3 1-2 by 5 inches in each case, giving a displacement volume of 192 cubic inches for the four and 288 cubic inches for the six. Cylinders are block cast and have divided detachable heads which cover a pair of cylinders each on the six, but the head on the four is one piece. A neat feature of the Northway construction is the combination of the breather orifice with the valve-inclosing plates, there being a slot which is covered by a bead cast in the cover, this bead serving to provide something by which to hold the cover when taking it off. This can be seen clearly in the side view of the six, and the other photograph of the four-cylinder motor shows the mounting of the Delco single unit starter and generator. It will be seen that this is driven through the water pump, and just in front of the fan belt is a little platform designed to carry a tire pump, supplied on the six but listed as an extra on the four.

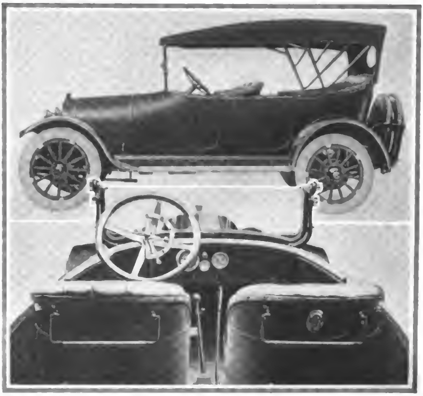
Owing to the use of the Stewart vacuum feed on both cars the carbureters can be mounted high and their accessibility is very great; they are not the same for the two cars as the six has a Rayfield and the four a Schebler. An air lever is supplied and attached to the steering post, while the high placing of the carbureters makes the accelerator connections very straight and simple. One of the little details that so greatly make for the driver's comfort is the throttle pedal which is shown in the sketch, the aluminum block making a convenient foot rest whence the plunger can be depressed



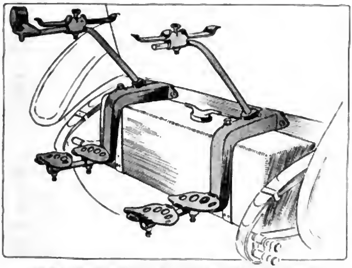
Westcott-Northway power plants. Upper—Carbureter side of six. Lower—Generator side of four or raised by a slight twist of the ankle. On the steering wheel there are the usual throttle and spark levers, while the horn button is located centrally in the wheel boss.

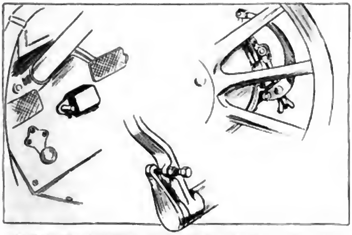
The leather-faced cone clutch is, of course, inclosed completely by the bell housing which connects to the three-speed gearbox, and the pedal is provided with a setting or adjustment, so that its altitude in the normal position can be made to suit the person who habitually drives the car. This is a petty refinement which ought to be part of every automobile, as it makes all the difference in the world to anyone with a little over or under the average length of leg.

Among other special details the most important are a hand adjustment for the external service brakes, and a particularly rigid and strong spare tire carrier. The brake adjustment is in the correct place; that is, on the last rod and close to the brake band itself. It consists of a large thumb screw which is easy to turn and can be reached by putting the hand through the rear wheel between a couple of spokes. Both brakes may be taken up in a couple of minutes.


Upper—Side view of model O-35 four-cylinder, 35-horsepower Westcott. Lower—Interior of six-cylinder Westcott showing aisle between front seats

The tire carrier combines the purpose of supporting the two demountable spares with a rigidity that eliminates any chance of shaking, and of holding the gasoline tank. How this is done is best seen by reference to the sketch, and it may be added that it is possible to jump up and down on the carrier without causing the least deflection.


Strong channel-section tire carrier and tank support


Left—Pad for accelerator. Center—Adjustment on clutch pedal. Right—Simple adjustment of service brake bands

There is an indefinable something about the body lines that suggests comfort, and the idea thus given is perfectly correct, as care has been taken to provide ample depth of cushion, which is the most important thing in car comfort. For the driver and front passenger there are separate seats with a narrow passage between them and this gives the driver as much freedom for his right arm as for the left. The height of the seat back beneath the driver's right armpit is just equal to that of the padded edge of the body on his left, which means that both arms rest naturally in the same position and this is an appreciable aid to comfort.

Roadster Bodies Also Made

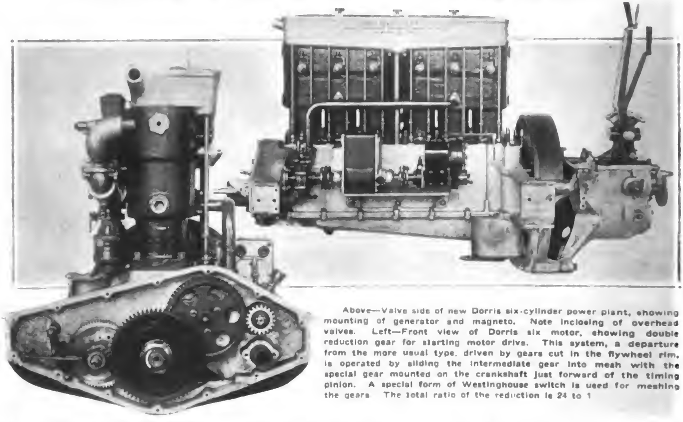
On the four there is plenty of room in the tonneau for three people and the front seats are undercut to provide space for the passengers' feet when they are reclining on the deep back cushion. In the six, folding seats are located behind the divided front seating and the tonneau is longer, so giving room for seven passengers altogether. Roadster bodies with three seats are made for both chassis and the center seat is a little set back in the modern style. The four cylinder is also obtainable in speedster form with a racing body.

Turning to the statistical details, the wheelbase is 113 inches on the four and 125 inches on the six, tires are 33 by 4 and 34 by 4 respectively and Firestones are the usual equipment. Two different top speed gear ratios are given, 3.75 to 1 and 4 to 1, according to the district in which the car is sold.

An ingenious little Delco fitting used on the Westcott is a buzzer that gives warning at once should a short circuit occur anywhere in the lamp circuits. This is inclosed within the cowl and gives out a loud rapping noise directly the discharge along any line rises above what it ought to be for the proper supply of the lamp. It is also very useful as a warning when the lamp lead is temporarily disconnected for any reason, since it sounds immediately if the end of the wire carrying the lamp connection should accidentally fall against the frame or any metal part of the chassis.

Original Design in New Dorris Six

Valves Removable with Seatings as Cages Screw Into Cylinder Head—Ingeniously Oiled—Seven-Bearing Crankshaft



Above—Valve side of new Dorris six-cylinder power plant, showing mounting of generator and magneto. Note inclosing of overhead valves. Left—Front view of Dorris six motor, showing double reduction gear for starting motor drive. This system, a departure from the more usual type, driven by gears cut in the flywheel rim, is operated by sliding the intermediate gear into mesh with the special gear mounted on the crankshaft just forward of the timing pinion. A special form of Westinghouse switch is used for meshing the gears. The total ratio of the reduction is 24 to 1

FOR many years past the Dorris Motor Car Co., St. Louis, Mo., has been making four-cylinder cars, using overhead valve motors of its own design and construction and applying a distinctive originality to the whole chassis. It has now added a six-cylinder model which embodies most of the recognized Dorris features, together with a variety of small refinements, and in this new car none of the originality of former designs has been sacrificed.

Valves Readily Removable

Unlike many overhead valve motors, the valves are readily removable complete with their seatings, as the cages are screwed into the cylinder head. The cylinder head is bored out to receive the cages and the latter make contact with the walls of their containing chambers, so that heat is transferred to the main casting and thence to the waterjacket. The use of cages of the correct thickness and the provision of adequately cooled walls in close proximity is an essential matter if an overhead valve motor is to be successful since the cages are liable to give trouble if allowed any opportunity to overheat, and this appears to have been taken care of most efficiently in the Dorris construction. Instead of an overhead camshaft, which might call for some intricacy of driving mechanism, the usual location is employed, the valves being operated by means of long push rods and short rocker arms, the latter mounted on a hollow shaft that lies along the top of the cylinder block. Adjustment for valve stem clearance is made on the push rods, and the detail appears in the end view of the motor. At the upper end of each push rod is a small cup, and the corresponding extremity of each rocker is cupped similarly, connection between the two parts being made by inserting a single steel ball of 5-8 inch diameter; this ought to be better than a yoke and pin coupling, because it compensates for wear automatically, needs less lubrication and facilitates the removal of a valve. This last feature is obvious from the drawing for it is only necessary to depress a valve by hand in order to free the push rod and allow the rocker to drop out of the way of the cage as this is unscrewed.

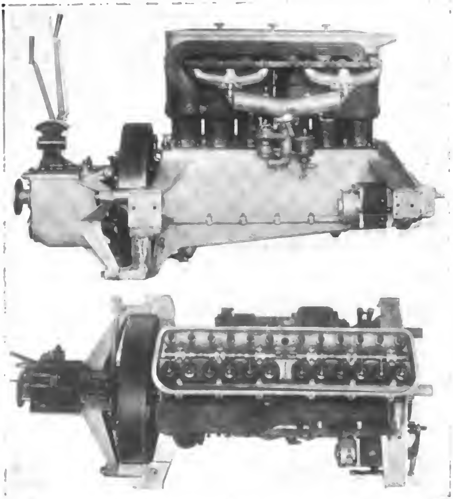
Features of Dorris Six

Unit Power Plant
Multiple Disk Dry Clutch
Inclosed Overhead Valve
Starting Motor Drive from Outside of Timing Case
Wheelbase, 128 Inches
36 by 4½ Inch Tires
Westinghouse Starting and Lighting

Valve Lubrication Ingenious

In lubricating the bearings of the rockers on the hollow shaft which carries them it is highly desirable to prevent pools of oil collecting around the tops of the valve cages because oil that gets down the valve stems in quantity is liable to produce quantities of carbon in awkward places. It is none the less necessary to see that the rockers are always free, since friction on their centers causes lag in the valve action and produces wear on every part of the valve operation. Oil is fed by the main gear pump, through a copper pipe and so to the inside of the hollow rocker shaft, whence it exudes within each rocker bushing. To catch the overflow the aluminum top piece which incloses the rockers has a ridge raised on its bottom and the floor beneath the rockers is sloped so that all oil drains towards the center. Here, as is shown in the plan view of the motor, is situated the breather orifice, so surplus lubricant passes directly back to the crankcase.

It may also be seen in the illustrations how the water outlet pipe is cleverly combined with the aluminum top piece. It should be noticed that this outlet lies alongside the valve cages, thus insuring a free circulation at this most important part of the system.



Above—Intake side of six-cylinder power plant of new Dorris, showing mounting of carbureter, intake and exhaust manifolds and starting motor

Lower—Plan view of Dorris six motor with overhead valve coverplate removed, showing rockers and oil draining arrangement

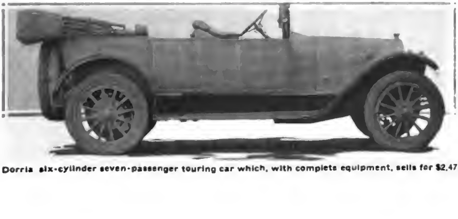
Starter System Unusual

Instead of using the almost universal flywheel drive for the starting motor, the Dorris has a double reduction gear located in the timing case, giving a total ratio of twenty-four to one, and operated by sliding the intermediate compound gear into mesh with a special gear mounted on the crankshaft just forward of the timing pinion. This construction is, of course, neater than the flywheel drive in some ways and it ought to be a good deal less noisy in operation as the gears can be lubricated efficiently. To mesh the gears a special form of Westinghouse motor switch is used, the operation being mechanical. Pressing the starting pedal engages the contacts A and this causes current to pass through the motor and also through a resistance which absorbs most of the power. This means that the motor turns slowly and as soon as the plunger passes the vee edges A the current is cut off again, leaving the motor spinning gently. Continued pressure on the pedal has now brought the parts B B into contact and so pushes the starting gears into mesh, the slow turning of the motor making engagement easy, and the last stage of movement engages the main contacts and passes the full current into the motor. To prevent the motor being over-driven when the engine starts there is a roller clutch inside the large sliding gear and this, of course, overruns at the first explosion in the cylinders.

The Westinghouse generator is located on the opposite side of the engine and has a magneto in tandem, connection being made through a leather coupling at either end of the armature shaft.

Seven-Bearing Crankshaft

Again contrary to usual practice, seven bearings are used for the crankshaft, this being thought to give the most rigid support possible, and it should be observed that room has been found for bearings of good width without making the motor excessively long for a 4 by 5-inch six.

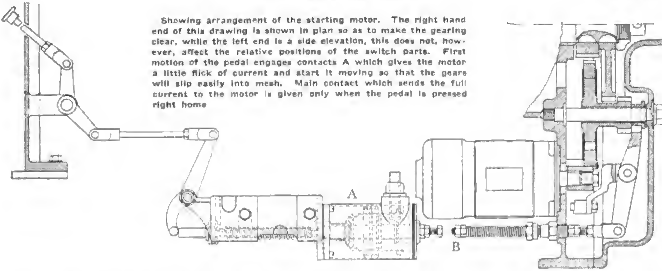


Dorris six-cylinder seven-passenger touring car which, with complete equipment, sells for $2,475

Both the intake and exhaust manifolds are rather different from standard ideas and it is to be observed that the gas is well warmed by an ample waterjacket round the main branch of the intake manifold. The carbureter fitted is a Stromberg, which is rendered very accessible by the absence of other fittings from that side of the motor.

In the illustration showing the magneto side of the motor the location of the oil pump can be seen, it being in the base and driven from the rear end of the camshaft. Lubrication for the crank and the other internal parts of the engine is by constant level splash, there being a gauge on the side of the crankcase and a drip indicator on the cowl board.

The motor is the most distinctive part of the Dorris chassis, but there are other parts that are also a little different from the normal. For instance, the clutch is a special design of dry multiple-disk and occupies the center of a fan flywheel, a form of draught inducer that is very uncommon on American chassis, though used a good deal in Europe. To



Showing arrangement of the starting motor. The right hand end of this drawing is shown in plan so as to make the gearing clear, while the left end is a side elevation, this does not, however, affect the relative positions of the switch parts. First motion of the pedal engages contacts A which gives the motor a little flick of current and start it moving so that the gears will slip easily into mesh. Main contact which sends the full current to the motor is given only when the pedal is pressed right home

allow this fan free action it is necessary to give an ample space for air escape around it, so the three-speed gearset is attached to the motor by arms instead of the more customary bell housing.

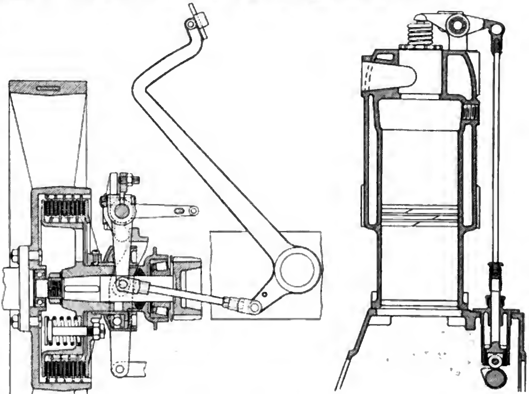
The unique feature of this car is a wrought iron bonding ring which is cast actually within the iron of the flywheel, just as copper lubricating pipes are sometimes cast inside the aluminum of the crankcase. The idea of this bonding is, of course, to assist the wheel to resist centrifugal stresses, since the fan construction is hardly so strong as the ordinary plain type of wheel. In the clutch drawing this bonding ring is shown in section, and another thing to be observed in the same illustration is the arrangemtnt of the levers operating the clutch. These are multiplying levers which greatly lessen the pressure needed to release the clutch and the desirable easy action is obtained with extremely few additional parts.

For the rear axle a Timken product is used with spiral bevel drive and the usual brakes, and there is nothing in the front axle or steering that calls for special comment. The Dorris company is among the few makers who still pin their faith to a platform rear spring, the side members being 50 inches long and the cross spring 40 inches; the front springs are, of course, half elliptic and also of good length.

Dash Is Part of Chassis

A peculiar little detail that seems to make for convenience is the use of a cylindrical gasoline tank located beneath the driver's footboard and attached to the side of the frame. This placing enables the filler and a gasoline gauge to be arranged so that they stand flush with the board; the gauge can be seen at any time by glancing downward, and the filler is accessible by merely opening the side door. A Stewart vacuum feed is employed for raising the fuel to the carbureter. Another important detail is that the dashboard is part of the chassis and carries all wiring, etc. The seven-passenger body simply drops in place over the dash and all switch gear is contained in a box clamped to the foot of the steering post. This is a very important detail of design that seems likely to become general practice. It is not, of course, unique on the Dorris, as several other automobiles have the same feature, but the other method is still so common that every manufacturer who adopts the improved system is deserving of congratulation. It is a manufacturing advantage to have the wiring all a part of the chassis, but the owner gains as well because the work of wiring up can be done better and more reliably when every portion of the electrical equipment is bare and readily accessible. That is to say the owner does not appreciate the scheme only when the body comes to be removed.

Body equipment is complete in all detail and includes a Golde one-man top, Stewart tire pump and 36 by 4 1-2-inch tires; the wheelbase is 128 inches with standard tread, and the price of the complete vehicle is $2,475.



Left—Shows construction of dry disk clutch and multiplying gear to make pedal pressure light. Right—Section of motor showing details of valve operation

Auto-Lite Doubles Factory Facilities

Two New Buildings Added—To Increase Output From 500 to 1,200 Accessories Per Day

TOLEDO, O., April 3—The Electric Auto-Lite Co., manufacturer of starting and lighting systems, lamps and horns, has taken over on a long-time lease two large buildings formerly occupied by the General Electric Co., which more than doubles its factory area. The larger of the buildings is 304 by 80 feet with a floorspace of 150,000 square feet, and four stories in height. The other is a three-story structure which will be used for offices, experimental and engineering departments, restaurant and rest rooms.

With the present factory, these structures aggregate 250,000 square feet of floorspace or about 6 1-2 acres. The larger of the two buildings will be used for manufacturing, some of the machinery already having been installed. The equipment will consist of automatic lathes, screw machines, grinders, milling machines, punch presses, etc.

The factory now employs 800 men, but this will be more than doubled when the new plant starts operation in the near future. The facilities provided by the additions, will enable the factory to increase its daily production from 500 to 1,200 complete outfits, consisting of lighting generators, starting motors, switches, lamps, horns and tire pumps. Orders are already booked for a large proportion of this production. The company has over fifty service stations throughout the country as well as branch offices and service stations in New York, Kansas City and San Francisco.

Officers of the company are: C. O. Miniger, president and general manager; Herman R. Saxon, vice-president and factory manager; C. S. Latting, secretary, and Walter Stewart, treasurer.

Top—First factory of the Electric Auto-Lite Co.

Middle—Second plant of the company, its first step toward larger production

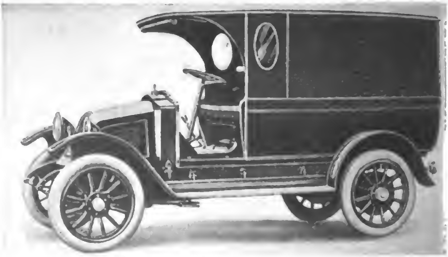
Bottom—Large three-story building which comprised the third home of the Auto-Lite organization

Upper left—Recent addition to the Auto-Lite plant

Below—The Auto-Lite factory whose facilities are more than doubled by the addition

New Lippard-Stewart—Two Brockways

Electric Starting and Lighting Feature of Lippard-Stewart, Which, Like Brockways, Is Worm Driven



The new Lippard-Stewart 1-2-ton truck fitted with delivery-type body

THE Lippard-Stewart 1-2-tonner is the latest vehicle of this capacity to be brought out by a manufacturer of heavier sizes. The new truck supplements a line of 3-4, 1, 1 1-2 and 2-ton models, all of which are consistent in the plan of assembly. The manufacturer is the Lippard-Stewart Motor Car Co., Buffalo, N. Y. The vehicle is of the French type, with a sloping hood over the engine and a Renault type of radiator on the dash, the use of electric starting and lighting being a feature. The unit power plant drives through a single shaft to the Timken-David Brown worm axle. Wheelbase is 106 inches and treads standard. Engine is mounted on three points, the integral arms of the flywheel bell-housing serving also to support the gearbox. The motor is a 3 1-4 by 5 block with a detachable head and cored intake manifold. The valves are inclosed and on the right. Both exhaust manifold and carbureter are on this side, a short length of tubing providing hot air for the latter. The carbureter is a Zenith, controlled by both the hand and foot. No governor is fitted.

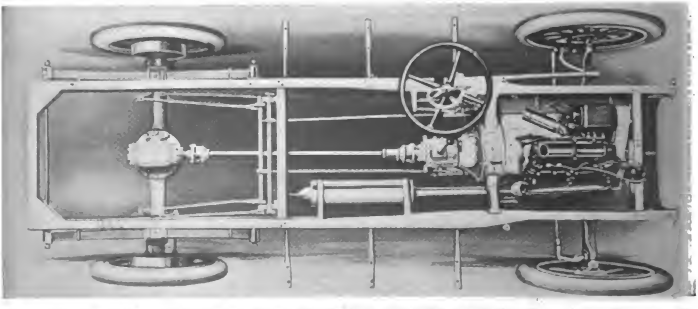
Ignition is provided by the Atwater Kent Unisparker system, the distributer being mounted over the timing gear case in front, and driven by helical gears. Circulating-splash lubrication is provided while cooling is by thermo-syphon.

From the leather-faced cone clutch the drive is taken by a three-speed gearset through Spicer joints and a single shaft to the worm-driven axle at a 6 to 1 reduction. The brakes are all on the wheel drums and are both internal, acting for the full width on the same drums, this being accomplished by the new Timken system, one set of shoes being in the vertical plane and the other horizontal. Drive and torque are taken by the half-elliptic springs.

Tires are 33 by 4 all around, on demountable rims. The electric system consists of a motor-generator on the left side of the motor, driven from the crankshaft by an inclosed silent chain in front of the timing gear case. It operates at 12 volts. Chassis complete sells for $1,000.

Two More Worm-Driven Brockways, 2,500 and 4,000 Pounds

SINCE January, when the change in Brockway models from the air-cooled line with elliptic springs and wood frames was first announced, the Brockway Motor Truck Co., Cortland, N. Y., has introduced two more models in which the chain drive is superseded by worm. These models, however, do not replace the 1,500-, 2,500-, and 4,000-pound water-cooled chain-driven models, but constitute alternatives to



Plan view of Lippard-Stewart 1-2-ton chassis, showing mounting of electric starting and lighting system and worm-drive rear axle

The new 2,500-pound Brockway truck which uses worm drive and sells for $1,900

these types in 2,500 pounds and 4,000 pounds capacity.

Similar in all respects but the size and weight of parts affecting load capacity, the new models are chiefly characterized by their general conformance with the present trends in standard design. Their motors are no longer under French hoods, but are housed beneath rectangular hoods with cast-case finned-tube radiators. All springs are semi-elliptic, left steer and center control are employed, the motor, clutch and gearset are incorporated in one unit and drive is by a single shaft to the worm-driven axle.

They are built upon rolled channel steel frames, from which the motors are suspended directly from three points. Continental motors are used, cast in block, with centrifugal pump cooling assisted by both a radiator fan and a vaned flywheel. A Schebler carbureter and a Kramer governor are used on each of these motors, and a Bosch single magneto with fixed spark furnishes the ignition current.

Gear Reduction 8¾ to 1

From the motor the drive is taken by a dry-disk clutch and three-speed selective gearset of Brown-Lipe make, through a single shaft with two universals to the Sheldon rear axle. Torque and propulsion are taken by the springs on both models.

The motor of the 2,500-pound model is 3 3-4 by 5 1-4 inches. Maximum speed by governor is 15 miles per hour. This model has 124-inch wheelbase and uses 36 by 3 1-2-inch tires in front and 36 by 4 1-2 in the rear. It sells for $1,900.

On the 4,000-pounder the motor is 4 1-8 by 5 1-4. Wheelbase is 132 inches and tires are 36 by 4 front and 36 by 3 1-2 dual or option of 36 by 5 in the rear. The price of this vehicle is $2,200.

A One-Man, Pay-Enter Motor Bus Design

RESPONSIVE to the demand for motor buses, the Great Southern Automobile Co., Birmingham, Ala., has produced a special model of chassis and body for passenger service having a low floor with a pay-enter door arrangement for one-man operation. It has its motor under a conventional hood with drive by a bottom worm, the latter making the low floor possible with direct mechanical drive.

The chassis is rated at 2 1-4 tons capacity, and the complete vehicle is 22 feet long overall, 7 feet 6 inches wide at the eaves, 8 feet 9 inches high, from the ground to the rooftop, and has 7 inches clearance under the worm.

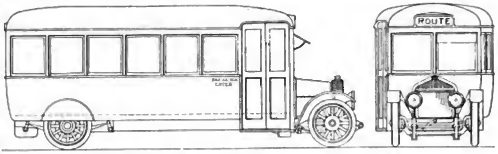
Twenty-five passengers are carried on a single deck, all of the seats being of the transverse type except at the rear where a rotunda arrangement allows room for the rear wheels. It is expected to have the new buses ready for the market in June.

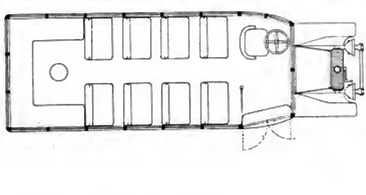
197-Inch Wheelbase

In detail, the vehicle is built upon a heavy pressed steel drop frame with a 197-inch wheelbase, the front axle being deeply dropped and the rear of the frame having a high arch over the rear axle. Long, half-elliptic springs are fitted both front and rear, both sets underslung. These springs are 3 inches wide, and auxiliary springs to take care of any standing load are also provided. Tread is 65 1-2 inches. The worm-gear has a reduction of 7 3-4 to 1.

The 4 1-8 by 5 1-4-inch motor forms a unit with the dry-disk clutch and three-speed selective gearset. The motor is cast in block with the valves on the left. It is cooled by a centrifugal pump and a built-up cast-case finned-tube radiator. Dual Bosch ignition with hand spark control is provided and the motor is governed by a motor-driven Pierce governor. This governor is set at 1,057 r.p.m., or 16 miles per hour in high gear.

The door is two-leaf folding, operated by a crank at the driver's hand. When closed it is flush with the side and conceals the steps. The driver's seat is to the left and the body, which is made by the Great Southern company, is of metal with ash and metal framing, metal panelling, metal roof, wood doors and sash and metal moulding. The seats are of cane. Tires are solid, 36 by 5 inches in front and 36 by 4 dual in the rear.





Above—Front view of Great Southern twenty-five-passenger bus. Upper left—Side of Great Southern bus, which is a one-man-operated, pay-enter design. Lower left—Plan view of bus showing seating arrangement

THE AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, April 8, 1915 No. 14

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico -One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - - -One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

S. A. E. Efficiency

THE establishment of a central station in Detroit, the heart of the factory situation in the automobile industry, marks a step in advance in the efficiency of the work of the standards committee of the Society of Automobile Engineers. While the work of this committee has been one of the bright spots in the automobile industry, the establishment of a record bureau and the formulation of a set of standard regulations for the conduct of the work of the committee and its many divisions cannot but result in the elimination of duplication in labor and better efficiency.

The use of the record bureau puts into the hands of the committee chairman exact information as to what each division of his committee is doing. It will enable him to spur on those who lag and also to hold in its particular province each division of the standards committee. It gives a complete checking system on all the work and cannot help for this reason but be an economical asset to the entire society.

This same idea should be followed out by the standards committee in other ways. There are other logical central points which should form the seats of conference of these men who are endeavoring to cut the costs in manufacture and promote national interchangeability. Toledo, Cleveland and possibly other cities which are representative of the manufacturing interests would be other logical points at which conferences could be held with the certainty of obtaining the attendance of men to whom the problems of factory management are close to heart and who will come from sheer self interest. This is the attendance which causes progress in the work of manufacturing standardization and therefore is not only desirable but necessary if true progress is to be made and justice done in standardization work as applied to production.

Humanized Metallurgy

MOST automobile owners and many engineers have only very vague ideas as to the real meaning of modern metallurgical terms. The steel scientist has created a great many new words which have been seized upon by the salesmen of both steel maker and automobile manufacturer and used by them without any appreciation beyond the advertising value of a high sounding and mysterious name. Ask the average man why steel is not simply steel just as copper is copper or gold gold and he would not be able to offer a very coherent explanation. Pure copper is the best sort of copper, why not pure steel?

Commencing in this issue THE AUTOMOBILE explains this in simple language; in a way that anyone can grasp without knowledge of any more science than is necessary to appreciate the need for difference in diet in summer and winter or difference in clothing called for by the tropics or the arctic. So much nonsense is talked about materials of automobile construction by people possessing a list of the metallurgist's terms and little more, that it is worth while to obtain a broad understanding of the subject. It is all quite easy, quite simple and quite free from mystery when ordinary words are substituted for jargon.

A Jitney Endurance

THE success of the jitney car will largely be a matter of the human intelligence of the man owning it, driving it and caring for it. Certain men can make a living out of the small jitney car, whereas other men will fail. The man who knows how to take care of a car, who is thrifty, who has good average business sense, and who combines these qualities with certain mechanical ability, will succeed. The man who will fail in the jitney field will be the same one who fails at everything else, plus the lack of mechanical ability. There is a wide range of differences among jitney drivers, and the success of the cars is invariably measured by the success of the people controlling them.

The fact that in some cities fifty-six of the original 100 jitney cars are still in business and making money, is proof of the part played by the human factor. Perhaps later, not more than ten out of the original 100 will continue in business, but if 10 per cent. should prove successful this will be a higher percentage than is crowned with success in many other ventures for what is true of the jitney business is true of other industries.

Shipper Wins Freight Car Shortage Case

May Sue Either in Federal or State Courts for Damages in Case of Discrimination in Furnishing of Cars

WASHINGTON, D. C., April 5—A shipper may sue either in the Federal or state courts for damages in case of discrimination or failure for any reason in the furnishing of cars, according to a decision handed down today in the United States Supreme Court, in a case of the Pennsylvania Railroad Co. against the Puritan Coal Mining Co.

The case arose out of the failure of the carrier in the period of the coal strike in 1902 to furnish the proper quota of cars to the Puritan Coal Mining Co., and the company set up a claim for a loss of profits amounting to $260,777.

Justice Lemar, in the decision, holds that Section 3 of the Interstate Commerce act makes it unlawful for the carrier to prefer one shipper over another, and that Section 8 gives the shipper the right of action for damages by presentation of his case to the Interstate Commerce Commission for a determination of the facts, and then by suit in the Federal Courts having exclusive jurisdiction. With these two sections standing alone, the shipper would have had no remedy in the state courts, but under Section 22 of the act it is provided that there shall be no abridgment of remedies now provided at common law or statute, so that all three sections must be read together with the result that Sections 8, 9 and 22 give the shipper new rights and protect those he has already enjoyed.

While former decisions provide that suits for discrimination must be passed on first by the Interstate Commerce Commission, and that until the commission has passed on the case no court has any jurisdiction, the decision today holds that if the carrier's rule shows on the face of it that it has been unequally applied and suit is brought for damages by violation, there is no administrative question involved, and the state courts may decide on the facts, the shipper having under the express terms of the statute the right to go into either state or Federal courts. The decision holds that the liability is the same whether there is a breach of common law duty to furnish cars or discrimination in the supply of cars.

DETROIT, MICH., April 2—The Interstate Commerce Commission has decided that railroad companies have not been unreasonable in charging $2.15 per 100 pounds on shipments of automobile truck axles from this city to Los Angeles, Cal. The decision was made in connection with the plea of the Moreland Motor Car Co., Los Angeles, Cal. This concern, which makes motor trucks, had been buying its axles in Detroit and received some shipments which were billed at the rate of $1.15 per 100 pounds. Later the railroads raised the rate to $2.15 per 100 pounds, which the car manufacturer declared was exorbitant. Since the opening of the Panama canal the Moreland company has been receiving its shipments of axles over that route, the axles being first shipped to New York.

Reddig King Chief Mechanical Engineer

DETROIT, MICH., April 6—C. E. Reddig, assistant chief engineer of the Timken-Detroit Axle Co., during the past year and previously connected with the engineering departments of the Stoddard-Dayton, Maxwell-Briscoe and Columbia companies, has been appointed chief mechanical engineer of the King Motor Car Co. P. F. Todd has been appointed chief draftsman of the company. During the last 3 years he held a similar position with the Northway Motor Mfg. Co., and previous to that was with the Buick and E. M. F. companies. C. E. Jacobs, who was the King company's chief draftsman, has been appointed chief inspector.

JERSEY CITY, N. J., April 6—S. P. Woodard, for many years connected with the automobile industry, has been appointed general sales manager of the tire and tube department of the New Jersey Car Spring & Rubber Co., of this city. For the past 8 years, this concern, which was established in 1858, has manufactured and sold car springs, tires and tubes. It has branches in Chicago, Cleveland, Los Angeles, New York, Philadelphia and Pittsburgh, and contemplates opening a retail store in New York.

PHILADELPHIA, PA., April 5—Architects are preparing plans for a three-story addition, 40 by 108 feet, to the plant of the Hess-Bright Manufacturing Co. at Front street and Erie avenue.

NEW YORK CITY, April 5—The eleventh annual automobile outing for the local orphans will be held June 3. It is the intention of the Orphans' Automobile Day Assn. of New York to take 5,000 on this year's outing.

The association met last week and elected officers for the ensuing year. W. J. Morgan, founder of the original orphans' day, was unanimously elected president. W. S. Silver was elected first vice-president; C. A. Stewart, second vice-president; G. H. Robertson, treasurer; A. L. Prindle, secretary; J. J. Korbel, acting secretary, and Frank Griffin, counsel.

Massachusetts Registrations May Reach 95,000

Gain of 15,000 in First 3 Months of 1915

BOSTON, MASS., April 3—Present indications point to the registering of at least 95,000 cars in Massachusetts during 1915, and the receiving of more than $1,000,000 in registration fees from motorists, according to E. J. O'Hara, who has charge of the registration department of the Massachusetts Highway Commission. For the first 3 months of 1915 more than 60 per cent. of the total registrations for last year have been sent in, and close to $700,000 have been received in fees. The gain over the first 3 months of last year is nearly 15,000 cars and $170,000. There has been a big gain in the trucks, too. Last year for the first 3 months there were 5,200 commercial vehicles registered, while this year so far 7,800 are listed. As there were 8,236 trucks registered for all of 1914 it indicates that business is going to be good for that line, too. As the tax collectors make their rounds on April 1 looking for property a lot of people who have bought cars stipulated that they should not be delivered until after that date so as not to be included in last year's tax list, and to escape the coming year as much as possible. So from now on there will be another big rush at the registration department. The following figures show how the registrations compare for all of 1914, and for the three months of this year with the 3 months of last year:

	Jan., Feb., Mar., '14	Jan., Feb., Mar., '15	Total, 1914
*Motor Veh.	41,750	56,931	77,246
Commercial	5,200	7,800	8,236
Motor Cyc.	2,262	3,995	8,161
Commercial	5,200	3,995	8,161
Mfgs. & Dlrs.....	1,300	1,489	1,518
Licenses	3,355	5,826	26,858
Renewals	15,151	15,848	72,674
Examinations ...	1,458	1,855	7,497
Receipts	$512,183.04	$682,524.05	$925,964.75

*Total, including trucks.

DOVER, N. J., April 5—The International Peace Brotherhood, with officers at The Hague, will build automobiles, marine motors, aluminum castings and pressed and spun wares in this city. Through the medium of the Dover Board of Trade the Brotherhood will locate its first American office and factory in this city. The site comprises 7 acres. Work on the construction of the buildings will commence in the near future. The new industry will employ 200.

Partin Cars Are To Be Continued

Commonwealth Motors to Act as Selling Agent—G. D. Whitcomb Co. To Manufacture Them

CHICAGO, ILL., April 3—The Commonwealth Motors Co., with C. C. Darnell as president, has been organized with a capital of $100,000 to act as selling agent for the Partin-Palmer cars, taking over the functions of the Partin Mfg. Co. The manufacturing end of the business will be undertaken by the George D. Whitcomb Co., of Rochelle, Ill., an old established concern which has been manufacturing gasoline motors and electrical mining machinery. The general offices of the Commonwealth company will be maintained at 29 South La Salle street, Chicago, while the manufacture of the Partin-Palmer cars will be carried on at Rochelle.

President Darnell formerly was identified with the Partin Mfg. Co. as sales manager, but severed his connection last fall, before the American Mfg. Co., which had the manufacturing end of the combination, got into financial difficulties which closed its plant. These court proceedings, however, did not involve the Partin company itself, which was left free to enter into this new deal whereby its good will and its 1915 contracts with some 400 dealers are taken over by Mr. Darnell and his colleagues.

Shipments of parts and machinery from the old plant here in Chicago, formerly occupied by Staver, are being made now, and it is anticipated that cars will be turned out from the Rochelle factory at once, so that shipments may begin almost immediately. It is said that the company now has orders booked for 800 cars.

It is declared that this deal permits the new combination to start out without any embarrassment from the previous arrangement and that there will be very little interruption in the marketing of Partin-Palmer cars.

Associated with Mr. Darnell are W. H. Conklin, who has been elected secretary and sales manager, and T. J. Shanahan, formerly production manager, who will be connected with the manufacturing end of the business. Outside of these there are none left from the old régime. W. C. Whitcomb, president of the Whitcomb company, is vice-president of the Commonwealth, while D. G. Kingery, a brother-in-law of Mr. Whitcomb, will serve as treasurer.

Kline Company To Resume Operations

RICHMOND, VA., April 2—Bondholders who recently acquired possession of the plant and equipment of the Kline Motor Car Corp., this city, are now planning to get together and to arrange, at a meeting to be held in the near future, a definite program for the operation of the plant on full time and a complete resumption of business. Reorganization on a larger scale will be effected and in the mean time the plant is running.

Overland Surplus for 6 Months $2,853,864

NEW YORK CITY, April 6—The semi-annual report, ending December 31, 1914, of the Willys-Overland Co., Toledo, O., shows a surplus of $2,853,864 equal to 14.26 per cent. on the $20,000,000 common stock for 6 months.

Preferred dividends amounted to $165,235 on $4,721,000 in the stock, and the common dividend was $600,000. The balance sheet as of December 31, 1914, shows the cash account equal to $3,928,098, real estate, buildings, plant and equipment, $9,127,188. Balances due from European distributing agent and affiliated domestic selling companies, $901,942; and deferred charges to future operations, $124,943. Under the liabilities, the company has listed: reserve for quantity and other rebates to customers, $235,485; reserve for car repairs under guarantee, $30,000; reserve funds, $834,005; and profit and loss surplus, $7,651,931.

Rubber Goods Earnings $2,193,220

NEW YORK CITY, April 5—The Rubber Goods Mfg. Co. reports for the year ended December 31, last, net earnings of $2,193,220 as against $2,325,954 for 1913. Dividends amounted to $2,143,984 as against $2,862,518 for 1913. The total surplus for 1914 was $9,003,042 as against $8,576,510 for 1913. The balance sheet, as of December 31 last, shows cash amounting to $3,115,153 and total assets and liabilities of $53,937,815. The report states that two considerations materially affected the amount of sales in 1914, namely, the lower level of tire prices and the general business depression due to the European war.

Vacuum Oil Earns $2,075,644 in 1914

NEW YORK CITY, April 2—The Vacuum Oil Co.'s annual report of its 1914 business, ending December 31, 1914, shows a decrease in profits which was fully anticipated, owing to the interruption of commerce resulting from the war. What the total earnings of the company were in 1914 is not stated in the annual report, but exclusive of the company's share of profits in its foreign subsidiaries, net earnings were $2,075,644, a decrease of $1,300,130. In 1913 the profits from the foreign companies amounted to $1,457,156 additional.

The reduction in the capital requirements has made it possible for the company to declare a 2 per cent. extra dividend. The balance sheet shows an increase in real estate, from $3,501,109 in 1913 to $4,139,791 in 1914. Accounts receivable amount to $9,118,050, of which $6,609,087 is due from foreign Vacuum Oil companies. Owing to the war it is not possible to determine the undivided profits on the shares held by the company in the various foreign marketing companies. While there has been some growth of business, cash surplus has increased from $1,096,661 in 1913 to $3,152,417 in 1914, due to a temporary reduction in capital requirements.

Detroit Steel Products Adds $750,000 Capital

DETROIT, MICH., April 5—At a recent meeting of the board of directors of the Detroit Steel Products Co., the capital stock was increased from $500,000 to $1,250,000, the increase consisting in $500,000 in common stock and $250,000 in preferred. The latter stock was provided in the form of a 50 per cent. dividend. The plant is being operated 24 hours a day. Business in March was the best the company had since it was started. Indications are that the year will be much better than 1914.

Hayes May Make 1,500,000 Wheels

JACKSON, MICH., April 5—This year the production of the Hayes Wheel Co. is expected to reach the million and one-half mark, according to officials of the company. The concern started in business in 1908 and has made automobile wheels ever since. In 1909 its output totaled 81,416 wheels, in 1910 this total was 145,660, the output in 1911 was 228,576, in 1912

Market Reports for the Week

NEW YORK CITY, April 7—Changes in this week's market reports occurred for the most part in the metals. Tin was lower and the market was dull with prices prevailing around $48.00 per 100 pounds. Lead was strong and active at 5 cents per 100 pounds higher than last week, now quoting at $4.20. Copper this week was firmer but quiet. Sales in electrolytic for war purposes were reported. Pennsylvania petroleum dropped to $1.35 per barrel on Saturday. A firmer tone developed this week in the rubber market, but aside from that, there were no other developments in the situation. Fine Up-River Para was more or less erratic in its prices, going down to 57 cents on Saturday and then closing at 58 1-2 at a gain of 1-2 cent for the week.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.21½	.21½	.21½	.21½	.21½	.21½	......
Beams & Channels, 100 lbs.	1.26	1.26	1.26	1.26	1.26	1.26	......
Bessemer Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	......
Copper, Elec., lb.	.15¾	.15¾	.15¾	.15¾	.15¾	.15¾	......
Copper, Lake, lb.	.16	.16¼	.16¼	.16¼	.16¼	.16¼	+.00¼
Cottonseed Oil, bbl.	6.56	6.59	6.55	6.6[illegible]	6.60	6.55	—.01
Cyanide Potash, lb.	.21	.21	.21	.2[illegible]	.21	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	.92	......
Lead, 100 lbs.	4.15	4.20	4.20	4.20	4.20	4.20	+.05
Linseed Oil	.62	.62	.62	.62	.62	.62	......
Open-Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.40	1.40	1.40	1.35	1.35	1.35	—.05
Rapeseed Oil, refined	.75	.75	.75	.75	.75	.75	......
Rubber, Fine Up-River, Para	.58	.58	.58	.57	.58	.58½	+.00½
Silk, raw, Ital.	..	3.90	..	..	3.90	3.90	......
Silk, raw, Japan	..	3.57½	..	..	3.55	3.52½	—.05
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	51.00	49.00	48.00	48.00	48.00	48.00	—3.00
Tire Scrap	.04¼	.04¼	.04¼	.04¼	.04¼	.04¼	......

the production was 322,599 wheels; there was only a slight increase in 1913, when the output totaled 333,523; production more than doubled in 1914, when 844,608 wheels were made.

NEW YORK CITY, April 5—The United States Rubber Co. has declared regular quarterly dividends of 1 1-2 per cent. on the common stock, 2 per cent. on the first preferred stock and 1 1-2 per cent. on the second preferred stock. Dividends are payable April 30 to stock of record April 15.

DETROIT, MICH., April 2—Preferred stockholders of the Continental Motor Mfg. Co., received the semi-annual dividend of 3 per cent., Thursday, April 1.

NEW YORK CITY, April 5—A dividend of 1 1-2 per cent. on the common stock of the Kelly-Springfield Tire Co. has been declared, payable May 1, 1915, to the stockholders of record at the close of business April 15, 1915.

EAST PALESTINE, O., April 1—The McGraw Tire & Rubber Co., East Palestine, O., has declared the regular quarterly dividend of 1 3-4 per cent. on its preferred stock, payable April 1 to stockholders of record March 20.

National Gauge and Equipment Replaces Hans

LACROSSE, WIS., April 5—The Hans Motor Equipment Co. has been re-incorporated under a new name, articles of incorporation for the National Gauge and Equipment Co. with a capital of $200,000 having been filed recently with the local register of deeds by P. M. Gelatt, D. G. MacMillan and J. M. LaVaque as its incorporators. Officers of the firm have not been elected.

The incorporation of the company is the result of a meeting held March 15, at which it was decided to take over the interests of J. H. Hans, president, Edmund Hans, vice-president of the Hans company.

Reorganization Plan Outlined for U-S-L

BUFFALO, N. Y., April 7—The reorganization plan of the United States Light & Heating Co. provides that a new company be organized with a capital of $3,000,000 7 per cent. non-cumulative preferred stock, and $4,000,000 common stock. The preferred is to to have the right to elect a majority of the board of directors and will be held in a voting trust for 5 years. It is also proposed to authorize $1,000,000 first mortgage sinking fund 6 per cent. 20-year gold bonds, of which $500,000 are to be issued and sold at present. Preferred stockholders are given the right to subscribe to the new preferred stock and upon the payment of $15 per share of their present holdings will receive share for share in new preferred stock. Common stockholders will be given the privilege of subscribing to the preferred and common stock of the new company, and upon the payment of $2.50 per share of their present holdings of common stock will receive $5 in new preferred and $20 in new common stock.

Both common and preferred stockholders of the old company may subscribe for the new bonds at the price of $875 for each $1,000 bond. Subscriptions to the new stocks must be paid on or before May 5 next. The debts of the company, with expenses of receivership, amount to nearly $800,000.

Automobile Securities Quotations

NEW YORK CITY, April 6—Automobile and accessory securities this week were marked, in a majority of cases, by their erratic price fluctuations. Trading, however, continued very active, and at the closing yesterday, the automobile issues showed their strength in the face of the disturbing influence of violent fluctuations, up and down, by registering large gains for the week.

All of the automobile stocks listed on the Exchange made substantial gains. In fact, almost all of the other stocks showed gains, the few declines being small. In a number of cases, especially in the tire issues, the gains were very large.

On April 1 the minimum prices on stocks and bonds on the Stock Exchange became ineffective, evidencing that bankers consider financial conditions completely in hand, and reflecting the great improvement in this country's trade. Minimum prices have been the order since December 12, when the Exchange reopened. The abolition of the minimum prices in this city, it is said, will doubtless automatically remove the minimums in force for London trading. On March 31, the heaviest day's trading in stocks since December 12 occurred, when 737,475 shares changed hands. Trading in bonds of $4,306,500 was the heaviest since the Exchange reopened. Optimism in Wall street has been keyed up by the discussion of an early peace. The outlet for this optimism has been the stock and bond market.

The largest gains this week were made in tire issues when Firestone common went up 40 points; Goodyear common rose 12 points; and Kelly-Springfield common closed with a 12-point gain. The rest of the tire securities showed gains ranging from 1¼ to 7 points.

Maxwell Motor issues advanced sharply, the common showing a gain of 9 points; the first preferred, 7 points; and the second preferred, 7⅛ points. Studebaker, on dividend talk, advanced 9¾ and 6½ points on both its common and preferred, respectively.

In the Detroit quotations, the majority of the stocks show substantial gains. Chalmers common went up 8 points; General Motors common and preferred gained 5 and 3 points respectively; Maxwell common went up 9½ points, while both its first and second preferred went up 6 points; and Studebaker common and preferred went up 10½ and 6 points.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com.	200	..	285	..	..
Ajax-Grieb Rubber Co. pfd.	99	102	100	..	..
Aluminum Castings pfd.	98	100	98	100	..
J. I. Case pfd.	..	..	76	85	—2
Chalmers Motor Company com.	..	83	80	86	..
Chalmers Motor Company pfd.	90	94	90	92½	..
Electric Storage Battery Co.	..	..	47½	48½	—1¼
Firestone Tire & Rubber Co. com.	280	285	438	445	+40
Firestone Tire & Rubber Co. pfd.	107	108	110	112	..
General Motors Co. com.	75½	76½	126	128½	+2
General Motors Co. pfd.	94	94½	102½	103	+3
B. F. Goodrich Co. com.	24	24½	43	43½	+6½
B. F. Goodrich Co. pfd.	86	88½	99½	100½	+2¼
Goodyear Tire & Rubber Co. com.	170	175	220	225	+25
Goodyear Tire & Rubber Co. pfd.	94	95	102½	104½	—1
Gray & Davis, Inc., pfd.	90	97	..	..	..
International Motor Co. com.	..	5	5½	6½	—2½
International Motor Co. pfd.	..	15	18	22	—4
Kelly-Springfield Tire Co. com.	59	60	129	131	+12
Kelly-Springfield Tire Co. 1st pfd.	145	150	83¾	84½	+2¾
Kelly-Springfield Tire Co. 2d pfd.	..	..	130	131	+7
Maxwell Motor Co. com.	7	7½	46	46¼	+9
Maxwell Motor Co. 1st pfd.	33½	35	85	85¼	+7
Maxwell Motor Co. 2d pfd.	13	13½	39¼	40	+7⅛
Miller Rubber Co. com.	..	..	170	176	+5
Miller Rubber Co. pfd.	..	..	101	103	..
New Departure Mfg. Co. com.	..	..	139	144	+5
†New Departure Mfg. Co. pfd.	..	..	105	..	..
Packard Motor Car Co. com.	102	116	80	92	..
Packard Motor Car Co. pfd.	94	96	93½	97½	..
Peerless Motor Car Co. com.	20	30	20	21	..
Peerless Motor Car Co. pfd.	..	80	..	55	..
Portage Rubber Co. com.	..	30	34	36	..
Portage Rubber Co. pfd.	..	85	85	95	..
*Reo Motor Truck Co.	7	8¼	12½	..	+1
*Reo Motor Car Co.	19	20	30	30½	+1¼
Splitdorf Electric Co. pfd.	..	..	..	..	..
Stewart-Warner Speed. Corp. com.	61½	62½	58½	59½	+1½
Stewart-Warner Speed. Corp. pfd.	98½	106	102	105	—½
Studebaker Corporation com.	34½	35	60¼	61½	+9¾
Studebaker Corporation pfd.	86	86½	99½	100½	+6½
Swinehart Tire & Rubber Co.	60	67	80	85	+5½
Texas Company	..	..	138	139	+4
U. S. Rubber Co. com.	62¼	62½	64¼	65¼	+¾
U. S. Rubber Co. pfd.	103½	104¼	106¼	106½	+1¼
Vacuum Oil Co.	..	..	199	201	..
White Co. pfd.	107	110	103	108	..
Willys-Overland Co. com.	65	67	125	126	+4½
Willys-Overland Co. pfd.	89	94	100⅛	101½	+1¼

*Par value, $10; all others $100 par value.

†Ex-dividend.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Chalmers Motor Co. com.	..	83½	82	88	+8
Chalmers Motor Co. pfd.	90	93	90	92½	..
Continental Motor Co. com.	150	..	160	180	—5
Continental Motor Co. pfd.	..	75	78	82	—2
General Motors Co. com.	75	77	128	130	+5
General Motors Co. pfd.	90	92	102	103¼	+3
Maxwell Motor Co. com.	6¾	7¾	45	47	+9½
Maxwell Motor Co. 1st pfd.	33	35	83	85	+6
Maxwell Motor Co. 2d pfd.	11¾	12	38½	41½	+6
Packard Motor Car Co. com.	103	..	80	92	..
Packard Motor Car Co. pfd.	94	98	93½	97½	..
*Reo Motor Car Co.	19¾	20¾	30	..	—1¼
*Reo Motor Truck Co.	7¾	8¼	12⅞	13½	+1¼
Studebaker Corporation com.	..	..	60½	62½	+10½
Studebaker Corporation pfd.	..	..	99	101	+6
INACTIVE STOCKS					
*Atlas Drop Forge Co.	..	21	..	..	..
Ford Motor Co. of Canada	..	550	550	..	..
Kelsey Wheel Co.	195	..	190	200	..
*W. K. Prudden Co.	..	21	19	20½	+½
Regal Motor Car Co. pfd.	..	45	10	20	—5
BONDS					
General Motors, notes, 6s, 1915	100¼	101½	101	..	+⅛
Packard Motor Co. 5s, 1916	95	98½	95	..	..

*Par value $10; all others $100 par value.

Detroit Wants More Accessory Plants

Manufacturers Receiving Letters Explaining Advantages Derived from Locating There

DETROIT, MICH., April 2—The Detroit Board of Commerce is sending a special letter to all manufacturers of automobile accessories in the country with a view of getting them ultimately to locate there, or rather, to move to this city.

Four reasons are given why the accessory makers should locate in Detroit. First, because Detroit is the center of the automobile industry of the world, and as such is the place to get skilled labor; second, because the city is known the country over as an open shop town, only 10.2 per cent. of the wage-earners being organized; third, because it is easier to sell automobile accessories from Detroit than from any other place in the world; fourth, on account of the unexcelled railroad facilities and the lake transportation which saves freight charges.

Here are some statistics compiled by the Industrial Bureau of the Board of Commerce:

The population of Detroit is 658,970, the monthly increase being about 4,000. In 1914 the total bank clearings amounted to $1,349,000,000. The savings deposits amounted to $141 per capita, while the average for the United States is $35. Detroit's tax rate for 1915 is $19.80 per $1,000 on assessed valuation.

Artificial gas is furnished at the following rates: Less than 50,000 cubic feet, 85 cents per 1,000 cubic feet; the second 50,000 cubic feet, 75 cents per 1,000 cubic feet; for the next 100,000 cubic feet, 65 cents per 1,000 cubic feet; all over 200,000 cubic feet, 55 cents per 1,000 cubic feet. Gas engines, 65 cents per 1,000 cubic feet.

There is a deduction of 10 per cent. per 1,000 cubic feet if paid within discount period.

A comparison of first-class freight rates per 100 pounds from Detroit to various important cities shows the local rates to be very low:

To: From:	New York	Phila.	Chicago	New Orleans	Montreal	San Fran.
Detroit	61.5	59.5	38.9	1.16	61.5	3.50
Cleveland	55.9	53.9	43.1	1.16	67.8	3.60
Buffalo	47.3	41.3	47.3	1.16	46.2	3.60
Chicago	78.8	76.8		1.10	78.8	3.40
Cincinnati	68.6	66.6	42	.98	74.9	3.50
St. Louis.	92.2	90.2	45.5	.90	92.2	3.30

The following transportation companies operate from Detroit:

Anchor Line
Ashley & Dustin Line
Canadian Pacific R. R.
Detroit & Cleveland Navigation Co.
Detroit Terminal Railroad
Detroit & Toledo Shore Line
Detroit, Toledo & Ironton R. R.
Detroit United Railway
Grand Trunk Railway
Michigan Central R. R.
New York Central Lines
Pere Marquette R. R.
Star-Cole Line
Wabash Railroad
White Star Line

Jeffery Reduces Four-Cylinder $300

KENOSHA, WIS., April 5—The Thomas B. Jeffery Co. has reduced the price of its four-cylinder model from $1,450 to $1,150. Co-incident with this announcement is the one that the Jeffery company has received $4,000,000 worth of truck orders in 3 weeks so that 500 men have been added to the factory working force, the entire staff now working 24 hours a day in three 8-hour shifts.

Baker Reduces Prices on Three Models

CLEVELAND, O., April 6—The Baker Motor Vehicle Co., this city, has reduced the price on three of its models, namely, the D. A. coupé, from $2,800 to $2,475; the Double Drive Brougham from $3,250 to $3,000; and the W. A. roadster from $2,300 to $2,000.

Ford Buys More Detroit Land

DETROIT, MICH., April 2—The Ford Motor Co., has purchased a tract of land covering 56.7 acres which is located opposite its plant in Highland Park. The land was owned by the Chevrolet Motor Co., Flint, Mich., which purchased it from the Highland Park Land Co., 2 1-2 years ago, paying at that time approximately $250,000. The Ford company has now paid about $580,000 for the ground.

There was a rumor about a year ago that there were negotiations pending between the Ford and the Chevrolet companies as the former concern wanted to get the land, but the report was denied at the time.

The property has a frontage of 920 feet on Woodward avenue, 920 feet on Hamilton boulevard and 2,640 feet along the terminal railway. The ground covers exactly 56.7 acres and is exempt from all incumbrances.

When asked as to what will be done with the property, officials of the Ford company said that nothing had been decided and that probably the land will remain as it is for many months.

March Car Shipments 16,316 Carloads

NEW YORK CITY, April 7—According to reports received at the directors' meeting of the National Automobile Chamber of Commerce this afternoon, freight car shipments of automobiles for March were 16,316 carloads, or an increase of 25 per cent. as compared with the 13,117 carloads for the same month last year. January and February also showed an advance over the figures for 1914, while the 3 months showed greater shipments of cars than for any similar period in the history of the industry. Both motor trucks and passenger cars were more in demand than ever.

The commercial vehicle committee's report showed excellent progress in plans for the convention to be held at Detroit, May 5 and 6. Eight or ten important papers will be read and discussed.

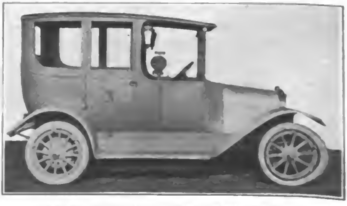
The good roads committee reported increased interest in favor of Federal road improvement. It was shown that although the burden of this would fall most heavily on city residents, these people have been the strongest advocates of the movement.

Among those in attendance were: Charles Clifton, Wilfred C. Leland, E. R. Benson, S. T. Davis, Jr., C. C. Hanch, Wm. E. Metzger, H. H. Rice and Alfred Reeves, general manager.

INDIANAPOLIS, IND., April 5—The Oakes Co., Indianapolis, manufacturer of the Beartone horn and fan combined, has made public the announcement that the price of this combination has been reduced to $5.

Atlas Company Enters Chicago Taxicab Field with Half Rates

CHICAGO, ILL., April 1—Upon the heels of the reduction in the legal rates of fare for taxicabs by the recent action of the city council, there is announced by a new cab concern a further cutting of the schedule which makes the use of taxis still less expensive. The rate war, if there is to be such, is brought on by the entrance of a new company



One of the taxicabs of the Yellow Cab Co., Chicago, Ill.

in the field, the Atlas Co., whose rates, it is announced, will be from two-thirds to one-half the present schedule and considerably lower than the new ordinance rates which go into effect in 2 weeks.

The Atlas company proposes to use a fleet of twenty-five 1915 Chalmers limousines and the rates as compared with the present and new ordinance schedules are as follows:

	Present Rate	New Ordinance	War Rate
First mile	$.70	$.60	$.50
Each additional ¼ mile	.10	.10	.05
Each additional passenger	.20	.15	.10
Each hour wait	1.50	1.50	.80

Announcements of the new company followed immediately upon the publication of the plans of the new Yellow Cab Co., which were outlined last week in THE AUTOMOBILE. This company whose officers are the same as those of the Walden W. Shaw Co., is putting on the streets 100 cabs to be operated strictly on the European plan. That is, the method followed in Europe is to be employed, in which taxis are picked up on the street or on public stands instead of from the private branches at clubs, hotels and cafes. Also, the European system is on a strictly cash basis, charge accounts being unusual. The Yellow Cab company's vehicles will be painted yellow, to distinguish them from the Shaw cabs. They are much lighter and more economical than the latter, but they seat four passengers and are fitted up in the same style as the others.

Pedestrian Partly Responsible for Accidents, Says Wisconsin Court

MILWAUKEE, WIS., April 6—The Supreme Court of Wisconsin extends advice to automobilists in an important decision which absolves H. J. Lindenmann, a Milwaukee motorist, from blame in connection with the injury of Mrs. Catherine Parkes of Milwaukee, who was struck by Lindenmann's car. The decision establishes an important precedent in the matter of driver's liability and is greeted with satisfaction by motorists, inasmuch as the pedestrian is charged with at least some responsibility.

The court says in part: "Many prudent chauffeurs deem it safer to pass in front rather than behind persons standing in the street. By so doing they pass in the line of vision of persons standing and are less likely to frighten them, even though they come closer. A driver cannot be charged with prescience nor with a reasonable anticipation of possible, but only of probable results. Lindenmann had every reason to believe that from the time he entered National avenue he was within the line of vision of Mrs. Parkes, where she stood waiting for the approaching car. He took a course that in all probability seemed to be outside of where she would be likely to be or go, and yet where she would see him. That the fact turned out to be otherwise does not alter the case."

Mrs. Parkes was injured in 1908 while standing in the street waiting for a car. Evidence showed that as Lindenmann attempted to pass in front of her she walked forward. He then turned his car to pass behind her but she stepped back and was struck. A verdict of $7,500 damages in the first trial was set aside as perverse. A jury in the second trial awarded her $4,000, but the trial judge reduced this to $2,500. The supreme court now orders a reversal of judgment and dismissal of the case on the merits of Lindenmann's plea.

Speedwell Assets Purchased by Puritan Machine

DETROIT, MICH., April 5—The Speedwell Motor Car Co., which has been manufacturing automobiles and trucks for the past 8 years in Dayton, O., has been purchased by the Puritan Machine Co., Detroit, Mich., and in an interview with A. O. Dunk, President, he advises that business will be continued at its plant in Detroit and all the assets are now being moved to that city. They will also render complete service and supply repair parts to all owners of Speedwell motor cars and trucks. All original patterns, drawings and engineering data were included in the purchase, so that they are in a position to duplicate any part in case that same is not in stock ready for immediate shipment. This is the sixty-first company whose assets have been purchased by the Puritan Machine Co.

MARION, O., April 5—Upon the application of the Marion County Bank, C. H. Lewis of Harpster, O., has been appointed receiver for the Ohio Tractor Mfg. Co., Marion, O. The bank seeks to collect on a chattel mortgage of $20,000 against the machinery in the plant. W. H. Bones of Marion; Ezekiel Brown of Morral and the Ohio Roller Sales Co. are named as co-defendants. The total amount of claims, secured by chattel mortgage, amount to $58,000.

Mass. Legislature Favors Motorists

Nearly 30 Bills Presented—Few Reported Out of Committee—Good Roads Receive Much Attention

BOSTON, MASS., April 3—As far as automobilists are concerned this year, the Massachusetts legislature has made a new record, that of practically letting the industry alone. Out of all the bills presented, numbering close to thirty, but a few have been reported out of the committee, and these did not amount to very much. Some were favorable to motorists. The Roads and Bridges Committee had the greater part, as it does every year. This year the Bay State had the best committee that ever handled motor legislation, for there were no delays, and everyone got fair consideration. But the freaks were quickly eliminated. There were no clashes among the motor organizations this year. At the beginning of the session the Bay State A. A. legislative committee secured a meeting of other organizations and discussed the different bills so that uniform action might be had.

There were a number of bills on headlights calling for dimming them in various ways in different sections. The motor organizations suggested that the whole matter be turned over to the Highway Commission for consideration. So the committee reported a resolve that the commission take the matter up for investigation and report to the legislature next January. There were bills to make automobiles stop 8 feet from a street car; to require all owners to carry a liability policy of $3,000; to use some of the money from automobile fees to pay for guides for blind people; that number plates should be sent by parcel post; that chauffeurs be examined as to their eyesight; to change the law for registering operators; to regulate the sale of second-hand cars; to require a different truck registration; to have all cars used for hire take out a $3,000 insurance; to change the speed limit.

30-Mile Bill Killed

These were all heard by the Committee on Roads and Bridges. They were all thrown out except a speed bill. This was to change the law from the reasonable and proper definition at present to one calling for a flat 25-mile-an-hour speed. When it was argued some of the motorists said that if any change were made that the least it should be was 30 miles. The committee reported a 30-mile bill, but made no great effort to have it passed. It was killed in the Senate. Senator J. W. Haigis, who was chairman of the committee, has been thanked by the Bay State A. A., and asked to extend this thanks to the committee for the organization for its fairness to the motor industry.

Joint Judiciary Committee had a bill to place chauffeurs under the workmen's compensation law, but it turned it down. The Social Welfare Committee reported a bill to allow prisoners to work on the State highways. Mercantile Affairs Committee had the jitney bus bills and it reported one that was far different from that asked for by the street railway association. So the motorists have every reason to be thankful for what they received at the legislature's hands this year.

COLUMBUS, O., April 5—The Terrell bill pending in the Ohio House of Representatives, making the owner of an automobile prima facie responsible for damages caused by accident, no matter who drives the car, was defeated by an overwhelming vote last week. Only twenty-nine votes for the measure were secured in the house.

DETROIT, MICH., April 2—A petition for dissolution was filed in the circuit court today by the Metal Products Co., whose plant, buildings and machinery were purchased by the Timken-Detroit Axle Co., in March. All the assets of the metal company have been sold to the Timken company, the entire capital stock of the concern being given as $478,500 with no incumbrances.

DETROIT, MICH., April 5—The Union Trust Co., which has acted as temporary receiver for the bankrupt Benham Mfg. Co., which made the Benham cars, has filed a petition asking for the dissolution of that company, in the interest of the stockholders.

Another Process for Cheaper Gasoline

Kansas City Man Claims 10,000 Gallons of 30 Gravity Can Be Converted Into 11,900 Gallons of 65

KANSAS CITY, April 7—A local man claims to have an electro-chemical process which will make it possible to market gasoline at a profit at 3 cents a gallon. He is Louis Bond Cherry, 15 West Thirty-first street. His process converts low gravity oils into high grade gasoline. Local chemists state that undoubtedly he has a process that will cheapen the cost of gasoline, although to what extent they are unable to say. Mr. Cherry says his company already is formed for the production of gasoline.

To a represenative of THE AUTOMOBILE Mr. Cherry said, "Ten thousand gallons of 30 gravity distillated can be converted by this process into 11,900 gallons of 65 gravity gasoline. All of the volatile parts of the crude oil are turned into gasoline at any desired gravity and it takes less than 1 cubic foot of natural gas to a gallon of gasoline produced and not to exceed 5 kilowatts of electricity for the conversion of 10,000 gallons of crude oil a day. This will make the cost of conversion less than .75 cent a gallon."

Cornell Student Branch of S. A. E. Opened

NEW YORK CITY, April 3—At the first meeting of the Cornell Student branch of the Society of Automobile Engineers, there were about sixty-five students present, over forty applying for membership in the branch. It is expected that this will increase to 100 before long. The following officers have been elected: Honorary Chairman, Professor R. C. Carpenter; branch president, Lenox R. Lohr; branch vice-president, P. K. Linsey; branch secretary, H. A. Knight; branch recording secretary, N. W. Suiter; branch treasurer, S. Dewsnap.

INDIANAPOLIS, IND., April 6—*Special Telegram*—On account of a lack of quorum, the S. A. E. meeting, which was to have been held tonight, was postponed until May 11 when the members will discuss the constitution and by-laws with a view to standardizing them.

New Dealers' Organization in Milwaukee

MILWAUKEE, WIS., April 3—The Milwaukee Automobile Dealers, Inc., is the title of a new organization that has supplanted the Milwaukee Automobile Dealers' Assn. The association comprises practically every dealer in Milwaukee and the charter membership is thirty-two.

President, Frank J. Edwards; vice-president, George W. Browne; secretary, Jesse A. Smith; treasurer, John G. Wolleager; assistant secretary and manager, Bart J. Ruddle.

Headquarters have been established on the second floor of the new Hotel Wisconsin, in the heart of the downtown business section. Here the association will meet not only dealers, but automobilists from everywhere, and provide them with touring and route information, maps, etc.

A progressive motor show is a plan which the new association will carry out. On April 17 and 18 each of the thirty-two members will conduct special displays and exhibits in their salesrooms, and enough cars will be provided to transport all visitors and guests to the exhibits.

RACINE, WIS., April 5—The L-P-C Motor Co. announces that it is prepared to furnish the Vulcan electric gearshift, made by the Cutler-Hammer Mfg. Co., Milwaukee, Wis., on the Lewis six at an additional cost of $150.

NEW YORK CITY, April 7—H. Kerr Thomas, assistant manager of the Pierce-Arrow Motor Car Co., and a member of the Commercial Vehicle Committee of the N. A. C. C., will deliver a paper whose title is "Can A Standard Load Rating Be Devised and Approved by the Manufacturers?" at the third truck convention of the N. A. C. C. at Detroit, May 5 and 6.

Hermann Small Eight for Light Cars

DETROIT, MICH., April 6—The Hermann Engineering Co. has produced a small eight-cylinder motor of 2 1-2-inch bore by 4-inch stroke. This little eight follows the general lines of the maker's well-known four-cylinder motor. The connecting-rod bearings are placed side by side on the crankpins, and the camshaft is of the sixteen cam variety. Valves are operated directly without the use of rockers. Cooling is by thermo-syphon and lubrication splash from troughs placed beneath the crankpins. Valves are rendered accessible by the use of a detachable cylinder head.

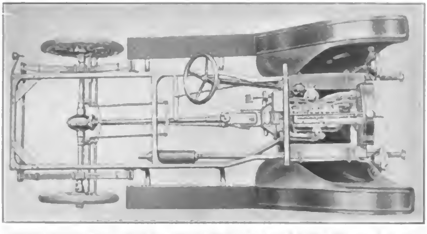
NEW YORK CITY, April 7—At the annual meeting of the stockholders of the Studebaker Corp., held in Jersey City yesterday, the retiring board of directors was re-elected. Nothing was said concerning the declaration of a dividend on the company's common stock. The directors are: J. M. Studebaker, chairman; E. R. Benson, F. P. Delafield, A. R. Erskine, F. S. Fish, Henry Goldman, J. G. Heaslet, A. B. Hepburn, W. R. Innis, H. H. Lehman, Philip Lehman, N. J. Riley, G. M. Studebaker, G. R. Turner and D. M. F. Weeks.

NEW YORK CITY, April 3—In the description of the four new United Motor truck models which appeared in THE AUTOMOBILE for March 25, it was stated that the 2-ton truck has a 148-inch wheelbase. This should have been given as 144 inches. The tires on this model were given as 34 by 4 front and 36 by 4 dual rear; whereas, they are 36 by 4 front and 36 by 4 dual rear. The standard wheelbase of the 5-ton model was given as 120 inches, which should have been 144. It was also stated that Frank T. Hulswit, president of the company, is president of the local railway and light company. Mr. Hulswit is president of the United Light and Railway Co.

Lima Light Car to Sell for $500

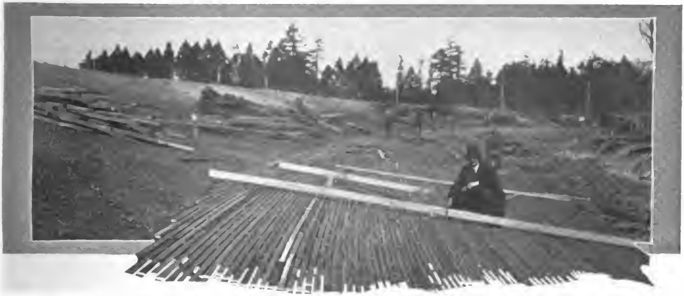
LIMA, O., April 5—The Lima Light Car Co., organized with a capital of $50,000, has announced the Lima light car to be produced at the rate of ten a day as maximum for the present. The chassis is a simple standard shaft-drive type and the car will be made in three body styles, speedster, roadster and light delivery wagon. The four-cylinder block valve-in-the-head motor is rated at 18 horsepower and forms a three-point suspended unit power-plant with the leather-faced spring insert cone clutch and three-speed gearset. Atwater Kent ignition is used. Both brakes are equalized and electric lighting is standard equipment. Wheelbase is 100 inches and tires 28 by 3. Cooling is by thermo-syphon. Springs are semi-elliptic all around and rear axle is semi-floating. Left drive and center control are standard. Equipment includes lamps, electric horns, tools and tire repair outfit and the car sells for $500. Top, windshield and speedometer are $50 extra. The radiator used is extra large with Dippert patent tubes. Steering gear is worm and sector, irreversible.

Officials of the company are: I. J. Miller, president; C. E. Miller, vice-president; and A. C. George, secretary, treasurer and general manager. Experimental cars have been tried out.



Chassis of Lima light car which, as runabout, speedster and light delivery, sells for $500

Rapid Progress in Planking Tacoma's 2-Mile Speedway



TACOMA, WASH., April 2—As stated in THE AUTOMOBILE this week, the Tacoma Speedway Assn. is planking its 2-mile speedway. About 2,500 feet has been completed in the past week, the width being about 18 feet. The illustration shows one of the curves, there being four of these on the course, each with a radius of 890 feet and all banked on the outside to the height of 18 feet and in place of being banked on a straight line there is a ditch of about 2 feet from top to bottom on each curve, making it practically impossible for a car to leave the track on the turn even at the highest speed. All of the intersections of the track will be filled with small gravel after which the entire surface will receive a thin coating of asphaltum oil and sand. This will prevent skidding and give a smooth, uniform surface. The contract specifies that the course must be completed by June 1

Indiana Speedway Is True to A. A. A.

Attempts to Induce Rupture Unsuccessful, Says Director—Burman Defeats Cooper and Disbrow—Other Racing News

NEW YORK CITY, April 7—Attempts to influence the Indianapolis Motor Speedway to break away from the American Automobile Assn. control by the recently organized racing association in southern California are apparently meeting with little success, according to a bulletin issued today by the American Automobile Assn., which quotes as follows from a director of the Indianapolis speedway, in which it is stated that the speedway stands firm for A. A. A. control. The director said: "The Indianapolis Speedway believes that the only safe way to control racing from the point of view of protecting the public is through the impartial, sportsmanlike, administration of a disinterested body like the A. A. A. As long as the speedway endures we shall give our support to the A. A. A. and we hope the support will never fall into the control of various local, organizations who will run things practically as they please."

Three Maxwells Enter Chicago Race

CHICAGO, ILL., April 5—The entry of the three Maxwells for the Chicago speedway race on June 19 is announced by Contest Director F. E. Edwards, bringing the total number of declarations up to eleven—three Stutzes, de Palma's Mercedes, two Sunbeams, a pair of Duesenbergs and the three Maxwells. The Maxwell drivers are not named.

Burman Defeats Cooper and Disbrow

LOS ANGELES, CAL., April 4—*Special Telegram*—Driving his rebuilt Peugeot, Bob Burman defeated Disbrow in a Simplex and Earl Cooper in a Stutz in the three-cornered 50-mile match race at Ascot Park today. Cooper finished second, almost two laps behind Burman. Disbrow broke a drive chain on his twenty-first lap, losing three laps. Again on his thirty-fifth lap he broke another chain and retired.

Burman's time for the half-century was 52:36.9 and Cooper's 53:46.45. The poor condition of the track was responsible for the slow time. Cooper began to lose from the start and at the end of ten laps was 1-2 mile in the rear. On the seventeenth Burman lapped him and on the twentieth Disbrow passed him but broke down the next time around.

INDIANAPOLIS, IND., April 5—John de Palma, a brother of the road racing champion, will have a mount in the 500-mile race on the local speedway. Upon him will devolve the task of piloting the Delage, which won the 1914 sweepstakes with Rene Thomas at the wheel. John de Palma has been selected by W. E. Wilson, who now owns the Delage, to represent him, and the entry was filed today.

Suggests Stock Cars for 1,000-Mile Race

INDIANAPOLIS, IND., April 6—A 1,000-mile race at the local speedway among the winners of the 500-mile international sweepstake contests, but limited to the registered stock touring car models of these makes, is proposed by Walter Marmon, president of the Nordyke & Marmon Co. Mr. Marmon's idea is to have each of the factories, Marmon, National, Peugeot, Delage and the winner of the 1915 race, provide regular stock touring models which would carry no extra racing fittings. Let each car be raced with top and windshield up, carrying five passengers, with electric lighting and starting equipment and tools and everything that a man expects to have on his car on a touring trip with the exception, perhaps, of the luggage for the passengers. Then run the race at 1,000 miles on the Speedway for a purse of $100,000.

NEW YORK CITY, April 7—Application has been made to the A. A. A. for a sanction to hold automobile races on the afternoon and evening of June 12 at Brighton Beach. The Brighton Beach Motordrome management, which is promoting the race, plans to illuminate the track with powerful electric and gas lights at night.

NEW YORK CITY, April 7—F. W. Stelle was yesterday elected trustee in bankruptcy of the Twombly Car Corp. of 1790 Broadway, with a bond of $5,000. D. D. Sherman was elected trustee for the Twombly Motors Co., the Twombly Power Co., and the Twombly Taxicab Co.

Developments in the Jitney Bus Field

Motor Bus Movement Will Regulate Itself if Given Fair Chance

THE jitney bus question is likely to regulate itself in a short time, in the opinion of the National Automobile Chamber of Commerce, without any attention from legislators and city councilmen, if given a chance. The eagerness with which the public has taken to riding in the buses shows that they fill a need in local transportation. Patient citizens long ago grew weary of strap-hanging and will not see promised relief snatched from them without a protest.

Eventually, in the opinion of the chamber, the jitney will be succeeded by especially built motor omnibuses, like those operating in the largest European and American cities. Their real function will be to supplement the street car service, which is insufficient in most large cities, and to this end the public will demand that their development along proper lines be not discouraged.

Jacksonville Trolley Co. Installs Automobiles

JACKSONVILLE, ILL., April 3—In order to head off any possible jitney competition, the Jacksonville Street Railway company has installed automobiles to operate from the terminus of the trolley line to Diamond Grove Cemetery, accepting transfers from the street cars. The automobiles will operate hourly temporarily. Should the experiment prove successful, additional service will be installed to other points not reached by the street cars. L. F. O'Donnell, owner of an automobile, is also planning to install a jitney service between the square or business district, and the depots.

To License Common Carriers in Lansing

LANSING, MICH., April 1—At a meeting of the city council the new jitney bus ordinance was read. It will probably be passed at the next meeting, the matter of the amount of bond being as yet undecided.

The ordinance provides that any person in the business of a common carrier of persons, using for that purpose any carriage, cab, coach, coupé, omnibus, taxicab, jitney bus, automobile, sleigh or any other vehicle for hire, must obtain a license from the city clerk. The license will cost $10 for the first vehicle and for each additional vehicle $5.

The driver or owner of the vehicle may make the following charges: from 6 a. m. to 11 p. m. for a distance not exceeding 1 1-2 miles by the most direct route, the sum of 25 cents per passenger and for a distance greater than 1 1-2 miles, 50 cents per passenger. Between 11 p. m. and 6 a. m. double fare may be asked. No charge for children under 6 years when accompanied by a paying passenger and for children of 6 to 12 years only half the fare is to be charged when accompanied by a paying passenger. Passengers have a right to carry free of charge baggage not weighing more than 50 pounds, while for excess weight there may be charged 25 cents. A vehicle may be used by the hour and for one carrying four or less passengers a charge of $1.50 may be made for the first hour and 1 dollar for each additional hour or fraction thereof, these rates being doubled between 11 p. m. and 6 a. m.

In the ordinance a bond of $1,000 for one vehicle is proposed and a bond of $2,000 for two or more vehicles.

GRAND RAPIDS, MICH., March 30—The local jitney bus owners have formed a temporary organization, W. D. Vandecar, distributor for the Reo and Premier cars, being elected chairman, and C. H. Lillie, secretary. When the first meeting adjourned sixty-two owners were on the membership list.

The principal matter discussed at the meeting was relative to liability. It was stated by several owners of single cars that when they first tried to get liability insurance the rates quoted were from $27 to $34 for a $5,000 policy to cover liability for injury to a single person, but since then the rate has been increased to $100, which is prohibitive.

$9.23 Per Day Given as Jitney Bus Cost

SAN FRANCISCO, CAL., April 2—It costs $9.23 a day on an average to run a jitney bus, according to P. V. Marshall, principal of the Y. M. C. A. Automobile School. He has it figured down to a nicety. He estimates that the cost of operating for 300 days a year, 12 1-2 hours a day, a jitney bus costing not more than $600 when it was new will be about as follows:

	Per Yr.
Six per cent. interest on one-half of $600, investment	$18.00
Insurance	192.00
Depreciation	300.00
Storage	120.00
Driver's wages ($100 a month)	1,200.00
Licenses	28.00
Jitney association dues	12.00
Yearly fixed charges	$1,870.00
Average for 300 days per year	$6.23
Oil, gasoline, grease, etc	1.50
Tires (150 miles at ½c.)	.75
Mechanical upkeep, repairs, etc	.75
Daily cost	$9.23

"If you start with a new bus car," says Marshall, "one which costs approximately $600, you must take in $9.23 a day or subtract the difference from your wages, $100 per month. This is little enough for driving a jitney 150 miles a day. If your car is second-hand or cost more than $600 when new, or is heavier than a $600 car, you must of course, estimate higher daily cost figures."

MILWAUKEE, WIS., April 5—Milwaukee's jitney industry is still in a thriving condition and getting better every day. On April 3 the total number of jitney licenses issued was 237 and the daily average issue is fifteen. Until May 1 the fee will be $5, as for a 1-2 year, and after that date the annual fee of $10 will be charged, licenses being good until May 1, 1916. The licenses are the same as for any "for hire" vehicle and are not special grants for jitney buses.

One of the most pressing problems for the jitney owners as well as the jitney passenger is the question of insurance. Insurance agents are plying their home offices with questions as to the liability for injury while riding in jitney buses. Jitney owners are wondering what the consequences will be if they are struck or strike another. And the passenger is wondering how and from whom they would be able to collect damages in case of accident. Few, if any, jitney buses carry liability insurance, the rate being considered altogether prohibitive.

About 150 jitney operators have organized as the Independent Jitney Assn. and chosen a business agent with downtown headquarters. The association proposes to settle the matter of insurance by mutual liability unless the insurance companies reduce their premium rates.

GRAND RAPIDS, MICH., March 30—The village council of East Grand Rapids, has passed an ordinance requiring a license fee of $60 per year from jitney bus owners and a liability insurance bond of $10,000 to protect passengers, pedestrians or the village against accidents. The cars and chauffeurs must be licensed.

Pay-As-You-Enter Jitney in Baltimore

BALTIMORE, MD., April 3—The jitney bus service continues to thrive in Baltimore and in the past few days several new lines have been started. Among the latest is a pay-as-you-enter affair fitted up with a signal bell for the passengers to ring when they want the vehicle to stop.

The police of Baltimore have started taking a census of all the jitney buses in the city. So far they have found thirty-five different lines, but more are entering the field so fast they are having trouble in keeping up with them.

A great deal of interest is being taken in the proposed bus line plying between this city and Washington. It will touch Halethorpe, St. Denis, Elkridge, Dorsey, Waterloo, Savage, Laurel, Muirkirk, Ammendale, Beltsville, Branchville, College Park and Hyattsville, starting at the Hotel Emerson in this city and ending at the Hotel Willard in Washington. The fare will be 75 cents each way. Forty-horsepower buses will be used with a capacity for twenty-six persons. They will weigh approximately 7,500 pounds.

The local authorities and those of the District of Columbia have been asked to grant permission for the operation of the line. It will begin within the next 2 weeks, it is said.

Providence Jitney Assn. Is Formed

PROVIDENCE, R. I., April 3—At a meeting last week a number of owners of jitney buses in Providence formed the Rhode Island Jitney Bus Association with a charter membership of more than thirty. The following officers were chosen: Jerome Gaudet, president; E. J. Corbett, secretary; James H. McNiff, treasurer.

PORTLAND, ME., April 3—The second jitney bus line has been put in operation in Portland and now runs to Deering Centre and return. Another line will be run to Westbrook, and a fourth is planned for the Summer parks in South Portland. One of the local dealers is planning to run a number of the buses to the ball park and back during the Summer season.

Two Jitney Concerns in Hamilton Ont.

HAMILTON, ONT., April 3—Two jitney companies have been started in this city, one of which is already in operation while the other has just been capitalized. The Hamilton Jitney Service Assn. came into being this week when articles of partnership were drawn up by A. A. Decker and C. M. Wilson as an operating company for a jitney service through the principal streets of the city. C. W. Bell is acting for the association and the company works in conjunction with the owners of automobiles. The other concern is the Hamilton Jitney Co. which has been incorporated at $40,000. The purpose of this company is to own and operate automobiles in Hamilton as a livery service. The following men are behind the proposition, A. Carey, F. W. Reinke, L. H. Allen, E. S. Carey and C. V. Langs.

HARTFORD, CONN., April 3—After due investigation and full consideration Hartford has at last come to the jitney way of thinking. Early in the week one audacious spirit announced what he termed the blue line operating from West Hartford center to city hall, a distance of about 3 miles. An Overland touring car is used for this service. The success of this venture has emboldened others to try the experiment. Coincidental with the blue line which operates along the route of the West Hartford trolleys is the red line which traverses Franklin avenue. This is also a 5 cent line. Still another line operates over the Cedar Hill route and from all reports is not wanting in custom. The north end of the city is also covered. The first suburban jitney is that operating between Hartford and South Manchester, for which ride 15 cents is charged.

LOS ANGELES, CAL., March 29—The jitney bus situation has assumed a new phase in Los Angeles. A member of the mounted traffic squad tied tags on fifteen or twenty jitneys standing on Hill street between Fifth and Sixth streets yesterday, ordering the owners to appear in police court for violation of Section 7 of the traffic ordinance. This section makes it unlawful for the owner or driver of any "for hire" vehicle to stand upon any street in the business district unless such person shall have procured a permit in writing for such privilege from the Board of Police Commissioners.

The Auto Bus Owners' Assn. attorneys claim that if the jitney men are to be prosecuted for violation of Section 7 of the traffic ordinance, the city can not collect more than $7.50 per quarter, the license fee for rent machines that occupy stands.

350 Jitneys in Vancouver, B. C.

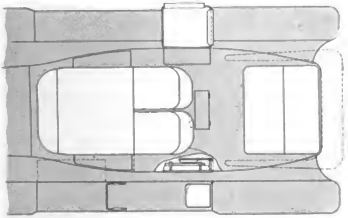
VANCOUVER, B. C., April 5—Consul-General Mansfield at Vancouver, in a report on jitney operation in that city, says that they made their first appearance about January 1, 1915, and about 350 are now being operated. Average daily receipts of each jitney are reported at $8.00 and the traffic of the British Columbia Electric Railway has been severely affected. In January, 1915, the railway company carried 1,138,333 fewer passengers than in January, 1914, when the number of passengers carried was 3,364,062. In January, 1914, the company paid the city $2,766 as its percentage of the gross receipts of the railway, while in January, 1915, this payment was but $1,816 a decrease of 33 1-3 per cent. It is estimated that the city will lose $30,000 in these payments if the present decrease in the electric railway receipts is maintained.

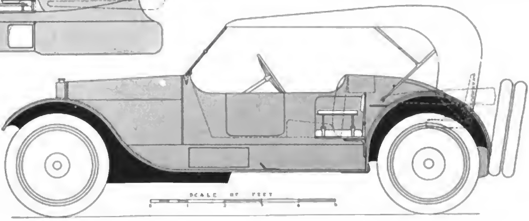
LOS ANGELES, CAL., March 30—A bus line into Griffith Park has been projected by the city council of Los Angeles. Owing to a freak charter provision, no electric railway may run its line into the park and the motor bus is the next best thing and will operate until the time comes when a railway line may legally be constructed to accommodate the visitors to the park.

OTTAWA, ONT., April 2—The first jitney has made its appearance locally and if successful it is expected within a few weeks all the main and suburban lines will be covered.

JOLIET, ILL., April 5—In order to secure transportation facilities to Forest Park, not reached by the street cars, a jitney bus service is to be inaugurated shortly. The line will be operated upon the co-operative plan, shares being sold at $5 each. If there is any profit, it will be divided among the stockholders.

CAMDEN, N. J., April 3—Three lines of jitney buses began operation in this city starting March 29.





Six-passenger roadster body now building for a Chandler six chassis. Four passengers are accommodated within the body and the other two can sit on disappearing seats that can be set up on the running boards. With raked windshield the car will have an exceptionally smart appearance, unique for a car of this capacity

Factory Miscellany

DAYTON Engineering to Add—The Dayton Engineering Laboratories Co., Dayton, O., has authorized the erection of another large addition to the plant. The new structure will be 500 feet long, 66 feet wide and six stories high. The company employs approximately 1,700 men. The officers of the company are: E. A. Deeds, president; C. F. Kettering, vice-president; G. F. McCann, secretary-treasurer. Other directors are B. F. McCann and W. H. Chryst.

Hood Rubber to Add—The Hood Rubber Co., Watertown, Mass., plans to construct an addition to its plant in that city.

Hudson's Windsor Plant—The Hudson Motor Car Co., Detroit, Mich., plans to establish a branch factory at Windsor, Ont.

Polson to Add—The Polson Mfg. Co., manufacturer of automobile tops and windshields, plans to build an addition to its factory at Chenango street, Buffalo, N. Y.

Regal Adds to Berlin Plant—The Regal Automobile Co., Detroit, will make an addition to its factory in Berlin, Ont., and will require machinery. Mr. Nyberg is branch manager.

Detroit Foundry Sale April 9—The machinery, tools and foundry supplies of the bankrupt Detroit Foundry & Mfg. Co., Detroit, Mich., will be sold at public auction at the plant, 1218 Hastings street, at 10 a. m., April 9.

Remy to Build—The Remy Electric Co., Detroit, Mich., obtained recently a construction permit for various structures, which will cost $96,075. A two-story plant, 60 by 50 feet, will be erected on East Grand boulevard, between Beaufait and Mount Elliott.

Work Started on Williams Plant—Work has been started in the erection of a large factory at Vista Station, Irwin, Pa., for the manufacture of automobile tires and other rubber goods by the Williams Tire & Rubber Co. Five hundred men will be employed.

Detroit Body Co. Adds—A permit for a three-story addition, 55 by 110 feet, has been obtained by the Griswold Motor Body Co., Detroit, Mich. When completed it will mean 55,000 square feet of additional floor space or an increase of 60 per cent. over what the concern now has.

Progress Auto Parts Co. Opens.—Herman Hersch and Harry Greenberg have organized the Progress Auto Parts Co., Cleveland, O., doing a general jobbing business in automobile parts and accessories, specializing in purchasing parts of discontinued cars and regular stocks.

Havers Equipment for Sale—Motor car manufacturing machinery, shop equipment, automobile parts and accessories from the bankrupt Havers Motor Car Co., Port Huron, Mich., are now for sale either at the plant or at the offices of the Harris Bros. Co., Jefferson avenue, Detroit which purchased the entire stock.

The Automobile Calendar

April 5-10	DuBois, Pa., Show, Moose Hall.
April 7-10	Calumet, Mich., Show, Coliseum Rink.
April 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
April 20-22	Oklahoma City, Okla. Road Race, S. W. Auto Racing Assn.
May 15-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17	Spokane, Wash., Show, Davenport Hotel.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4-5	Tacoma, Wash., Road Race.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.

Harrison Radiator Enlarges—The Harrison Mfg. Company, Lockport, N. Y., manufacturer of radiators and accessories for automobiles, is preparing to build an extension to its plant, and will probably let the contract within a few days. It will not require any additional machinery. H. C. Harrison is president.

Buys Detroit Foundry Plant—The Peninsular Smelting Co., has purchased the plant of the old Detroit Foundry & Mfg. Co., 1218 Hastings street, Detroit, Mich., and will soon move there from its present location at 52 Baltimore avenue. The new plant which consists of a one-story brick building 90 by 165 feet, provides 11,000 square feet of floor space.

New Kelsey Wheel Plant—Construction work will be started shortly on a new one-story brick and steel building, 90 by 313 feet, for the Kelsey Wheel Co., Detroit, Mich. When completed the total floor space of the company, including its plant in Memphis, Tenn., will aggregate more than 205,000 square feet. The new structure, which will cost $50,000 will be used for stamping purposes.

Hayes Body at Full Capacity—During the last 2 months business has been better than at any other time during the last 3 years, according to a report by an officials of the Hayes-Ionia Co., Ionia, Mich., automobile body makers. About 425 men are now working, which means that the plant is operated to its full capacity. Between eighty and eighty-five is the average daily output, and this will be gradually increased if possible.

Ford Tire Plant in Findlay—The Toledo-Ford Tire Co. has announced its main factory will be located in Findlay, O., and that preparations are being made to erect a 50 by 400-foot addition to the present factory on Lima avenue. The company has taken out a building permit to construct a $1,500 boiler house. The plant will be in operation within the next 3 weeks.

Parrett Tractor Moves Plant—The Parrett Tractor Co., which was organized by James Parrett and sons, Dent and Henry, moved the Ottawa (Ill.) plant to Chicago Heights April 1. The Ottawa quarters are somewhat limited, and it has been found that the machines can be manufactured more economically in a large shop, already in operation, and adapted to any kind of machine construction. Dent Parrett, president of the company, will have his headquarters at 409 Fisher Bldg., Chicago.

Superior Co. May Enlarge—The Superior Mfg. Co., Ann Arbor, Mich., which originally manufactured only gasoline lighting systems, but which for some time has been making automobile windshields, is rapidly developing this part of its business to such an extent that it may be necessary to enlarge the plant. President H. H. Seeley reports having orders for 50,000 windshields for the Buick Motor Co., Flint, Mich.; 50,000 for Dodge Bros., Detroit, besides receiving the orders for the entire output of the Reo Motor Car Co., Lansing, Mich., and the Chalmers Motor Co., Detroit.

Maxwell Force Increases 5,930—At the end of February there were 13,291 men on the pay-roll of the different plants operated by the Maxwell Motor Co., Detroit, Mich. This shows an increase of 5,930 men as compared with February, 1914. In February of last year the office forces totaled 506 while this year the number was 936. W. E. Flanders, president of the Maxwell company, has arrived in Dayton, O., from Detroit, and announces that work on the duplication of the factory in North Dayton will be started at once. The construction will be of brick and will conform with the present factory. Employment will be given to 400 additional workmen.

Schlieder Valve to Build—A new plant will be erected at East Grand boulevard and Oakland avenue for the Schlieder Mfg. Co., Detroit, Mich., which makes automobile valves. The structure will be partly two stories high and cover a piece of ground 80 by 135 feet. The new plant will provide 14,800 square feet of floor space, or over 50 per cent more than now available. Recently a 400 per cent stock dividend was declared to provide for the increase of the capital stock of $100,000 The annual output has increased from 12,000 valves to over 100,000. The stockholders are: A. E. Schlieder, president; H. F. Osborn, secretary-treasurer, and W. F. Spath, chief inspector. The entire output for 1916 has been contracted for, said President Schlieder.

The Week in the Industry

Motor Men in New Roles

CROOKER Regal Advertising Mgr.—R. H. Crooker, during the past 2 years with the advertising department of the Burroughs Adding Machine Co., has been appointed advertising manager of the Regal Motor Car Co., Detroit, Mich.

Snarr Wesco Sales Mgr.—G. W. Snarr of the Wesco Supply Co., St. Louis, Mo., has been advanced to the position of manager of automobile accessory sales.

Armstrong Bowser Detroit Mgr.—W. A. Armstrong has been appointed manager of the local branch of S. F. Bowser & Co., Detroit, Mich., gasoline tank manufacturers.

Graham Perkins Purchasing Agent—G. M. Graham, designing engineer of the Massnick-Phipps Mfg. Co., Detroit, Mich., maker of the Perkins four and eight cylinder motors, has been made purchasing agent.

Kennedy Resigns—L. E. Kennedy has resigned as secretary, treasurer and general manager of the Western Brass Co., Milwaukee, Wis., and returned to Burlington, Wis., his former home, to engage in business on his own account.

Gewinner Marathon Representative—H. J. Gewinner has been appointed by the Marathon Tire & Rubber Co., Cuyahoga Falls, O., as its Southeastern representative. His headquarters for the present will be at Birmingham, Ala.

Ellis Beaumont Cadillac Mgr.—H. D. Ellis has been appointed manager of the Beaumont, Tex., office of the Cadillac company to succeed George DeWitt, who has been appointed to look after the Cadillac interests in the Cotton Belt section of the state.

Berger Joins Lozier—L. B. Berger, who was with the Willys-Overland Co., having charge of the sales of the Willys-Knight at the Garford plant, in Elyria, O., has resigned to join the Lozier Motor Co., Detroit, Mich., where he now has charge of the sales department.

Britt Buys Out Business—R. H. Britt, who had been in the automobile business in Mexico for 2 years, returned to Springfield, Mass., a short time ago and now he has bought the Springfield Auto Top & Upholstering Co. from W. H. Shinks, and will continue the business at 42 Harrison avenue.

Wentdorf Succeeds Bremer—The Standard Aluminum Co., Two Rivers, Wis., announces the retirement of William Bremer as president and the succession to the executive position of Herman Wentdorf, until now secretary and treasurer. Louis Gloe has been elected to succeed Mr. Wentdorf. The company built a large rolling mill at its plant a year ago and several weeks ago increased its capital stock to better accommodate its growing business.

Dawe Heads Steel Treating Club—C. N. Dawe, metallurgist of the Studebaker Corp., Detroit, Mich., was elected president of the Steel Treating Research Club, at the annual meeting. C. R. Poole, chemist and metallurgist of the Frost Gear & Forge Co., Jackson, Mich., was elected secretary. The club's members are chemists, metallurgists and hardening room foremen of the plants in Michigan. Associate membership is open to representatives of manufacturing concerns whose products are connected with heat treating departments.

Garage and Dealers' Field

Dayton Rubber Branch Moves—The Chicago, Ill., branch of the Dayton Rubber Mfg. Co. has moved to 2011 Michigan avenue.

McGraw Tire Branch in Buffalo—The McGraw Tire & Rubber Co., East Palestine, O., has opened a branch store at 737 Main street, Buffalo, N. Y.

Pyrene's N. Y. Offices Moved—The Pyrene Mfg. Co. has moved its offices to the Vanderbilt Concourse Bldg., 52 Vanderbilt avenue, corner East 45th street.

Braender Opens Trenton Branch—The Midler Auto Supply Co., 7 North Montgomery street, Trenton, N. J., has been appointed distributor for Braender tires.

Burd Executive Offices Moved—The general and executive offices of the Burd High Compression Ring Co., Rockford, Ill., have been moved to 307-309 South Main street.

Studebaker Commercial Sales Good—The Studebaker Corp., Detroit, Mich., during the first week in March, 1915, sold through its commercial car department, fifty-one vehicles.

Kalamazoo Dodge Moves—The salesroom and garage of H. J. Cooper, Kalamazoo, Mich., agent for the Dodge cars, has been moved from 420 West Main street to 107 North Church street.

Bachem Moves—Max Bachem, distributor in Detroit, Mich., of the Gabriel snubbers, Ritz-Wolier gasoline gauges, and the Bachem pressed steel wheels, has moved to 1235 Woodward avenue.

Frisco Bosch Moves—The San Francisco, Cal., branch of the Bosch Magneto Co., has moved to larger quarters, from the lower end of Van Ness avenue to the upper end of the boulevard in the center of the automobile section. B. R. Miller is manager.

Takes Philadelphia Batavia Branch—Franklin Kesser has taken over the business of the Philadelphia (Pa.) branch of the Batavia Rubber Co. and will conduct an agency for eastern Pennsylvania and southern New Jersey. Headquarters are at 844 North Broad street.

Goodyear's Western Managers Meet—Branch and district managers of the Goodyear Tire & Rubber Co. in Washington, Oregon, Montana, and California, attended a conference in Seattle, during the past week. The meetings were presided over by M. E. Morris, manager of the Pacific Coast interests with headquarters in San Francisco.

Takes on Van Speedometer—The Cutting & Smith Sales Co., 997 Woodward avenue, Detroit, Mich., which is distributor for automobile components and accessories, has completed a deal whereby the Van speedometer will be handled by the company in the states of Michigan, Ohio and Indiana. The Van is manufactured by the Van Sicklen Co., Aurora, Ill.

Electric Garage for Baltimore—The Electric Service Garage Co., Baltimore, Md., plans to build a central garage for electric trucks and automobiles. An option has been obtained on a lot at Calvert street, near Centre. A two-story garage, 150 by 200 feet, will be built, to be opened about June 1. A machine shop and a battery department will be installed.

New Accessory Firm in Spokane—The Automobile Accessory Agency opened in Spokane, Wash., during the past week at 105 Riverside avenue. H. A. Holland is president; A. Phillips, vice-president; L. D. Holland, second vice-president, and A. E. Torelle, secretary and manager. A general retail and jobbing business will be conducted in automobile and motor supplies, and featuring the Goodrich line of tires.

Grand Rapids Dealers Organize—The automobile dealers of Grand Rapids, Mich., have organized the Auto Business Assn., the object of which is to bring about closer relationship between the dealers, with a view of obtaining more co-operation between dealers and owners for the development of the roads in western Michigan and securing more equitable legislation. R. E. Becker was elected president of the association.

Large Detroit Garage Opened—One of the biggest garages in Detroit, Mich., the Wolverine Garage Co., has opened for business. The owners are J. R. Gilbert, until recently manager of the local branch of the Pennsylvania Rubber Co., who is president and general manager, and A. T. Hamlin, who has been in the automobile repairing business during the last 12 years, having been connected with the Packard, Knox, Northway and several other big manufacturing concerns. The garage, which has 14,000 square feet of floor space, will be open day and night. It is located at 248 Jefferson avenue, East.

Convict-Made Trucks Sold—Five new motor trucks, manufactured by the convicts in the Ohio penitentiary at Columbus, were delivered to various state institutions last week. The five trucks were assembled inside the walls and represent an entirely new phase of prison labor which will probably be utilized in the future by the state officials. The idea of building motor trucks was at first regarded as impracticable but an experimental model constructed 6 months ago demonstrated that such trucks can be built. The cars were built under the supervision of an expert machinist. Each truck has a carrying capacity of 3 tons. They are provided with 35-h.p. Continental motors. Many of the parts were made entirely within the walls, including the bodies, gear-shift levers, muffler, frame and upholstering. The trucks will be sold to the state institutions for $2,500 each which will leave a small profit to the prison management.

Automobile Agencies Recently Established

PASSENGER CARS

Michigan

Detroit	Ohio	Ohio Electric Sales Co.
Detroit	Briscoe	Foster Motor Sales Co.
Dowagiac	Overland	L. C. Wells
Grand Rapids	Glide	F. P. Oswald
Grand Rapids	Remington	Remington Sales Co.
Holland	Jeffery	F. W. Jackson
Iron River	Case	Iron River Motor Car Co.
Jackson	Saxon	W. T. Murray
Kalamazoo	King	W. O. Harlow
Ludington	Saxon	Cartier Auto & Garage Co.
Maointee	Ford	Traverse Auto Co.
Manistee	Reo	Traverse Auto Co.
Marshall	Argo	O. L. Linn & R. S. Scott
Marshall	Briscoe	O. L. Linn & R. S. Scott
Marquette	Ford	F. W. Jones
Perry	Dodge	Danning & Hart
Port Huron	King	F. S. Church
Saginaw	Argo	Electric Vehicle Service Co.
Saginaw	Borland	Electric Vehicle Service Co.
Saginaw	Broc	Electric Vehicle Service Co.

Minnesota

Anoka	Lexington	J. H. Ward
Lake Crystal	Case	W. R. Roberts
Lanesboro	Kissel	J. G. McMaster
Minneapolis	Davis	White Garage

Missouri

Kansas City	King	Karshner Motor Car Co.
Kansas City	Stearns-Knight	Scarritt Motor Car Co.
Maysville	Lexington	H. O. Williams
St. Louis	Lexington	Lindell Motor Car & Repair Co.
St. Louis	Davis	Cherokee Automobile Co.

Nebraska

Omaha	Davis	Wilson Auto Co.
Omaha	Stearns-Knight	McIntyre Automobile Co.
Omaha	Davis	Freeland Auto Co.

New Jersey

Burlington	Detroiter	M. J. Gray
Camden	Detroiter	O. O. Phillips
Elizabeth	Ohio	Elizabeth Auto Co.
Gibbsboro	Detroiter	H. Parker & Sons
Glen Ridge	Oldsmobile	Glen Ridge Auto Co.
Landisville	Detroiter	C. F. Riedel
Millville	Detroiter	Troth & Keen
Morristown	Oldsmobile	Cain-Henry Motor Car Co.
Mullica Hill	Detroiter	J. P. Stratton
Newark	Simplex	J. M. Quinby & Co.
Newark	Kissel	C. F. Briggs
Newark	Case	North Grove Garage Co., Inc.
Toms River	Detroiter	A. W. Brown
Trenton	Davis	F. P. Holz
Trenton	Detroiter	Toman Brothers
Woodstown	Detroiter	E. G. Peterson

New York

Albany	Simplex	Albany Garage Co.
Amenia	Saxon	Amenia Garage
Amityville	Case	Amityville Garage
Brier Hall	Case	A. D. Griffin
Buffalo	Case	C. R. Cool
Buffalo	Simplex	Simcott Motor Sales Co.
Buffalo	Apperson	Poppenburg Motor Car Co.
Ceres	Detroiter	Raymond & Lamphere
Colfax	Case	G. B. Carter & Son
Cortland	Case	C. M. Smith
East Hampton	Case	L. O. Edwards
East Port	Case	L. S. Tuttle
Ellicotville	Detroiter	J. E. Doolittle
Elmira	Detroiter	J. B. Bishop
Farnham	Detroiter	C. J. Peters
Flushing	Case	D. L. Rapalje
Greenport	Case	J. Kluge
Grantsville	Case	J. R. Eliason
Hempstead	Case	National Garage Co.
Hicksville	Case	C. A. Reinhard
Hillsboro	Case	Richard Brothers
Islip	Case	Gates Auto Garage
Kenoza Lake	Saxon	Thiess & DeLap
Livonia	Detroiter	Scott W. Crane
Madalin	Oldsmobile	C. M. Otis
Marlboro	Imperial	J. A. DuBois
Middleport	Detroiter	F. A. Whittaker
Millerton	Case	Millerton Garage
Mineola	Case	T. F. Roche
Monsey	Saxon	C. A. Johnson
New Glarus	Case	Hoesly & Hoesly
New Rochelle	Saxon	Tracy Rochfeld
New York	Lexington	Lexington Sales Co.
Oyster Bay	Case	Sagamore Garage Co.
Park Falls	Case	J. B. Saunders
Quogue	Case	C. W. Beery
Rhinebeck	Saxon	Turton & Snyder
Richland	Case	W. O. Paddoch
Rochester	Lexington	Pritchard-Lyon Motors Corp.
Schenectady	Imperial	Wideman-Niles Garage
Seneca Falls	Kissel	O. E. & E. J. Riegel
Silver Creek	Detroiter	F. B. Porter
Southold	Case	Southold Garage
Stevens Point	Case	Reliable Garage
Syracuse	Saxon	Shaw & Simons
Utica	Detroiter	Henry & Morris
Waterloo	Detroiter	Iroquois Garage

North Carolina

Charlotte	King	A. Burwell

Ohio

Akron	Davis	L. P. Putt
Camden	Davis	J. E. Sizelove
Cincinnati	Davis	Bente & Ricke
Cincinnati	Lexington	Cincinnati Motor Truck Co.
Cleveland	Jeffery	J. H. Greenwald Co.
Cleveland	Chandler	Cuyahoga Sales Co.
Cleveland	Cole	Richardson Motor Car Co.
Cleveland	Paige-Detroit	Lucas & Christenson
Cleveland	Velie	Velie Motor Car Co.
Cleveland	Maxwell	Velie Motor Car Co.
Cleveland	Krit	Forest City Garage
Cleveland	King	Dunham Motor Car Co.
Cleveland	Moon	Dunham Motor Car Co.
Cleveland	Franklin	Eckeroth Sales Co.
Cleveland	Haynes	Cleveland Motor Car Co.
Cleveland	Hudson	Hudson Stuyvesant Co.
Cleveland	Apperson	Fisman Automobile Co.
Cleveland	Imperial	Fisman Automobile Co
Cleveland	Lewis	Fisman Automobile Co.
Cleveland	Dodge	Neighbors Motor Co.
Cleveland	Milburn	H. D. Haupt
Cleveland	Reo	Auto Sales Co.
Cleveland	Saxon	Euclid Square Supply Co.
Cleveland	Ohio	H. D. Haupt
Cleveland	Briscoe	Empire-Briscoe Co.
Cleveland	Empire	Empire-Briscoe Co.
Cleveland	Chalmers	J. H. Greenwald
Cleveland	Milburn	H. D. Haupt
Columbus	Lexington	F. Mayer & Son
Covington	Davis	J. B. Kindell & Son
Dayton	Davis	McCann Realty Co.
Dayton	Davis	G. T. Foster
Dayton	King	W. C. Wampler
Greenville	Davis	J. M. Warner
London	Davis	Herbert Harper
New Lexington	Buick	C. C. Dillow
Toledo	Saxon	G. R. Ford
Toledo	Grant	Grant Motor Sales Co.
Wapakoneta	Ohio	F. M. Bowers
Wapakoneta	Maxwell	F. M. Bowers
Waynesville	Davis	Rogers & Son

Pennsylvania

Allentown	Detroiter	I. N. Miller
Allentown	Imperial	V. H. Steckel
Clement	Detroiter	J. M. Dunsmore
Cressona	Detroiter	H. E. Zerbe
Douglasville	Detroiter	J. C. Egoll
Galeton	Detroiter	O. C. Mosch
Gordon	Detroiter	Gordon Garage
Greensburgh	Davis	Penn Motor Sales Co.
Harrisburg	Detroiter	E. C. Ensminger
Hawley	Detroiter	Graham Watts & Son
Hazleton	Detroiter	W. Oelwine & Son
Kingston	Detroiter	Keystone Motor Car Co.
Lebanon	Detroiter	Lebanon Auto & Garage Co.
Lewisburg	Detroiter	F. H. Smith
Lewiston	Detroiter	J. M. Bratton
Lock Haven	Detroiter	J. S. Waite & Co.
Montoursville	Detroiter	A. Z. Young
Mt. Union	Detroiter	C. S. Price
Pen Argyl	Detroiter	I. F. Batt
Philadelphia	King	Philadelphia Agency
Philadelphia	Davis	W. W. Gawthrop
Philadelphia	Milburn	Milburn Electric Car Co.
Philadelphia	Simplex	Thornton Foller Auto & Co.
Pittsburgh	Simplex	T. M. Pepperday Co.
Pittsburgh	Davis	B. C. Emerson
Pittsburgh	Davis	Kossler Motor Sales Co.
Reading	Detroiter	Star Motor Car Co.
Reading	Oldsmobile	Penn. Garage
Ridley Park	Detroiter	W. N. Erskine
Rimersburgh	Davis	J. I. Randolph
Scranton	Saxon	Lackawanna Automobile Co.
Shippensville	Davis	J. M. McLaughlin
Spangler	Saxon	Saxon Sales Co.
Towanda	Kissel	W. E. Dayton
West Newton	Davis	West Newton Garage Co.
Wilkes Barre	Stearns-Knight	Deitrick Motor Car Agency
Wilkinsburg	Lexington	Central Garage Co., Inc.
York	Dodge	J. W. Richely Auto Co.

South Carolina

Lexington	Saxon	A. J. Fox

Tennessee

Memphis	Ohio	J. A. White Auto Co.

Texas

El Paso	King	J. E. Sullivan
Galveston	Saxon	C. Newling

Utah

Salt Lake City	Chandler	C. A. Quigley

Virginia

Richmond	Imperial	Alsop Motor Car Co.

Washington

Walla Walla	King	Moore Auto & S. Co.
Spokane	King	Moylan & Reilly Auto Co.

Vermont

East Burke	Detroiter	F. M. Davis

West Virginia

Clarksburg	Lexington	J. M. Shields
Huntington	Oldsmobile	C. T. Rabert
St. Mary's	Oldsmobile	G. K. Riggs

Wisconsin

Antigo	Maxwell	J. W. Hoefer
Antigo	Dort	Hessell Hardware Co.
Berlin	Dodge	Leschelt & Schweikle
Boscobel	Chevrolet	Olson & Kratochwill
Brandon	Regal	P. G. Dreger
Brandon	Ford	P. G. Dreger
Cedarburg	Kissel	Glen Rix
Delavan	Reo	W. H. Stewart & Son
Denmark	Dort	Kirwanek Bros. Co.
De Pere	Dodge	Toonen-Berlament Wright Co.
Fall River	Case	A. E. Kosek
Fond du Lac	Chevrolet	J. D. Giddings
Fond du Lac	Dort	Clark Motor Co.
Fredonia	Dodge	E. C. Clauss
Green Bay	Sphinx	Hooker & Kittell
Green Bay	Dort	Du Bois, Haevers Co.
Green Lake	Ford	G. A. Hill
Green Lake	Overland	G. A. Hill
Lyndhurst	Chevrolet	Voelz & Boehm
Madison	Dodge	Madison Motor Car Co.
Madison	Moline-Knight	Madison Motor Car Co.
Markesan	Kissel	W. H. Wilson
Marshfield	Kissel	Hugo Wegner
Marshfield	Grant	Hugo Wegner
Mayville	Dodge	Pioneer Auto Co.
Milwaukee	Marmon	Hughes Motor Car Co.
Milwaukee	White	Wells Garage Co.
Milwaukee	Moline-Knight	Wait Automobile Co.
Milwaukee	Chevrolet	Frint Motor Car Co.
Milwaukee	Dort	E. F. Sanger
Neenah	Oldsmobile	Harvey Brown Agency
New London	Dort	Anderson-Dort Motor Car Co.
Oshkosh	Overland	Thom Automobile Co.
Oshkosh	Studebaker	Thom Automobile Co.
Oshkosh	Dodge	Thom Automobile Co.
Prairie du Chien	Franklin	L. Bushing
Stevens Point	Dodge	Auto Sales Co.
Sparta	Kissel	George Mannel
Westfield	Moline-Knight	Schauer Bros.
Whitewater	Moline-Knight	A. A. Coburn & Son

Wyoming

Rock River	Oldsmobile	J. C. Schork

COMMERCIAL CARS

California

Los Angeles	Koehler	W. S. Sparks

Colorado

Denver	Walker	E. M. Jackson

Connecticut

Hartford	G.M.C.	The Keeney Garage

Indiana

Batesville	Koehler	Meyer Hardware Co.
Shelbyville	Koehler	Carson & Morrison

Iowa

Cedar Rapids	Nevada	Blake Auto Co.
Webster City	G.M.C.	Hanson & Tyler Auto Co.

Kentucky

Louisville	Republic	P. M. Andriot & Sons
Louisville	U.S.	Louisville Auto. Exchange

Massachusetts

Boston	Garford	R. E. Taylor Co.
Boston	Rowe	E. F. Banker
Boston	Willys-Util'y	R. E. Taylor Co.
Boston	Denby	Denby Motor Truck Sales Co.
Boston	Peerless	Beacon Motor Car Co.
Cheshire	Koehler	S. W. Curtis
Monson	Koehler	Monson Garage
Worcester	Vim	F. S. Howard

Michigan

Detroit	O.K.	Arthur Power

Missouri

St. Louis	Knox Tractor	West End Auto Repair Co.

New York

New York	Denby	Denby Motor Truck Sales Co.

Ohio

Cleveland	Krebs	National Garage Co.
Columbus	Koehler	Miller-Main Garage

Pennsylvania

Reading	Koehler	S. A. Stein

Tennessee

Nashville	Republic	Hatsfield Auto Co.

Texas

Houston	Vim	Magnolia Motor Sales Corp.

Utah

Ogden	G.M.C.	Fell-Wright Co.

Virginia

Charlottesville	Koehler	Charlottesville Hardware Co.

ACCESSORIES

Remy Eight Cylinder Timer

REMY equipment for ignition of eights follows the general lines of the four- and six-cylinder outfits, that is to say, there is one form in which the distributer is mounted separately, another in which it is combined with a coil and mounted on a pad to take the place usually occupied by the magneto, and the third which has the distributer mounted integrally with the generator. Each type is made with either manual or automatic spark advance, and it is pointed out that the automatic kind can be made to suit the needs of any particular motor.

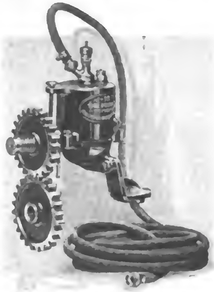
Remy timer for eight-cylinder motors

A Remy feature that has some good points is the fact that advance and retard are effected without moving the whole distributer, which means that the spark plug leads are not moved and shifting the spark lever cannot by any possible chance cause the wires to chafe.

The Remy company has an eight-cylinder magneto in preparation at present and expects to have it on the market shortly.—Remy Electric Co., Anderson, Ind.

J-M Engine Driven Tire Pump

This is a single-cylinder tire pump which, though small and compact, is said to be capable of inflating a 34 by 4 tire in 2 1-2 minutes and a 30 by 3 1-2 in less than a minute. The pump is 3 3-4 inches high by 3 inches in diameter and weighs 4 1-2 pounds; the bore is 2 1-4 inches and the stroke 7-8 inch. Cylinder piston and base are of fine-grained gray cast iron with the wearing surfaces ground; the connecting-rod is of steel; and the piston packing is of an asbestos material made especially for the purpose.



J. M. engine driven tire pump

To minimize heating the intake and outlet valves are made extra large, and an automatic pressure relief valve is provided. This, blowing off at the pressure at which the tire is fully inflated, eliminates the necessity for a pressure gauge. Lubrication is effected by packing the pump with soft graphite grease, so that there is no liquid lubricant to work into the air supply.

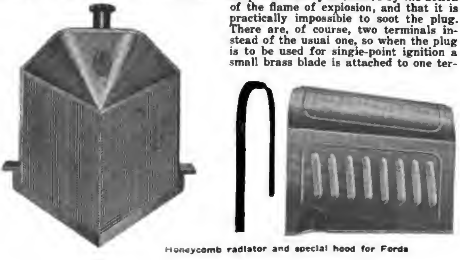
At present the pump is supplied for installation on Fords, Overland models 79-80, Buick models 24, 25, 36, 37 and 56, and all Reos except the late 1915 models. Brackets for other cars will be added. Installation is simple, requiring no machine work and no readjustment of any part of the motor. A split gear is furnished which is placed on the crankshaft of the motor and drives to a gear on the pump shaft. The pump gear slides into and out of mesh, a coil spring normally holding it out.

The price of the pump complete with gears and air hose is $7.50.—H. W. Johns-Manville Co., New York City.

Special Ford Radiator

The illustrations below show a new hood and radiator for Ford cars, these two fittings being made in two different patterns to suit 1915 Fords and those previous to 1915. Both radiators are of honeycomb construction following the usual Livingston system which carries the water round three sides of each air tube, the flow being both horizontal and vertical. They can be had with a flat front or pointed, the only difference in fitting being that the latter type needs an extended starting crank for the motor which is given with the pointed radiator without extra charge. The use of corrugated tubes in the radiator is said to allow some freezing up without damage, as the natural spring allows for the expansion. The flat radiator costs $35 and the pointed type $40.

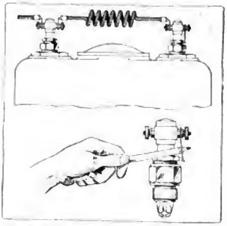
The hoods have ventilating slats and they attach to the standard Ford hooks so only a screwdriver is necessary to change from the old to the new. It should be added that the hoods do not necessarily go with Livingston radiators as they will fit equally well on the ordinary Ford radiator. The hood is cheap, costing $8 finished in black enamel.—Livingston Radiator Mfg. Co., New York City.



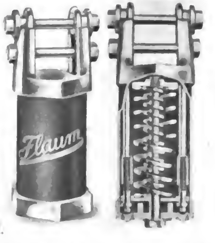
Honeycomb radiator and special hood for Fords

Double Pole Plug

The "Peco" is a spark plug with two insulated electrodes, and it can therefore be put in series with another plug so as to give a two-point ignition. It has as another feature a special sort of porcelain which is carried well down into the combustion chamber and is shaped like a wedge, being thus freed from hollows likely to accept accumulations of carbon or oil. It is claimed that this wedge-shaped extremity is cleaned by the action of the flame of explosion, and that it is practically impossible to soot the plug. There are, of course, two terminals instead of the usual one, so when the plug is to be used for single-point ignition a small brass blade is attached to one ter-



Peco double pole plugs showing series mounting and use of side blade for testing spark



Flaum shock absorber with double spring for heavy cars

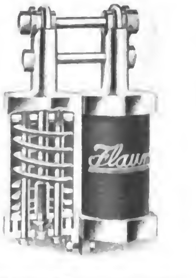
minal, with its lower end touching the plug body. This can be used as a spark gap for testing the source of current by inserting the point of a pencil between the plug and the blade and lifting it away from its contact with the plug body. Two-point ignition has shown increased power on a good many motors, and this plug makes it easy to try out because all necessary is a set of plugs and enough wire to make the bridges across from one plug to the other in each cylinder. The plug sells for $1.25.—Power & Efficiency Co., Trenton, N. J.

Adjustable Shock Absorber

To shock absorbers of the supplementary coil-spring type there seems no end, which shows that this apparently simple accessory is capable of a great deal of refinement. One of the most recent additions to the range is the Flaum, which comprises a compression spring contained within a cylinder, the spring being readily adjustable from outside. For light cars a single spring is employed, but two concentric springs replace this when the chassis is exceptionally heavy. Besides the adjustment for the spring to give the requisite ease of riding to suit the car and the road there is also an internal adjustment to permit the absorber hangers to be altered in height to suit the original springs of the car. Either single-cylinder or twin types are obtainable, and the prices vary from $15 to $30, according to to size.—Flaum Shock Absorber Co., New York City.

Large Tube Spanner Kit

No automobile can be considered well equipped without a set of tubular spanners; but the kit illustrated below is not intended for use on the road. As a complete outfit for a garage it should be extremely useful, as it would surely be difficult to find a nut on any kind of car that could not be tackled with some portion of this compendium of spanners. The whole kit with its case sells for $60. —Walden Mfg. Co., Worcester, Mass.



Twin pattern of Flaum shock absorber

Catalogue and Pamphlet Review

To Prevent Belt Slip—Sticky compounds are usually employed to give belt adherence to ordinary pulleys, but there is an alternative which consists in covering the pulleys with a leather-like substance, and this is claimed to give driving grip without "stiction." The process is simple and a recently published leaflet describes it fully.—Gripwell Pulley Covering Co., Hollis, Long Island, N. Y.

Exide Batteries—Motorists who want to keep their batteries in proper condition must treat them intelligently, and to do so it is necessary that they understand them to a limited extent. Manufacturers, on the other hand, in choosing battery equipment for their cars, want to know the why and wherefore of different kinds. Both user and automobile maker will find much information along these lines in the latest Exide catalogue, which is very complete in detail information.—Electric Storage Battery Co., Philadelphia, Pa.

Tire Wisdom—The care and repair of tires is a never ending subject, and its importance will last just as long as the pneumatic tire itself. A tire is unique amongst automobile parts in that it is expected to wear out rapidly and the worst of chassis is reckoned equal to the destruction of a good many sets of the very best of tires. It is probably true that a poor tire used properly will give as good service as a good tire used stupidly, and it is also likely that most motorists through ignorance of what it pays to do with tires, never get much more than half the possible mileage from a set of tires. Thus a booklet telling in simple, terse expressions how tires can be abused by lack of thought is bound to be of value to any one who will spare the time to read it. Everything, from the choice of a tire down to the repair of little injuries in an intelligent manner, is contained in a Firestone book, "Care and Repair of Tires," and it is illustrated so well, with such carefully chosen wording, that any one could gain much useful knowledge from it. Half an hour would suffice to read it through and grasp the principles it teaches and it would be a half hour well spent. The book is not an advertising pamphlet, but a really useful addition to a motorist's library.—Firestone Tire & Rubber Co., Akron, O.

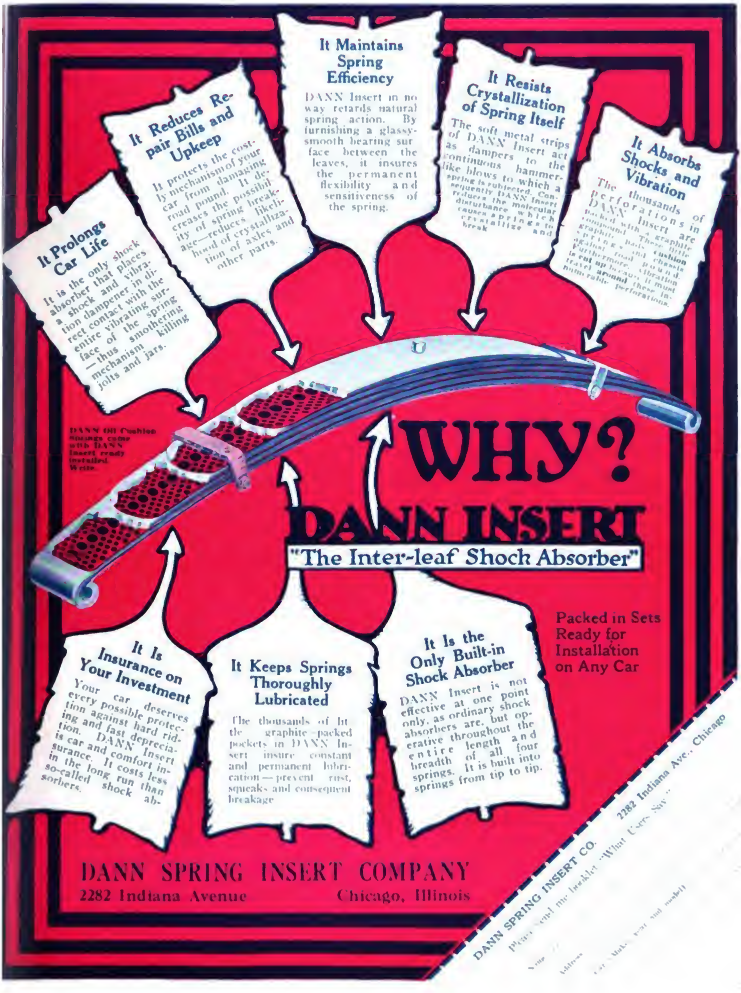
New Tops—A new top would seem a difficult thing to order by mail except from the maker of the original one, but it is really only a matter of measuring up the old top properly. A firm who specialize on top making have got out a form in which a typical top is illustrated and all the necessary dimensions marked in red—after the fashion of a tailor's self-measurement form. With this aid it should be possible for almost any one to order a new top with confidence.—Buob & Scheu, Cincinnati, O.

Walden tube spanner garage set

Windshields—It is not often that we receive so practical a catalogue as that which deals with Vanguard windshields, nor one that is more imposing in appearance. Externally it is a plain brown cover devoid of printing, and some 14 inches square. Inside there are five sheets of excellent half-tones showing the manufacturer's plant, and then follow 14 sheets of genuine blueprints giving all the styles and patterns of shields and showing the method of fitting. The angles through which the hinged parts turn are marked and the scale is somewhere about half actual size. The book would appeal much more to the manufacturer or dealer than to the private user, but it is not, of course, intended for the latter.—Vanguard Mfg. Co., Detroit, Mich.

Comfortable Roadside Meals—It is possible to enjoy a meal taken by the roadside, but it is not to be done without due forethought. For the tourist, means to provide really appetizing food that will not seem a makeshift spells better health and also saves money. Just now every one is thinking of the summer tour, so the full consideration of car commissariat is timely. It is easy enough to cook as well as to eat in comfort on a car if one has well designed apparatus to combine lightness and efficiency. How this can be done is the subject of an interesting little volume recently issued by —Prentiss-Wabers Mfg. Co., Grand Rapids, Wis.

Radiator Leak Stoper—A new compound which is claimed to stop leaks in a radiator by dissolving in the water and solidifying out as it escapes to the air is called X. It is claimed also to remove scale and so help cooling, while it is said to have no deleterious action upon either metal or rubber.—X Laboratories, Boston, Mass.



WHY?

DANN INSERT

"The Inter-leaf Shock Absorber"

It Prolongs Car Life

It is the only shock absorber that places a shock and vibration dampener in direct contact with the entire vibrating surface of the spring—thus smothering mechanism killing jolts and jars.

It Reduces Repair Bills and Upkeep

It protects the costly mechanism of your car from damaging road pound. It decreases the possibility of spring breakage—reduces likelihood of crystallization of axles and other parts.

It Maintains Spring Efficiency

DANN Insert in no way retards natural spring action. By furnishing a glassy-smooth bearing surface between the leaves, it insures the permanent flexibility and sensitiveness of the spring.

It Resists Crystallization of Spring Itself

The soft metal strips of DANN Insert act as dampers to the continuous hammer-like blows to which a spring is subjected. Consequently DANN Insert reduces the molecular disturbance which causes springs to crystallize and break.

It Absorbs Shocks and Vibration

The thousands of perforations in DANN Insert are packed with a graphite compound. These little graphite pads cushion springs and chassis against road pound. Furthermore, vibration is cut up because it must travel around these innumerable perforations.

DANN Oil Cushion Springs come with DANN Insert ready installed. Write.

It Is Insurance on Your Investment

Your car deserves every possible protection against hard riding and fast depreciation. DANN Insert is car and comfort insurance. It costs less in the long run than so-called shock absorbers.

It Keeps Springs Thoroughly Lubricated

The thousands of little graphite-packed pockets in DANN Insert insure constant and permanent lubrication—prevent rust, squeaks and consequent breakage.

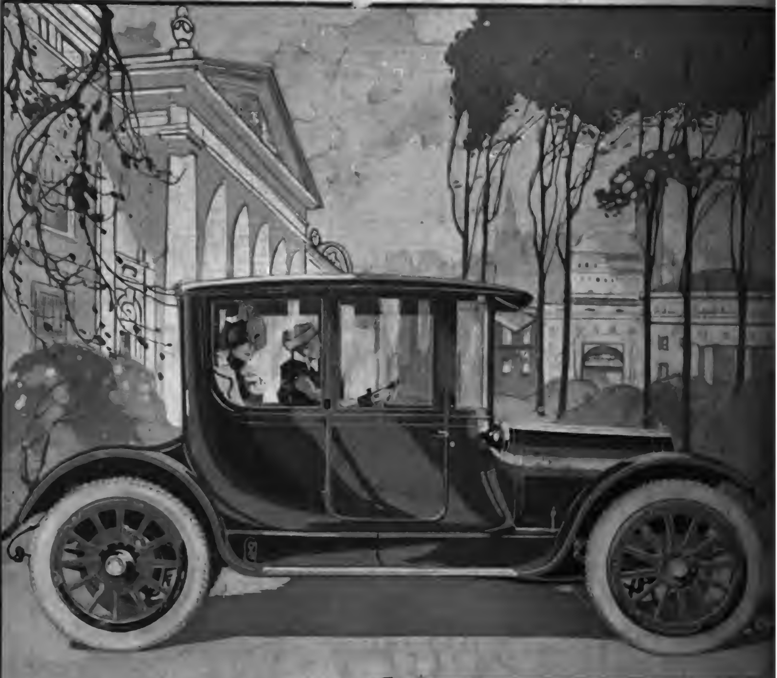
It Is the Only Built-in Shock Absorber

DANN Insert is not effective at one point only, as ordinary shock absorbers are, but operative throughout the entire length and breadth of all four springs. It is built into springs from tip to tip.

Packed in Sets
Ready for
Installation
on Any Car

DANN SPRING INSERT COMPANY
2282 Indiana Avenue Chicago, Illinois

DANN SPRING INSERT CO. 2282 Indiana Ave., Chicago
Please send me booklet "What Users Say"
Name
Address
Car (Make, year and model)



Overland
TRADE MARK RE

Coupe

$1600

F.O.B. TOLEDO

The Most Practical Car of the Season

The Overland Coupe is simple, beautiful and artistic.

It is a practical car for use in all seasons.

The interior is completely upholstered with fashionable mouse grey Bedford cord cloth of soft but strong texture.

Long underslung rear springs add much to the riding comfort.

The price is remarkably low—$1600.

Immediate deliveries.

Catalog on request. Please address Dep't 38

"Made in U. S. A."

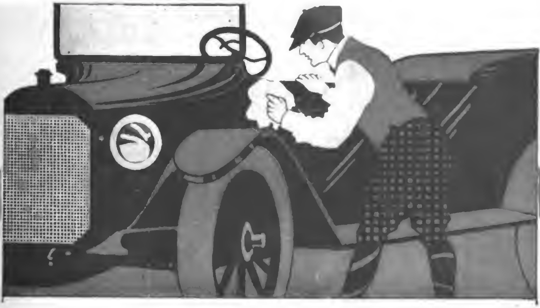
The Willys-Overland Company
Toledo, Ohio

The AUTOMOBILE

Vol. XXXII
No. 15

NEW YORK, APRIL 15, 1915

Weekly
Price Ten Cents



JOHNSON'S Prepared Wax is the *standard* polish for automobiles—used and endorsed by leading car manufacturers and body builders.

JOHNSON'S PREPARED WAX

One application of JOHNSON'S Prepared Wax makes an old car look new—imparts a **hard-dry** high gloss which holds its lustre indefinitely. Its greatest advantage is that

It Does Not Gather Dust

JOHNSON'S Prepared Wax minimizes the hard labor of keeping a car always looking its best.

JOHNSON'S Prepared Wax covers up small scratches, preserves the varnish, protects it from the weather and

"Sheds Water Like A Duck's Back"

It is clean and easy to use. Most economical. Absolutely harmless. A varnish food. Not an acid polish. Often saves costly refinishing bills.

Send 10c. for can of JOHNSON'S Prepared Wax — sufficient for one application on a large car

S. E. Johnson & Son
Dept. A
Racine, Wisconsin

BRISCOE

Individuality stands out all over the BRISCOE car. It is not a copy but a creation, possessing an air of exclusiveness that makes an instant appeal to every buyer—built to stand up indefinitely.

In representing the BRISCOE, you are selling a car that gives the purchaser greater value than anything else at anywhere near the price.

You are offering a foreign car, with all that term implies—an automobile of French design mechanically, as well as in graceful foreign body lines—*at an American price.*

The prospect feels instinctively that here is a car singularly worth while, and the more he studies it, the more positive he becomes—an enthusiastic worker on your behalf—a more valuable sales agent than money could buy.

This is one of many reasons that make the BRISCOE the easiest and most thoroughly satisfactory car for dealers to handle.

CONSIDER THE BRISCOE, FROM ITS UNUSUALLY SMART EXTERIOR TO THE INNERMOST PARTS OF ITS MECHANISM, AND YOU WILL FIND BY FAR THE BIGGEST VALUE, DOLLAR FOR DOLLAR, TO BE FOUND IN ANY CAR.

A liberal contract is offered to all responsible live-wire dealers who wish to increase their profits by the sale of BRISCOE cars. But territory is being allotted fast right now. Better get in touch with us without delay.

BRISCOE MOTOR COMPANY INC. JACKSON MICHIGAN

VOL. XXXII NEW YORK—THURSDAY, APRIL 15, 1915—CHICAGO No. 15

The AUTOMOBILE

Europe's High-Efficiency Motor

Part I

A Series Dealing with All Problems of Design for Racing or Touring Cars—Both Theory and Practice Considered—Forms Compared and Principles Elucidated

By S. Gerster*

MUCH of the recent progress in the design and construction of automobile motors is due to the rules of French road races and particularly to the 1913 French grand prix. In this race there were no restrictions of cylinder volume, but the fuel consumption had to be not higher than at the rate of 14.1 miles per gallon, with a minimum car weight of 1,763 pounds and a maximum of 2,425 pounds. The task was an unusually difficult one, for at the time exact data on motors of this type was lacking. Small motors of 250 to 300 cubic inches piston displacement filled the conditions to the best advantage.

In 1914 the race was run with a piston displacement limited to 4-5 liters, or 275 cubic inches, from which it was possible to obtain about 135 horsepower. In building the motors for this race advantage was taken of the experience gained during the 2 preceding years. It is a notable fact that not only was the piston displacement decreased for a given horsepower, but the fuel consumption was decreased in a very large proportion. Piston speeds were increased as much as possible in 1913, when it was found possible to attain a linear speed of 3,540 feet per minute; this figure was increased very slightly the following year. Rotary speed was carried up to 3,600 r.p.m. and the ratio of stroke to bore was 1.9 to 1.

In two-cycle motors piston velocity was limited by reason of the friction of the pistons in the cylinders, and to the inertia of the pistons when these latter were of the stepped or piston-pump type.

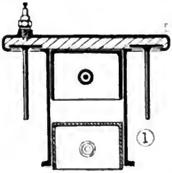
In four-cycle, poppet-valve motors piston speeds are generally limited by the sections of the gas passages through the valves. The inertia of the valve and of the pushrod enter into account and cause a certain lag in the closing of the valve. This brings about defective feeding and scavenging of the cylinders.

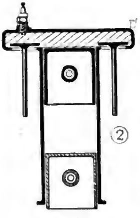
Later in this article I shall point out the progress and changes made in the earlier types of motors. For the present we are not concerned with *light* motors, but with motors that are efficient in relation to their displacement, and of motors with a low gasoline consumption.

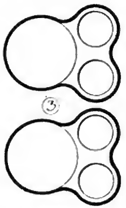
Linear piston displacement is the basis of the design of any motor, but this is tributary to other factors, such as the inertia of the masses in movement,

---

* EDITOR'S NOTE—*S. Gerster, the author of this series of articles written exclusively for* THE AUTOMOBILE, *is particularly well qualified to deal with all the problems of the small, high-speed, high-efficiency motors from which European engineers have obtained such wonderful results. After a technical training in the Swiss engineering schools and universities, Mr. Gerster entered first the steam then the gas engine department of one of the leading French engineering firms. For a number of years he has specialized in motor design, and as an independent engineer is responsible for the design of one of the most successful series of motors built by a firm manufacturing for the trade only. Mr. Gerster is a lecturer on motors at the French Army Aeronautic School.*







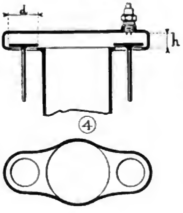


Fig. 1—Square motor with stroke and bore equal

Fig 2—Motor with stroke twice the bore, showing distance from spark plug to furthest point of combustion space greatly reduced

Fig. 3—Illustrating inconvenience of L-head motor when valves are large

Fig. 4—Showing proportion of combustion space depth to valve diameter—h may equal one-quarter d, in extreme cases

the section of the gas passages, the weight of the valves and pushrods, the shape of the combustion chamber, etc. If all these factors are in correct proportion, it is possible to obtain the piston velocity already mentioned, namely 3,540 feet per minute, or

$$V_p = 3{,}540 \text{ feet per minute.}$$

In the majority of touring car motors of the present day, piston velocity varies from 1,570 to 2,350 feet per minute. The higher value is that of the high-efficiency motors built by such firms as Hispano-Suiza and Vauxhall.

The number of revolutions of a motor is a function of the piston speed, of the stroke, and of the auxiliaries already mentioned. It may be stated that the r.p.m. of the motors under consideration is between 3,500 and 4,000, whereas the older types of car motors varied from 1,800 to 2,000 revolutions:

The ratio of bore to stroke is, in general, as follows:

$$\frac{D}{C} = \frac{1}{1.8} \text{ to } \frac{1}{2}$$

when

D = diameter of the piston

and

C = stroke of the motor.

Formerly motors were built with a ratio of

$$\frac{D}{C} = \frac{1}{1}$$

as shown in Fig. 1.

With such an arrangement the combustion chamber was very flat and an appreciable length of time must elapse before the whole of the mixture is ignited from the spark plug B to the point e.

Fig. 2 shows a cylinder with a bore-stroke ratio of 1 to 2. It will be seen that the combustion chamber is much more compact, and in consequence the ignition of the mixture from the plug to the point E is much more rapid and the motor is capable of turning at a higher number of revolutions. It is necessary, in order to secure the highest efficiency, to obtain a combustion chamber as nearly approaching the spherical as possible.

Effect of Shape of Combustion Space

The form of the combustion chamber is of the greatest importance in a high-efficiency motor; unfortunately structural difficulties do not always allow the most advantageous form to be adopted. Fig. 3 shows the least advantageous arrangement if high efficiency is to be secured. The two valves are side by side, and if they are made sufficiently big for their work the cylinders become widely separated, the length of the motor is exaggerated and weight is increased. However, it is possible to build this type of motor with a fairly high coefficient of power efficiency.

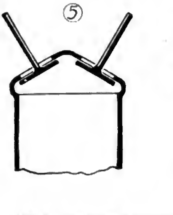
A better arrangement is shown in Fig. 4, with valves on opposite sides. In order to diminish the area of the combustion chamber it is necessary to reduce the height *h* as much as possible. It can be made 1-4 of *d*. By using a single spark-plug, placed over the intake valve, it is possible to obtain an excellent efficiency. This type of motor is well represented by the Hispano-Suiza. By the use of two plugs per cylinder it is possible to obtain an increase of 3 per cent. in the power.

A better arrangement is that of the Mercedes aviation motors with two valves per cylinder, as shown in Fig. 5, where the efficiency is again higher.

In order to get a better result from the combustion chamber, it has been fitted with four valves, two for the intake and two for the exhaust. In this way a more advantageous form of combustion chamber is obtained than with two valves only. Another advantage is the decrease in the weight of the valves. By the use of two intake valves for a given diameter of gas passage, it is possible to obtain a lower weight than with a single valve. By this means only it is possible to increase the r.p.m. of the motor without being handicapped by the inertia of the valves and the push rods. Fig. 6 shows an arrangement with four valves from which it is possible to obtain a very high efficiency indeed. The combustion chamber is the most compact possible with the T-head type of motor.

All Racing Motors Have Four Valves

The arrangement shown in Fig. 7 is more commonly employed and is that which gives the best results. The two intake and the two exhaust valves are on opposite sides and



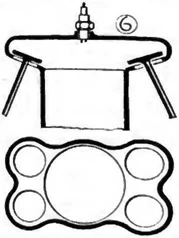


Fig. 5—Cylinder of Mercedes aviation type with two inclined overhead valves

Fig. 6—Best possible form of T head with four valves

in the same plane. They are operated either by a single camshaft with rocker arms or by two camshafts, one above each row of valves. With this arrangement the maximum efficiency has been obtained.

The latest racing motors built by Mercedes, Schneider, Opel, Peugeot, Delage and Alda were designed on this principle. The Alcyon company has sought to get better results by building a motor with the combustion chamber as shown in Fig. 8, AA being the longitudinal axis of the motor. The mechanism for operating these valves became too complicated, the weight of the moving parts became too great, vibrations were set up in these parts and the motor speed was limited.

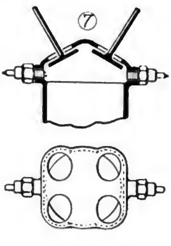
In designing a new type of motor, the use to which it is to be put should be kept clearly in view—whether it is for a racing car, an aeroplane, a dirigible balloon, or for a touring car intended to have a long life. If it is for a racing car there is every incentive to get the piston speed Vp as high as possible. Thus:

In aviation motors having the propeller mounted on the crankshaft, the designer is generally limited by the number of revolutions of the propeller and in consequence the piston speed is low, namely:

$Vp = 18$ to 20 meters (59 to 65 feet) per second.

For high efficiency touring car motors it is possible to get the following:

$Vp = 14$ to 16 meters (46 to 52 feet) per second



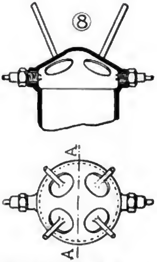


Fig. 7—Most popular design of four-valve overhead motor

Fig. 8—Four valves arranged so as to approximate still closer to the hemispherical form. This proved unsuccessful by reason of the weight of valve-operating parts

We may next proceed to consider the effect of compression and of the speed of the gas through the ports and manifolds.

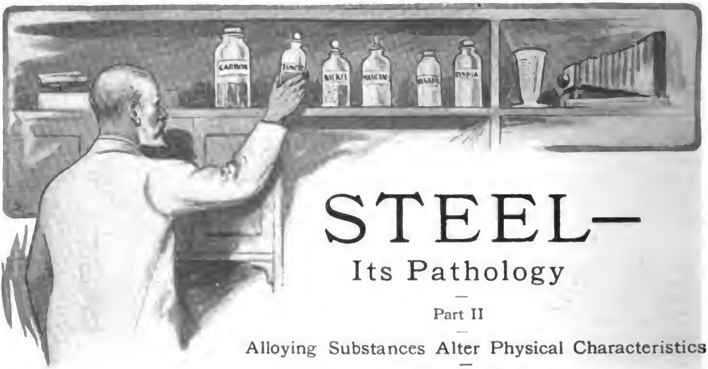
(To be continued)

Testing Cadillac Eights on 72 Motor Stands with Full Dynamometer Equipment

DETROIT, MICH., April 12—The motor testing department of the Cadillac Motor Car Co. is good proof of the fact that the concern is making eights and making them fast. The room has seventy-two engine stands with electric dynamometers and all apparatus ready for running the newly assembled motor. The test is really for "running-in" purposes, and each engine undergoes four different runs before it is ready to go into a chassis. The total of these runs is 5 hours, and they are as follows: First—At 450 r.p.m. developing 3 horsepower for 1-2 hour; second—at 600 r.p.m., 6 horsepower for 1-2 hour; third—developing 7.5 horsepower for 1 hour; and fourth—at 1,000 to 1,100 r.p.m. developing 10 horsepower continuously for a period of 3 hours.

After this preliminary testing, which takes in a complete adjustment of the engine, it goes to the chassis department, and, after being connected up, there is an indoor chassis test.

The power produced by these engines drives the individual electric generators, and is used to assist in supplying the Cadillac plants, the electric energy thus obtained being added to that received from outside sources, after having been put through a motor-generator set which takes care of any variation in the output of the testing department. The average current obtained in this way is 240 amperes per hour at 250 volts.



STEEL—

Its Pathology

Part II

Alloying Substances Alter Physical Characteristics

By J. Edward Schipper

DOSAGE

Element	Per Cent.
Carbon	.05 to 1.5
Manganese	.35 to 12.0
Nickel	1.00 to 36.0
Tungsten	.40 to 24.0
Chromium	.50 to 2.0
Vanadium	.12 to 6.0
Silicon	0.00 to .4
Titanium	0.00 to .1
Aluminum	0.00 to .02
Molybdenum	0.00 to 15.00

THERE are two main steps in the preparation of an alloy steel: first, the writing of the formula which consists in selecting the required alloying substances in the proper quantities, and second, the heat treatment.

To one only slightly familiar with the principles of metallurgy the marvelous changes that can be made in the qualities of the steel are well known, but before the temperature can be used to good effect the ingredients must be correct. In other words, the prescription accurately written. On the other hand, before the best effects of the alloy are gained the proper heat treatment must have been applied. Thus the two work hand in hand. The doctor of steel must first write his prescription and then place his patient in the climate which will be the most beneficial for the particular ends which he desires to gain.

Before touching upon the effects of temperature we will first consider the alloys most employed in their particular uses. These are the medicines, the tonics, the diets and the health-giving and strength-promoting ingredients which enter into the makeup of the final product. As pointed out in Part I there are five primary qualities which are desired for structural work: Hardness, toughness, malleability and the ability for resisting shock and heat.

Nickel, being probably the most valuable of our alloys, is logically the first to be considered. Of all the alloy steels used in automobile work nickel steel is probably most frequently employed. It is valuable because it possesses the properties of high elastic limit, hardness and ductility. In other words, it can be put to severe stresses before becoming distorted, or, as it is technically termed, before it assumes a permanent set—elastic limit. It is sufficiently hard to withstand ordinary indenting stresses—hardness, and it is malleable enough so that if desired it can be drawn or forged without rupturing or harming the material—ductility.

Nickel is a sinew builder in steel. It increases the strength of the metal in many ways. Thus it is like the food of an athlete designed to build up the muscle. It is not the greatest creator of endurance, but inasmuch as endurance depends greatly on strength, it does render the steel somewhat greater in its resistance to repeated stresses. For example: In a competitive test between two steel shafts, one of .40 per cent. carbon and the other containing 3.25 per cent. nickel, the latter endured nearly six times the number of revolutions that were endured by the shaft of carbon steel. Krupp steel, which is used extensively for armor plate and which has played such a large part in the great European war, is a steel containing 3.25 per cent. nickel and in addition another great strength builder, chromium, to be dwelt upon later.

Nickel the Muscle Builder

Another way in which the nickel steel compares with the muscle-building food of the athlete is in the litheness which it promotes. The litheness of a man may be compared to the ability to be forged in a steel. Nickel steel forges readily and when the carbon is low it can easily be worked cold. Here is seen the trait of carbon which, when high, makes for hardness and, when low, for softness. Thus, low carbon nickel steel can be bent while cold without losing any of its strength; whereas, on the other hand, high-carbon nickel steel is very hard.

Nickel is generally added in the percentage of 3.5, and in nickel steel carbon ranges from .10 to .75 per cent. Tensile strength, which may be called toughness, or the ability to resist a force which tends to pull the metal apart, is the great criterion of steel. Nickel steel has a 40 per cent. greater tensile strength than a simple steel of the same carbon content. Or, to put it in another way, the elastic limit of nickel steel is from 10 to 20 per cent. greater than a carbon steel of the same tensile strength.

Nickel does not produce its full effect without the help of the medicine, manganese, the purgative. This must be in the correct proportion to neutralize the harmful sulphur and oxygen or the value of the nickel will be lost.

The use of nickel is not new, having been known since the earliest times of which we have record. It was employed by the old Chinese in the form of an alloy called pakfong and outside of its use as a structural steel alloy it has many other uses. One nickel steel known as Invar containing 35.7 per cent. nickel has such a small coefficient of thermal expansion that it is practically negligible.

Although in catalogs the use of nickel steel is mentioned for a wide variety of parts throughout the car, it is not true that only one kind of nickel steel can be used for all purposes. There are various kinds and qualities of nickel steel, the chief difference being that in the results secured by the heat treated processes. For general use the 3.5 per cent. nickel is that most in demand and one authority gives as a very useful composition for drop stampings or forgings of such parts as steering levers, connecting-rods, etc., the following:

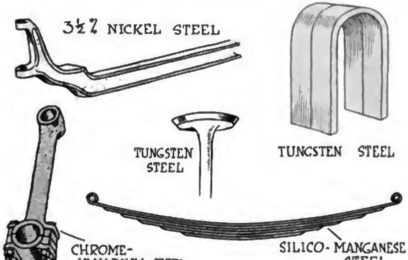
Carbon	.30 to .35	per cent.
Silicon	.15 to .175	" "
Sulphur not exceeding	.03	" "
Phosphorus	.03	" "
Manganese	.60 to .75	" "
Nickel	3.00 to 3.50	" "

After being heat-treated a steel of the above specifications will have a tensile strength of close to 50 tons per square inch. A 1-inch bar could carry suspended twenty-five large touring cars, a simple steel having carbon alone in the percentage of .40 would carry fifteen cars only. The elastic limit is 37 tons per square inch. Before stretching beyond its first length a weight equal to 74,000 pounds could be lifted as compared to 48,000 pounds for steel without the nickel.

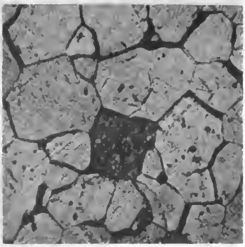
Thus, nickel is a toughener. It increases the elastic limit in great proportion to the ultimate strength of the material. At the same time, it produces a steel that acts well under repeated stresses. Furthermore, it can be made with great uniformity and the results obtained from a stated prescription can be calculated upon in advance with the certainty that the ultimate results will justify the calculation.

The probable reason for the strength of nickel steel and its toughness can be traced back to the molecular structure. Nickel steel has very minute grains, the molecules being small and uniform, furnishing no lines of weakness such as are found in structures where large grains exist. It is comparable to sewing together two pieces of cloth. If only a few stitches are taken to effect the joining of the cloth, it will be much weaker than were they sewed together with fine stitching. There are no lines of weakness and consequently there is little tendency for a crack to spread through a large extent of the metal.

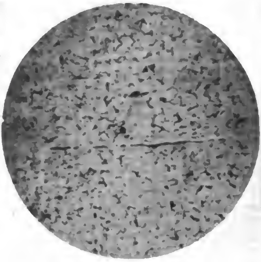
Tungsten does for steel what hard work and training do for the athlete. It hardens the metal and renders it impervious to wear. In the athlete, if he were training for a football contest and accomplished for himself what tungsten does for steel he would be able to withstand great punish-



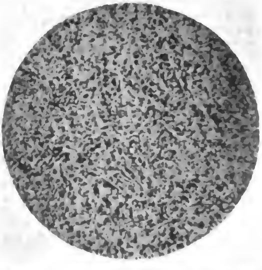
Parts made of alloy steel, showing uses of the principal alloying substances



Micro-photograph of wrought iron, showing the coarse grains when magnified 500 diameters. These grains are ferrite, a form of practically pure iron.—W. Campbell.

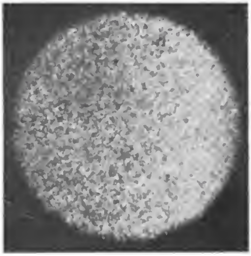


Low carbon steel magnified 50 diameters. Note the finer grain as compared with the wrought iron above, showing basic difference between iron and steel. The streaks through the center are slag, rolled into sheets.—W. Campbell.

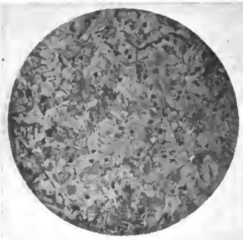


Refined steel casting. The three micrographs shown above are definite steps in the manufacture of unalloyed steels. It is interesting to compare them with the alloy steels shown on the following pages.—W. Campbell.

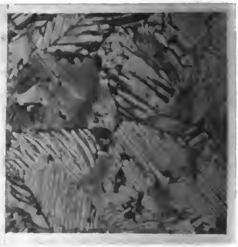
ment without becoming bruised. Tungsten steel has for its main recommendation the fact that it can go through enormous stresses and under trying conditions of high temperature without losing its quality of hardness. Primarily tungsten is a hardening element, a resister of heat and a retainer of magnetism. These three qualifications have made this one of our most important alloying substances.



Top—Chrome nickel steel in its refined condition, showing the closely interwoven molecular structure which gives the steel the remarkable tensile strength and high elastic limit.—United Steel Co.



Lower left—Hadfield's manganese steel before refining, showing the coarse structure of the metal. This shows the grains magnified 100 times.—R. A. Hadfield



Lower right—The same steel magnified 600 diameters, showing the lamellar construction of the grains which go to make up the mixture.—R. A. Hadfield

Tungsten Promotes Hardness

By incorporating simultaneously carbon and tungsten it is possible to obtain a much harder steel than with carbon alone and at the same time the dangers of increasing the brittleness to a dangerous extent are eliminated. It is used in combination with chromium for high-speed steels with which cutting is done at a high rate without the tools losing their edge through the high temperatures created. Naturally, to endure the stresses and shocks of cutting through steel the metal which acts as the cutter must be hard and it must have the necessary shock-enduring qualities. The hardness is imparted by the tungsten. The shock-absorbing qualities are imparted by chromium.

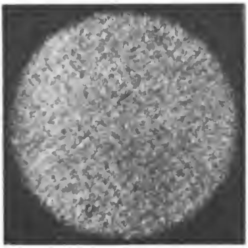
One of the greatest uses to which tungsten is put in the automobile industry is in the manufacture of magnet steel for the permanent magnets of magnetos. When added in proportions of from 5 to 8 per cent. to magnet steel it increases the retentivity of magnets to a remarkable degree and is one of the great factors which allow magnetos to be used for many years without requiring a recharging of the magnets. For poppet valves it is also of great service because it renders the steel hard and therefore removes the danger of pitting always present in cast iron which is frequently used because the resulting structure of the tungsten steel is so finely and closely grained and takes such a glass-hard finish that no inroads are made upon its surface by the heat of the exhaust gases or the pounding of the valve upon its seat. Tungsten raises the melting point of steel to such a degree that certain combinations have been known to resist the intense heat of the blowpipe.

Tungsten assists the carbon in producing hardness and, therefore, in tungsten steel where the tungsten is high the carbon may be low. A less amount of carbon will produce hardness in the presence of tungsten and therefore by its influence on the formation of the grains of different combinations of iron and carbon it renders the metal hard. Tungsten steels have been put on the market in which the percentage of tungsten formed nearly 1-4 or 25 per cent. of the entire mixture, but the usual composition includes only between 4 and 12 per cent. What quality in tungsten makes steel retain magnetism cannot be definitely said as it carries us back to the unexplained reasons for magnetism. The probable reason for the raising of the melting point of tungsten steels is due to its own high melting point.

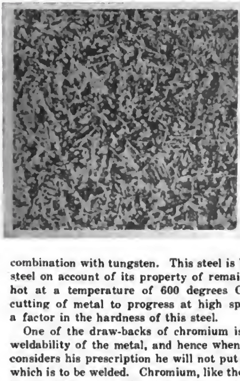
Chromium is the bone builder of steel. It is like the phosphates given by the doctor to build human bone. It strengthens its structural framework and gives it the ability to resist fatigue. In fact, many metallurgists insist that it is the chromium which permits the vanadium to exert its well-known property of making the steel able to resist continuous fatiguing stresses. Chrome-vanadium steels are known for this ability to resist stresses which are oft repeated, but exactly where the action of the chromium ceases and that of the vanadium commences is a much-mooted point. When a human being has a large, bony frame he is able to carry a much greater weight than a man of lighter frame with the same proportion of muscle and tissue. Chromium builds up this bony structure of the steel and overcomes its tendency to become fatigued. When steels become tired the term crystallization is often given to the intermolecular disintegration or separation which is stated to take place. In other words, the structure of the steel breaks down, eliminating the continuous chain of strength which should bind the molecules together.

Chromium takes the one weakness out of hard high-carbon steels. It is a great hardener in itself and yet, it has the valuable quality of combining when in the hardened or suddenly cooled state intense hardness with a high elastic limit. This combination tends to render the steel proof against sudden shocks—a much-desired condition in a hard steel. Since the steel that chromium is used with is hard, one would expect to find the carbon content high and this is the case. The S. A. E. chromium steels have from .95 to 1.20 per cent. carbon, twice as high as in carbon steel, and from 1 to 1.2 per cent. chromium. The hardness is proportional. The manganese in these steels runs from .20 to .45 per cent. and the phosphorus and sulphur not over .03 each. Owing to the property of the chrome steel to resist violent shocks, it is used practically universally for armor plate in conjunction with nickel. Armor plate must be tough and hard, hence nickel and chromium.

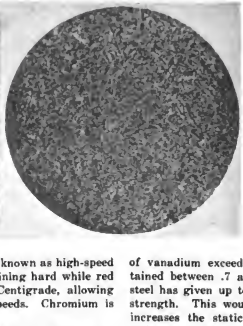
Chromium enters into what is known as high-speed steel in



Top right—Chrome vanadium steel in its refined condition, showing the closely interwoven grains which are due to the holding of carbon in the form of a solid solution. Here the grains are minute and the resulting structure is of great strength. —United Steel Co.



Lower left—Refined Hadfield steel which contains 12 per cent. manganese, showing the structure which is so valuable in securing the necessary hardness. This is magnified 600 diameters.—R. H. Hadfield



Lower right—Hadfield steel in a refined condition magnified 100 diameters. On this scale this steel can be directly compared with chrome-vanadium and nickel steel, also shown on these pages.—R. H. Hadfield

combination with tungsten. This steel is known as high-speed steel on account of its property of remaining hard while red hot at a temperature of 600 degrees Centigrade, allowing cutting of metal to progress at high speeds. Chromium is a factor in the hardness of this steel.

One of the draw-backs of chromium is that it lessens the weldability of the metal, and hence when the doctor of steels considers his prescription he will not put chromium in a steel which is to be welded. Chromium, like the other useful alloys, has an influence on the size of the grain, helping to render the intermolecular structure solid by reducing the size of the independent grains which go to make it up. All steel is crystalline and, naturally, the smaller the crystal the stronger the steel, generally speaking.

Vanadium—The Steel Tonic

Doctors of medicine give their patients tonics to increase their vitality when they are in an anemic condition. The metallurgist, the doctor of steel, gives vanadium for the same purpose. With the single exception of carbon there is nothing which has such a powerful effect upon steel according to most authorities as vanadium, for it is only necessary to add between .16 and .25 per cent. to give steel the property of resisting to an enormous degree the effects of fatiguing stresses. Incidentally, it acts as a great purifier in ridding the steel of oxygen and perhaps nitrogen. It is said to increase the uniformity of the structure of the metal and thus also to promote its strength. In automobile work it is used for springs, axles, gears, etc., which are subject to repeated and continued shock and it is generally incorporated in connection with either chromium or nickel.

Vanadium steels are not generally used where extreme hardness is required and hence we find the carbon content as a rule fairly low, ranging from .10 to .55 per cent., according to the S. A. E. specifications for nickel-chrome-vanadium steel. In these steels the vanadium percentage is at least 1.2 per cent. Nickel, the strengthener, is used in 1 to 2 per cent.; chromium, the frame builder, .30 to 1 per cent. Thus we have a steel which the specifications alone will tell those who have followed the qualifications of each ingredient that here is a steel which, while not exceptionally hard, has great endurance due to the vanadium, has great strength due to the nickel and has a healthy frame of chromium enabling the qualities inherent in the other ingredients to make themselves felt.

It would be impractical to put the muscles of a giant on the framework of a pigmy because the bones would be broken under the stresses of the muscles. Likewise in steel it would be useless to build up the strength of the molecules unless the frame work which held the structure together were sufficiently strong.

In steels containing .20 carbon and from 2 to 12 per cent. nickel, the tensile strength and elastic limit are both admittedly increased by the addition of small percentages of vanadium. An overdose of this great vitalizer is as bad, however, as overdoses of tonic of any kind would be to the human system, and many authorities are agreed that in no case should the percentage of vanadium exceed 1 per cent., the best results being obtained between .7 and 1. A 12 per cent. nickel vanadium steel has given up to 200,000 pounds per square inch tensile strength. This would indicate that the vanadium not only increases the static strength of the material but also its resistance to fatigue. It is therefore a valuable addition to the list of ingredients useful to the metallurgist.

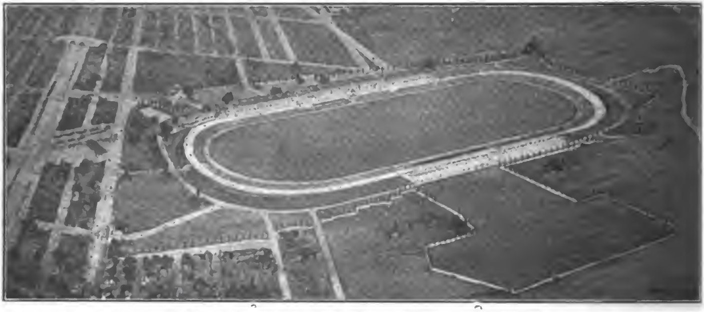
The alloys reviewed thus far are what may be termed the foundation of modern steel practice. They are the principal ingredients from which the doctor of steel writes his prescription to meet the needs of the particular class of work in view. There are others, however, which make up the secondary list that can be drawn upon in case special results are desired. Aluminum, for instance, is rarely thought of by the layman as a steel alloy and yet it forms an excellent deoxidizing agent. In other words, in the language of the steel manufacturer, it kills the metal, removing all the free oxygen. In contra-distinction to manganese, which has been pointed out is the deoxidizing agent most frequently used, it adds no hardness to the metal, being in this respect similar to silicon, arsenic and copper. It is said that .1 per cent. is ample to obtain perfect solidity of a steel by removing the oxygen, when the aluminum is added in metallic form.

In a word, it combines the functions of silicon and manganese and while these alloys are so cheap and aluminum so expensive there is hardly any use in employing the latter for work that can be just as well done by the cheaper products.

Silicon, which has been briefly mentioned, is a hardener of steel. In automobile work the most prominent use for this alloy is in silico-manganese steel springs. Here we

(*Continued on page* 695)

Big Backers for New York Speedway



Architects' plan showing how the Sheepshead Bay track will look as a 2-mile automobile speedway and arena for various other sports

Many Millionaires Among Stockholders of Corporation To Build 2-Mile Speedway at Sheepshead Bay—Design to Permit Speeds Up to 140 M.P.H.

NEW YORK CITY, April 13—A 2-mile automobile speedway 8 miles from City Hall, is at last to become a reality. The Sheepshead Bay Speedway Corp. has been duly incorporated with $2,500,000 capital, made up of $1,000,000 of 7 per cent. cumulative preferred and $1,500,000 common stock. The project is backed by the wealthiest interests in New York, who have come forward and subscribed $1,000,000 which will be paid into the treasury as the work of developing the speedway progresses.

432 Acres Secured

Sheepshead Bay race track, of world-wide reputation from the days of horse racing, has been secured, the track where the famous Futurity and Suburban stakes were the annual classics in horsedom. The location of the 432-acre property is one of the best in the vicinity of Greater New York, the track being situated on Long Island, within a few minutes of the well-known Brighton Beach track, famous for its 24-hour automobile races, and within sight of the ocean. It is within 35 minutes of Broadway, 20 minutes from Brooklyn and 10 minutes from Coney Island.

Two 500-Mile Races—Other Events

Beginning this fall, according to present plans, two feature races will be held on the speedway each season, one in early spring and the other about the middle of the autumn, both events being 500-mile contests with cash prizes of $50,000 or over for each. A 24-hour mid-summer race is also planned as well as a series of matinee events for stock cars.

The track itself will be a 2-mile oval of brick construction with scientifically banked curves. The width will be slightly greater than that of the Indianapolis Motor Speedway and the banking will be more of the saucer type used so successfully on the Brooklands track in England.

Two grandstands with boxes are planned to afford accommodation for 200,000 spectators, while within the track there will be parking space for 20,000 automobiles.

Track Is Very Accessible

In addition to automobile racing it is planned to stage other sporting events in the great enclosure. Present plans contemplate the promotion of international polo matches, aviation events, football, baseball and athletic games as well as military tournaments.

Facilities for reaching the track are excellent. Ocean avenue, one of the broadest of Brooklyn's boulevards, extends from Prospect Park direct to the main entrance, thus giving a boulevard approach with a driveway 100 feet wide for all automobilists. The Long Island railway from New York leads to within a block or so of the entrance to the projected speedway and within two blocks is the Brooklyn Rapid Transit system which connects with New York elevated and subway systems, making it possible to get there by the subway, by elevated, by steam trains, by automobile and lastly by boat from Coney Island, 10 minutes from the entrance.

Men of Means Behind Project

As an indication that this time New York is really to have an automobile speedway, the list of stockholders suffices to dispel all doubt, including as it does such well known names as:

Percy R. Pyne, 2nd; Harris M. Kilborn, Charles E. Danforth of Van Emburgh and Atterbury; Charles S. Sabin, president Guarantee Trust Co.; George F. Baker, Jr., vice-president First National Bank; Frank Bailey, vice-president Title Guarantee & Trust Co.; William Hull Wickham, of McKesson & Robbins; Kenneth Cowan; John J. Haynes; Mrs.

J. W. Gates; Anderson T. Herd; John J. Mitchell, president Illinois Trust & Savings Bank; Stanley Field, son of Marshall Field; A. J. Farwell, vice-president J. V. Farwell Co.; John M. Scott, of Carson, Pirie, Scott & Co.; A. A. Sprague, 2nd, of Sprague, Warner & Co.; Watson F. Blair, director Corn Exchange Bank; W. R. Linn, Southside Electric R. R. Co.; J. M. Cudahy, Cudahy Packing Co.; George A. Thorne, of Montgomery, Ward & Co.; James Deering, International Harvester Co.; John Stuart, Quaker Oats Co.; Chauncey B. Keep, Merchants Loan & Trust Co.; James A. Patten; Frank G. Logan, of Logan & Bryan; F. R. McLennan, director Continental & Commercial National Bank; Edward C. Carter; G. C. Nimmons; Fred F. Norcross; George R. Fearing, Jr.; N. F. C. Kachelmacher.

The Automobile Industry Represented

Among the prominent stockholders directly affiliated with the motor car industry are: Carl G. Fisher, president of the Prest-O-Lite Co.; A. C. Newby, National Motor Vehicle Co.; Hugh Chalmers, president Chalmers Motor Co.; H. M. Swetland, president Class Journal Co.; David Beecroft, directing editor of THE AUTOMOBILE, *Motor World, Motor Age* and *Motor Print;* Fred J. Wagner; Ralph DePalma; J. C. Nichols, president General Automobile Supply Co.; I. M. Uppercu, president Detroit-Cadillac Motor Car Co., of New York; S. S. Toback, president A. Elliott Ranney Co.; Charles E. Reiss; A. J. Kaufman, president Peugeot Auto Import Co.; William Parkinson, president Stutz Motor Car Co.; William A. Allen, president Allen Tire Cover Co.; William C. Poertner, president Poertner Motor Car Co.; Nathan Lazarnick; John C. Wetmore.

To Make Car Racing King Sport

With this galaxy of financial talent the aim of the movement is to make automobile racing the king sport of America, and through the motor enterprise and the club that will be connected with the speedway to get the millionaires purchasing racing creations and ordering special machines so that the sport will take as high a place in the land as horse racing did when at its zenith.

Organization Work Progressing

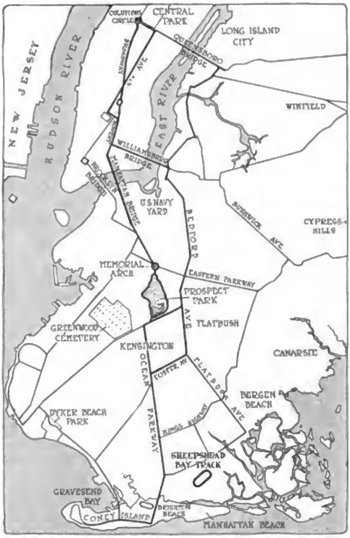
Elwood Thompson, graduate manager of the Yale Bowl, will resign to become manager of the Sheepshead Bay speedway and, as announced in THE AUTOMOBILE for April 1, B. H. Miller, who built the Indianapolis speedway, has been secured to superintend the construction of the track at Sheepshead Bay. Mr. Miller is now in the East attending to the preliminary details of organization work in this connection.

Anderson T. Herd, one of the first to be associated with James C. Nichols, who may be credited with being the pioneer in the enterprise, was the real estate broker who handled the transaction of purchasing the 432-acre Sheepshead Bay property from the Coney Island Jockey Club.

All the proceedings in regard to title and organization of the Sheepshead Bay Speedway Corp. have been passed upon and executed under the direction and supervision of Sherman & Sterling, Spier & Bartlett, Bowers & Sands and G. H. Previllier. The corporation has opened offices in the Whitehall Bldg., New York City.

Plenty of $50,000 Purses

With New York putting up $50,000 for each of two races, Indianapolis and Chicago each with another $50,000, and Sioux City with a fourth $50,000, or thereabouts, there is a possibility of a winning car in all four events cleaning up over $100,000 in a single season. These purses are the greatest ever offered in the sporting world and should be an inducement not only to our American factories to build special cars but also to our wealthy sportsmen to purchase machines to race on a complete circuit of the speedways.



Map showing location of Sheepshead Bay race track, which will be New York's great 2-mile automobile speedway, in relation to New York City, and also showing Brighton Beach and the various roads offering automobile approaches to the track

According to present A. A. A. rules but twenty-seven entries will be allowed on the track in one event, but this is more than enough, as it is not the number but rather the caliber of the cars and drivers that makes a great contest.

Elimination Trials Will Be Needed

Undoubtedly with three big American speedways there will be a great increase in the number of entries, and elimination races of 100 miles or more will be needed to evolve those who are going to start in the final race.

New York has long talked about a speedway but it has all been talk until today. Now the money is up, the paper signed and the régime of reality has dawned. Here racing in America had its inception, in the Long Island race of 1900 when Riker, in an electric, carried off the honors, leaving the gasoline and steam machines far behind. Later the Vanderbilt Cup race became an annual classic until taken to Savannah, Milwaukee and lastly to the Pacific Coast. But Gotham is once more to come into its own by a speedway that promises to excel all others.

Should Draw Huge Crowds

If Indianapolis with a population of only 233,000 can muster a crowd of 100,000 automobile race enthusiasts, New York City with 5,000,000 people and as many more within easy automobile touring distance should furnish at least double the attendance which is found each year at the Hoosier speedway.

Human Element Determines Success or Failure of Jitney Movement

Operator Must Be Industrious, a Good Business Man with Mechanical Ability—$10 Average Daily Receipts—Specifications of Kansas City Buses

KANSAS CITY, MO., April 10—Three months ago the big cities of the East began hearing of a remarkable system of motor transportation that suddenly had appeared as if by magic in the Pacific coast cities. From there it jumped to the cities of Texas and then to Kansas City and the Middle West. On it went, sometimes with a rush; especially in those cities where street car companies had herded their patrons into cars like cattle, while in other cities it appeared in a more desultory fashion.

The jitney fever broke out in the early winter in the coast states and Christmas found it with a foothold in Texas. Reports from Los Angeles last week said 1,200 cars were in operation there and the southern cities were all winter breeding grounds for the 5-cent motor passenger carriers. With the advent of warm weather in the more northern states, it is possible the same development will result there.

Warm Weather Breeds Jitneys

So far the jitney numbers have increased in the direct ratio to climate and city ordinances. Where the days have been warmest and the laws the least rigorous, the jitney numbers have increased the most rapidly, which doesn't mean, however, that the business has been established on a successful basis. There are many other considerations to be taken into account, but, as conditions differ in various cities, it is to be expected that the new industry will show different degrees of prosperity.

Perhaps the jitney experiment in Kansas City will serve as well as any other upon which to base observations as to the future of this mode of transportation. Kansas City has had the jitneys for 3 months, the first cars having been in operation since January 18. The weather since that time has been uniformly bad until the last few days. It has been cold and dreary and much of the time snow has been on the ground. The streets have been in a miserable condition, due to wornout pavement and the car that operated without side curtains up and, for much of the time, chains on the wheels, could not expect to do business. In addition, the jitney owners were harassed and discouraged by a series of council committee meetings that began with the expressed determination of regulating the jitney cars so that the new method of travel would be safe. The city councillor who has helped to draw a franchise for the Metropolitan street railway company here, giving that bankrupt company a 30-year franchise, gave the committee a draft of an ordinance to work upon for jitney regulation. The entire city administration and both houses of the council are tarred with the Metropolitan stick and it was realized that unless public sentiment came to the rescue, the jitney would be choked to death. A rather discouraging condition in which to develop a budding industry, yet one which in more or less degree has confronted the jitney wherever it has appeared. In some cities the jitney has crept into political campaigns, candidates standing for or against the new method of transportation.

Now in Kansas City, the council has not yet acted and this danger still hangs over the jitney, but the automobile dealers, the jitney owners themselves and the labor unions, have showed a strong enough front to hold the proposed ordinance up indefinitely. This ordinance proposed a $5,000 to $10,000 liability bond, depending upon the size of the car; a license tax of from $5 to $10, depending upon the size of the car; a 15-minute schedule; the obtaining of special permission from the park board for jitneys to cross boulevards and special permission from the board of public works to use the streets. The liability bond would cost not less than $150 a year for the smallest case, if obtainable at all, although one or two companies have announced they would write jitney insurance at that price. And one good-sized company is doing so in Los Angeles.

On the other hand, the jitney drivers have had in their favor, which has acted as a development in their business, an almost intolerable street car congestion, slow transit and admirable newspaper support. Police regulation has not been severe.

These conditions must be fully understood to be able to draw conclusions as to the future of the business.

Now, bearing all these things in mind, we come to what the actual development has been and what the future holds out.

The first week with bad snowy weather found sixty cars in operation. These cars made short hauls mostly, from the union station to the retail district; from the wholesale district to the wholesale district and from 2 to 3 miles out on the various street car lines into the residence districts. The cars ranged from the cheapest touring cars to the highest priced, although none of the high-priced cars were new. Most of them were very badly used and abused cars. Some of the cheaper cars were new.

After the first week the buses made their appearance. They were of all types, some of them moving vans with solid tires. These lasted only a few days. The people would not ride in them. Some of the buses were home-made bodies on touring car chassis. Some seated six passengers, some seated ten and twelve persons and some as high as twenty. Some had long routes and some short ones.

Drivers, Like Cars, Vary

The class of drivers and owners has varied as greatly as the condition of the cars. Some have been careful, business-like men sobered by families. Others, and these have been in the large majority, have been careless, irresponsible men who thought driving a jitney lots of fun and an easy way to fortune. These men have had accidents, breakdowns, police arrests and have been a peril to traffic generally. Many of these have been forced out of business already.

The number of jitneys, sixty the first week, increased during the cold weather to 150 at one time and then dwindled on the coldest days to half that number. Warmer days brought many of them back and now there are 350 cars operating. A month of pleasant spring weather may see the number up to 600 or more.

56 Per Cent Survive

After 3 months of operation, by careful investigation it is found that of the first 100 jitneys in operation, fifty-six are still paying their dues of $1 a week to the central organization at the uptown terminal and are in service the greater part of the time. Twenty-six of the first 100 have been in operation almost constantly.

In getting at the future of the business only the fifty-six of the first 100 need be considered. Perhaps it will be best to consider only the twenty-six who have been on the job faithfully. If the business has a future it will be men of the type of the twenty-six that will place it there. Now what are their qualifications and what have they proved?

A representative of THE AUTOMOBILE talked to a half dozen of these men. They had various types of machines from the small touring car to the twelve-passenger bus. Nearly all of them had hazy ideas of the cost of running their cars and all their figures differed.

It would be more or less useless to give the figures of earnings of the various kinds of touring cars and buses. But it will be illuminating to take the bus that has apparently been the most profitable and the touring car that apparently has been the most profitable and from that estimate their chance of success.

Twelve-Passenger Prosperity

Consider the case of Charles Thomas, who starts into business with a twelve-passenger bus on a straight haul without bad hills and a 2.5 mile trip. The round trip is 5 miles. Thomas averages two trips an hour and drives from 7 a. m. to 7.30 p. m., sometimes making an extra trip. He will average 125 miles a day. His bus has been in service 41 days. He has worn out two sets of 35 by 5 rear tires and one set of front tires. He figures his tire expense in that time at $150 in round numbers. He figures his oil and gas in that time has cost him $61.50; about $1.50 a day. He figures a new bus in 2 years at a cost of $1,300 and allows $2.50 for a repair and new car fund. This figures nearly $8, not counting licenses, accidents, insurance (of which he has none) and incidentals. Since he started with 21 days of cold weather and the rest of fair weather, he has averaged $13 a day. He has averaged on the pleasant days as high as $19 a day. Thomas says he can make his bus pay and pay $150 a year for insurance and $50 for license tags.

Now every bus is a modification of the Thomas bus. Some run farther and the driver may not be as smart a chap as Thomas nor so energetic. But, almost to a man, the ten and twelve-passenger light buses appear to be making from $3 to $8 a day. Some of the drivers are creating a sinking fund. Others will live themselves out of business and in a year or two will have neither car nor money to buy a new one. This twelve-passenger jitney which seems to be first choice and which the new jitney company here formed by W. H. Miller, father of the jitney service, has put its faith in to the extent of ordering forty buses, embraces these specifications:

CHASSIS

Frame, length—170 inches.
Frame, width—30 inches.
Frame, overhang—36 1-4 inches.
Body, overhang—8 3-4 inches.
Front springs—semi-elliptic.
Rear springs—elliptic.
Wheelbase—116 inches.
Size motor—3 1-2 x 5 inches.
Number of cylinders—4 block.
Rims—Demountable, quick detachable.
Tires—35 x 5 safety tread, rear; plain, front.
Weight complete—3,400 pounds.
Capacity—2,000 pounds.

BODY

Length inside—131 inches.
Width inside—59 inches.
Height inside—65 inches.
Capacity—13, including driver.
Seats arranged lengthwise.
Entrance and exit—Front right side, door operated by driver from seat.
Type—Pay-as-you-enter.
Price complete—$12,235.

This bus is fitted with glass windows which may be unscrewed and removed in summer and curtains roll down for protection from storms. The door is opened by the driver by means of a lever and the coin box is on the door, into which the passenger drops a nickel.

The body is not mounted on a passenger car chassis, but is designed especially for the use to which it will be put and should be good for 150,000 miles, and last 2 or 3 years in the jitney service, it is estimated.

There is still much to be learned about the profits of the jitney business. So far the biggest receipts of 1 day here have been $31.25 for one bus, running from 7 o'clock in the morning until 11 o'clock at night, with 4 hours of idleness at slack traffic hours. The lowest mark for a day's work is below $5.

$10 Is Daily Average

The general average for the buses has been about $10 a day under the worst circumstances of weather and other conditions. The average of the little jitney is much less.

Frank Mulkey, who has been driving a Ford car since January 24, has kept accurate account of his expenses and receipts in March. He runs 2 1-2 miles, paralleling a street car line and works from 7 o'clock until 7:30 each day. On Sunday he only handles special trips and then but infrequently. Twenty days in March show that he took in $153.20. His expenses for gasoline, oil, garage rent, jitney association dues and repairs were $49.78. The net was $103.42, or approximately $5 a day. Of this he charges off $1.50 a day for depreciation on tires and car, leaving $3.50 profits. He quit a $15 a week job as driver of a truck to go into the business and he expresses entire satisfaction at the change.

Mulkey knows something of mechanics and takes care of his own car, and thinks it will last more than a year. It was 6 months old when he went into the jitney business. For car depreciation he charges off $1 a day and for tires 50 cents a day.

Finds Speed Advantageous

On the same route with Mr. Mulkey is another man with a Ford, J. Beery, who plans to make at least $10 a day and who averages nearly $11, as against Mulkey's $7.50 average. Beery does this by fast driving, more trips and by jockeying for position. He makes four trips an hour in rush hours, which means over 20 miles an hour, including stops. His gasoline and oil bill is about $1.50 a day, as against Mulkey's 80 cents. Beery either drops several blocks behind the other jitneys on the line or he always leads. Preferably he gets ahead of a street car and picks up the waiting passengers until he gets a load and then he turns over on a street on which there are no car tracks and whisks his car down town at top speed. Speed does it, for he will not carry more than six passengers while Mulkey has carried eleven passengers seated in and hanging on his car. Beery also expects his car to last more than a year. As to tires, he is satisfied if they last a month. He figures that he makes money wearing his tires out quickly, getting the maximum service from the tires per mile and larger profits.

C. C. Meade, manager of the local assembling Ford factory, declares that the Ford cars in the jitney service will undoubtedly last 2 years but he is neutral in regard to sales of cars for the jitney service.

The jitney business is still on trial here, but there are certain things which may fairly surely be said to have proven their impracticability. The stern wheeler bus has been abandoned. This is the bus with a step on behind, and using a conductor in addition to the driver. These were seven-passenger chassis mostly with hastily made bodies. The objection to them is the unequal weight distribution.

One could go on indefinitely citing figures, but a summary of the situation appears to be this:

Summary

The bus driven by a private owner where overhead expenses are not counted, costing less than $1,500, seating ten to twelve passengers, with oversized tires, and a good route can clear from $5 to $10 a day, provided: that the owner is a fairly good hand at tinkering in mechanics; that he is industrious and has a fair amount of business acumen. And the same thing may be said of the small car costing less than $700 new or second hand, except that profits will be $2 to $4.

· *The Engineers' Forum* ·

Thinks Trend of Design Could Be Improved—Refined Simplicity Better Than Complex Experiment

By Charles Ethan Davis

NEW YORK CITY—Editor THE AUTOMOBILE:—A backward look at the business side of automobile manufacture seems to point to what may be termed Germ Invasion.

Many of the engineers who were guests of the English Institute of Automobile Engineers 3 years ago heard a great many complaints of the American invasion, the attack at that time being directed against the cheap car in general and the Ford in particular.

What are the periods of the Germ Invasion that have left a marked influence upon American cars, and what have been the results to the investor and manufacturer?

Among the first microbes to appear in any business which has had even a fairly profitable pioneer is the imitator, who, attracted by what seemed to be large returns for small initial investment, seeks for capital and by incomplete data and assumption of large engineering experience and manufacturing knowledge succeeds in securing a limited investment which it is promised will be sufficient to launch the ship and operate it until returns on sales are sufficient to continue the voyage to port.

What has been the result? Wonderful, in a few of the pioneer ventures; but what of the 104 or more imitators which are either total wrecks or breaking up on the rocks of credit extension or re-organization since 1907? Of these seven occurred in 1910, eight in 1911, twenty-two in 1912, forty-four in 1913 and twenty-three in 1914, and at least two seemingly prosperous corporations decided in 1913 and 1914 to abandon the voyage because the profits did not warrant its continuance.

Current records shows about 128 companies are still afloat, fifty of which are in the strong credit class.

American Engineer Leads

Several bacteria seem to have combined to produce the above results, aside from an inadequate conception of the fundamental problem, namely, to produce a simple, clean-cut, reliably-made, easily operated and economic means of transportation to replace the horse, street-car, railway train, bicycle, etc., for pleasure or commerce. To design such a universal servant of mankind calls for a very wide engineering knowledge, and while the results have never been greater in any field in the same time, on the other hand many men with superficial ability have contributed to the disasters. The field can now be said to have settled down to the survival of the fittest, and though for a time the foreign engineer held the supremacy because of more careful and thorough training, the American engineer today is in the forefront of achievement.

The Ford, a pioneer germ, was very early manifest and still is the striking example of the work of a man inoculated with the fixed purpose to put into the hands of the masses a well-made, reliable and economical automobile which will transport them comfortably, quickly and surely where they wish to go either for business or pleasure, at a price which will secure them a very low mileage rate and upon which they may rely for uniformity and interchangeable parts as the years pass. It needs only the record of the number of cars in use and the profit sheet to demonstrate the success of this germ for employer, employee and user.

Stop, Look and Listen!

About the same time the above pioneer germ appeared, or possibly earlier, there was a manifest desire for the foreign luxurious car and several licenses were secured for the manufacture of Americanized French, English, Italian and German cars, all to be sold to the necessarily limited class who can afford to maintain a luxury. What the business and financial result has been is shown by the names which still survive; those which are no longer on the profit side of the ledger are so numerous, and new names are so frequently added that it is time to Stop, Look and Listen, before new ventures are made in this direction.

Following these came the assembled car enterprise with its sidepartner, the parts maker. The result of this invasion has been the production of cars which have luxurious appointments at a greatly reduced price to the user, and a number of notable profit-showing corporations still in the race; but many others strew the road who have been skidded into the ditch by unskilful management, too much speed or a failure of financial fuel supply at the critical stage in the race. As for the parts making sidepartner he has always, and recently more than ever, staggered under stresses which require constant and varied heat treatment to maintain the elastic limit high enough to supply any safety factor to carry the load.

Knowing How

The Gamaliel of automobile engineering and manufacturing, H. M. Leland, at whose feet as students we are all glad to sit, said in his valedictory address on retiring from the presidency of the Society of Automobile Engineers:

"There are two magic words which are the most potent that can possibly be used to express the essentials of success in the manufacture of automobiles on a large, permanent and successful basis: 'Knowing How.' "

First, and most essential in this regard is the selection of a not too extended organization to carry out the details for the one who knows the requirements of shop management and who will not be side tracked from vital issues to make experiments that call for numerous untried changes and additional outlay. In the writer's opinion, germs have been allowed to clog rather than purify by attempting to replace immediately and in all departments old and proved methods

---

• EDITOR'S NOTE—Charles Ethan Davis, writer of this article, has had exceptional opportunities for studying automobile trade conditions both here and in Europe. When general manager of the Warner Gear Co. he came into close touch with manufacturing conditions in automobile factories of all kinds. There is probably no single automobile factory of any size in the world which he has not only visited, but studied on the spot, and his opinions are therefore based upon an extremely wide and unusual experience.

by new and largely theoretical ideas which not even the suggestors had any practice in applying, with the result that failure followed before the power to act intelligently was acquired. Equally important is the building up of a force of workmen who have a personal loyalty to the enterprise and management and the ability to manufacture a stable output.

M. W. Alexander of the General Electric Co. read a paper recently before the machine tool builders which was published in the Scientific American Supplement of February 13, setting forth very startlingly the economic loss due to floating labor and its relation to success or failure in manufacturing. The large demand for workmen to fill shop positions and the heavy drain on the supply of trained mechanics due to their leaving the shops to act as chauffeurs has made it almost impossible to supply all round mechanics, and, worse still, it is extremely difficult to interest the young men of today in learning trades, so there is a dearth of men who really know how.

The above takes no account of the necessarily increased cost of product due to higher wage, decreased output and greater waste because of this lack of men who have gray matter heads and trained hands.

Accessory Complications

The next epidemic that appeared was the struggle of the business management to keep up with the wild desire for a new model each year and for novelty and talking points to help the salesman to dispose of an increased product at maintained prices. The result is the addition of all sorts of accessories and devices, largely good in themselves, but not indispensable, and resulting in complication and increased operating and mileage expense, when after all, we ride only the same number of miles in the same time. A further disturber is the failure to hold down the variety of product by the sales and engineering departments and the too free promise of continued care of the cars in the hands of the user, regardless of use or abuse.

We might continue almost indefinitely to enumerate the germs of motor design, gearshift, self-starter, electric lighting, noise removal, worm gear vs. spiral bevel, right v. left steering, etc., all good, but are they all essentials for the everyday user? If not, who has counted the cost of equipment for their manufacture or the loss caused by making obsolete the plant installations already made?

The Eight-Cylinder Germ

What of the latest eight-cylinder motor germ which has caused several manufacturers to put new and in a great measure untried models on the market following the lead of the Cadillac? It is true there are great claims and many talking points for luxury and anti-fatigue riding qualities which can no doubt be sustained, but have the makers taken into full consideration all that it means to the user to familiarize himself with the added complications and so be able to locate and correct trouble on the road? Who has demonstrated that the simple car cannot be made so comfortable that only an expert can detect the difference in riding qualities?

It is told that a fanatic on quiet sewing machines once asked the Singer Mfg. Co. why they did not put out a new, silent model. The reply was, "Our machine sews, lasts and the public is educated to its use. What increased profit would a change secure us?"

The question is often asked, has the ultimate high- or low-priced car yet been produced? Probably not, but the public knows how to use the present vehicles, and profits will continue to swell the bank accounts at least until many of the existing plants have been charged off as a part of manufacturing cost.

Refined Simplicity

But why elaborate further? The cases are too numerous and similar to require a diagnosis for each new symptom. "The issue of a bacterial affection is either the death of the patient or the elimination of the bacteria." The writer was once convinced that a germ had gained a foothold in his system and a physician of wide experience said to him, "I am old and have been in practice long enough to tell you to let medicine alone and give Nature a chance." In the light of this advice, is it not a wise policy for many of the established manufacturers, if not all, to let complex experiment alone and give refined simplicity a chance?—CHARLES ETHAN DAVIS.

Dashboard Location of Radiator Best for Trucks

NEW YORK CITY—Editor THE AUTOMOBILE:—The position selected for the radiator on almost all cars is, with the exception of the position for the headlights, the most exposed on the car. It would be almost impossible to plan the radiator anywhere on a car where it would be more likely to become damaged. At the same time, the radiator is comparatively frail and easy to puncture.

That passenger cars should have the radiators in an exposed position is not strange, but that commercial trucks and army automobiles should have the radiators stuck out in front seems absolutely absurd. The position in front is accessible and cheapens construction, but these advantages are far more than offset by the possibilities, or rather probabilities of damage.

Radiators Invite Trouble

Some trucks are provided with a heavy bumper but this is only slight protection and practically none at all for army use. A water-cooled motor is helpless without a radiator, yet one well-directed shot, the pole of a wagon, or even the fender of another truck, will put the unprotected radiator out of commission. In spite of this fact recent U. S. Army trucks have the radiators stuck out in front where they simply invite trouble.

A radiator on the front of a car is extremely hard to protect, but the radiator can be placed where it is amply protected and where a car must be practically demolished before the radiator would be harmed. This position is directly back of the motor in front of the dash.

For passenger car work, this position is particularly desirable as the radiator is not only secure from injury but the car can be constructed with perfect stream lines. With the radiator in this position the lamps can also be protected by placing them further back.

Radiator at Dash Would Be Better

On trucks for commercial use, the position back of the motor would eliminate many repair bills and much lost time. For army use the position seems to be the only practical one as it permits perfect protection which can be secured in no other position.

An additional advantage in cold weather is that the heat from the radiator could be used to warm the front section of the car.

The location of the radiator back of the motor presents no great engineering or constructional difficulties as the application could be made in a number of ways to suit the construction of motors and cars. It would even be possible with this construction to completely enclose the motor so that it would be free from dust and dirt yet readily accessible.—C. J. MORRISON, Chief Engineer Meyer, Morrison & Co., Inc.

The Rostrum

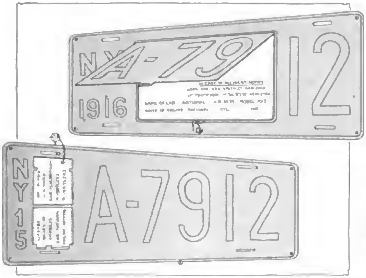


Fig. 1—Two methods by means of which a reader suggests identifying owner and driver of car. Upper shows identification card concealed by flap and license plate which is sealed by an official and only read when necessary. Lower shows method by which identification card is always visible behind a transparent medium

Carbureter Fuel Nozzle Incorrect

Editor THE AUTOMOBILE:—I have a 20-horsepower Hupmobile and have had new piston rings put in, the valves ground in well and have a new Breeze carbureter. It starts easily enough and as the motor runs idly it skips once in a while, then when I speed it along and put in first speed it runs fast, when I put in the second speed it slows up as if it were pulling a big load and then picks up again, first hitting on one cylinder then two, finally four and runs perfectly on the level. When I get to a grade it slows up and I have to put in the low speed and it climbs to the top of the hill. I have had it adjusted all sorts of ways but it still acts the same. After taking the manifold off I find it moist and I think it feeds raw gas. When I speed up the motor and then slow it up it runs slowly and misses fire once in a while, but if I want to make a quick getaway it again becomes balky. When it gets sucking in gas it finally hits on four cylinders and when I put it in second speed it slows up. I cannot go up any kind of a grade on high. This is a 1911 roadster and I never could get it to climb hills. I once saw it go up a hill with three people on high gear and now it won't go up with me alone. After getting it all overhauled the same trouble is found. Some people claim the spray nozzle in the carbureter is at fault. What do you think it can be?

Bridgeport, Conn. J. E. MICHAEL.

—The size of the fuel nozzle on the carbureter seems to be incorrect, and if you will get into communication with the makers of the carbureter they will no doubt correct it for you. Another possibility is that the spark plug points are spread too far apart and you are not getting good ignition at low speeds. The probabilities are, however, that all the trouble is in the carbureter. The spark plug points, should you adjust them, should be gauged by the thickness of an ordinary business card.

Car Should Carry Ownership Guarantee

EDITOR THE AUTOMOBILE:—I wish to present to your readers a new idea for license numbers attached to automobiles. It is my idea to provide a license number with a sealed pocket which shall contain a card supplied with material facts for the identification of the driver and owner of the car, the card to carry all the information demanded by the state, and in addition thereto to carry names of two parties to whom the automobilist or owner is known. The card is preferably to be sealed within the license plate either fully inclosed or such portions of the card in sight as to enable the authorities to promptly and immediately identify the car with its owner.

Under the present law, the state supplies the applicant (presumably the owner), with two distinct number plates and a certificate of registration which certificate contains the material facts supplied the state by the applicant. The law further tells the applicant that he must put the number plates at either end of his car, but does not tell him what to do with the card, although some states demand that the driver of the car shall have with him on his person or in some accessible place, the certificate of registration.

Identification Insured

It is my idea to provide within the license plate a place to securely seal the registration card, either partly or wholly in sight, or wholly out of sight as may be deemed advisable. This method of carrying the information demanded by the state is therefore available at a moment's notice and carries many special advantages, to both the owner and the authorities, among which are:

1—That the authorities would have immediate and first-hand information as to the owner of a car in event of accident or transgression of the law.

2—Authorities have immediate knowledge of friends of injured parties and where they can be found.

3—Authorities have an immediate and practical identification of cars which have been either abandoned or so positioned as to interfere with traffic that they must be taken to the station.

4—By a slight amendment to the act, the certificate of registration may be made the certificate of title to the car, transferable only at the office of the secretary of state.

Advantages to Car Owner

On the other hand, the peculiar advantages derived by the owner of a car are:

1—That the state provides a secure means of his, the owner's, identification.

2—A reliable safeguard against theft of the car, as whoever was in possession of the car must always be able to identify himself with a certificate of registration.

3—An immediate identification in event of accident and a prompt notification to friends.

4—A certificate or title of ownership which prevents the car being transferred or sold without the knowledge or consent of the party to whom the license and certificate are issued.

A canvass among owners of cars developed the fact that, although all of the cars were properly registered and carried their license numbers properly attached to the car, less than 15 per cent. of the owners of the cars had with them their certificate of registration, and would be absolutely unable to identify themselves with the car in event of any dispute of ownership.

It is my idea that the ordinary means of identification demanded by banks and like institutions shall be available by the owner in identifying himself with his own property. In this way any person driving a car not his own would have difficulty in establishing his right to that car unless provided with ordinary means of identifying himself with the party to whom the sealed certificate is made out.

Wants Readers' Opinions

I would like to hear from other readers on this, stating whether or not in their opinion this system would be advisable and also if they know of concrete examples where such an identification would have been of value.

Within the past few days examples have taken place that could not have happened had the license plate of the automobile contained such information. In one instance a man arrested for driving an automobile without a license left the car with the authorities as security for his appearance. Authorities later discovered the car was a stolen one. A second example was an accident on the Queensboro Bridge in which the automobilist was taken to the hospital and died there without the knowledge of his friends. In the first instance, the authorities should have held the man as not being properly identified with the car, and in the second instance the friends of the automobilist could have been communicated with at once from the knowledge displayed in the suggested method of connecting ownership with the license number.

Brooklyn, N. Y. L. A. Ward.

Information on Storage Battery Care

Editor The Automobile:—How can you remove a jar from a Willard storage battery box when it is fast to the container?

2—What kind of acid is used to remove the solution from the positive and negative plates?

3—What do you use to replace the solution in plates again? Please state how to mix same for each plate.

4—How can you straighten a buckled plate in a storage battery?

Conway, Kan. T. J. Gartner.

—In repairing a Willard storage battery a definite routine must be followed in tearing down and building up same in order that it will be in the best condition when re-assembled. These steps are as follows:

First: Remove all vent plugs and washers.

Second: Centerpunch both top connectors in each cell which is to be repaired; then drill 3-4-inch into top connector, with a 5-8-inch diameter drill. Now pull off top connector with pair of pliers, Fig. 2.

Third: Apply gas flame or blowtorch flame to the top of the battery long enough to soften the sealing compound under the top cover. Now, with heated putty knife, plow out the sealing compound around the edge of top cover.

Fourth: Insert a putty knife, or any other thin, broad pointed tool, heated in flame, along underside of top cover, separating it from the sealing compound. Then with putty knife, pry the top cover up the sides and off of the terminal posts.

Fifth: Then, with heated putty knife, remove all sealing compound from inner cover.

Sixth: Now play the flame onto the inner cover until it becomes soft and pliable; then take hold of both terminal posts of one cell, and remove the elements from the jar, slowly; then lift the inner cover from the terminal posts.

Seventh: Now separate positive and negative elements, by pulling them apart sideways. Destroy old separators.

Eighth: To remove a leaky jar, first empty the electrolyte from the jar, and then play the flame on the inside of the jar until the compound surrounding it is soft and plastic; then with the aid of two pairs of pliers, remove it from the crate, slowly, lifting evenly.

Ninth: To put in a new jar, in place of the leaky one, heat it thoroughly, in a pail of hot water, and force in gently.

Tenth: In re-assembling the battery, first assemble the positive and negative elements, pushing them together sideways; then turn them on the side and with both hold downs in place, insert new separators, being very careful to have the grooved side of the separators next to each side of each positive plate. Also be careful to have the separators extend beyond the plates on each side, so there will be no chance of the plates short-circuiting. Now press all separators up against hold downs.

Eleventh: Heat up inner cover with flame; then place same on terminal posts; then take hold of both terminal posts and slowly lower the elements into the jar.

Twelfth: Now, with expansion chamber in place on the inner cover, pour the melted sealing compound on to the inner cover, until it reaches the level of the hole in the top of the expansion chamber,—*i.e.* so that when the top cover is replaced, it will squeeze the sealing compound off the top of the expansion chambers.

Thirteenth: Now soften top cover with flame and replace on terminal posts until it rests on top of expansion chamber; then place a weight on top cover until sealing compound cools.

Fourteenth: Now, pour sealing compound around the edge of the top cover, until it reaches the top of top cover; then when the sealing compound has cooled, take a putty knife and scoop extra sealing compound off of top cover, making a smooth surface over all the top of the battery.

Fifteenth: In burning the top connector to terminal post, proceed as follows: Scrape the hole of the top connector until the surface is bright and clean; scrape terminal post until top and edge are bright and clean. Now, scrape a piece of lead—preferably a small bar—bright and clean; then apply hydrogen gas flame, mixed with air under pressure, to the top connector and terminal post assembled, at the same time heating lead bar. When top connector and terminal post begin to melt, apply lead bar directly on same, melting it, thus making a firm burned connection. Then fill rest of hole-space with melted lead and smooth off even with top of top connector.

2—In this question you no doubt refer to sulphation rather than solution and no acid of any kind is required to remove

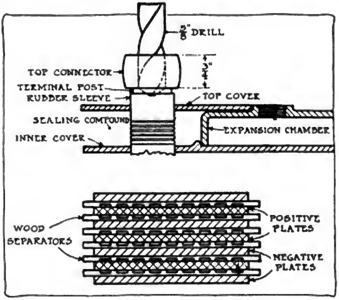


Fig. 2—Diagram showing construction of points to be reached in the rebuilding or tearing down of a Willard storage battery

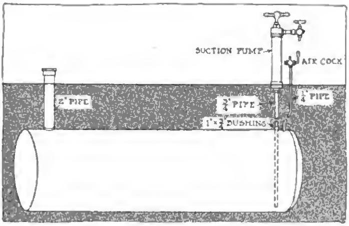


Fig. 3—Gasoline storage tank buried beneath surface of ground, showing size of pipe generally used

it. If the plates are not too hard from this cause, sulphate will be removed by continued charging at a very low rate which in most instances should not be higher than the finished rate given on the name plate of the battery.

3—This question seems rather indefinite unless you refer to the electrolyte in the battery. The electrolyte in Willard batteries is of 1.285 density and is composed of about three parts of water to one of chemically pure, 1.842 density sulphuric acid. Unless you are entirely familiar with battery practice it would be inadvisable for you to attempt to replace the electrolyte in the battery.

4—It is impossible to straighten buckled plates in a battery of this type. A paste plate that is buckled can under no circumstances be straightened.

How to Sink a Gasoline Tank

Editor The Automobile:—Will you please advise me the best method of sinking a galvanized iron drum for the purpose of underground storage of gasoline?

2—What sort of bed should be made for the drum and the different connections of piping, together with size necessary to connect it with the garage?

New York City. Stanley Fullwood.

—The best method of sinking a galvanized iron drum for the purpose of underground storage of gasoline is to line the well in which the tank is to lie with some hard material such as brick or concrete that will not sink unequally afterwards and put strain upon the tank connections. There are many methods suggested by different companies in this business and a few examples may be of value to you. Janney, Steinmetz & Co. state that the best method of sinking such a drum, both as regards the life of the drum and cheapness, is to paint the tank thoroughly with a good asphaltum paint or smear thoroughly with tar. After the hole for the tank is made, put in this either a tarred paper or burlap, smearing the tank thoroughly with asphaltum or tar and then folding over it the burlap or tarred paper. The asphaltum or tar is again daubed over the tank after this is done, after which the ground is filled in and, according to the estimate of this company, the tank should be good for 50 or 100 years.

L. O. Koven & Bro. state that it is customary simply to dig a hole in the ground and place the tank therein, making the pipe connections and then closing with earth. This company does not approve of this method, however, but believes it better to dig a pit so that the top of the tank will be about 3 feet below the surface. The base is then made with cement into which bricks are laid, a brick wall built to a thickness of 8 inches. This brick wall should be extended up to the surface and provided with a cover made of steel plate so that if it is desired to get at the tank the tank cover need merely be removed.

The Cleveland Faucet Co. states that all that it is necessary to do is to dig a hole large enough to hold the tank, then give the tank about three coats of asphaltum and drop it into the hole so that it will come about 18 inches below the ground. The accompanying illustration, Fig. 3, shows the position of the tank, stand pipe, pump, etc.

The American Oil Tank & Pump Co. warns the user of subterranean tanks against placing the tanks where cinders come in contact with the metal as these cause corrosion, making the tank rust through very quickly. This company advises placing the tank from 24 to 30 inches below the surface and states that it should be placed level on a concrete base, the base consisting of a slab of concrete about 6 inches in thickness. This is necessary in order to prevent the tank from settling at one end, thereby causing a strain on the pipe fittings which would cause air leaks and prove troublesome. Two coats of paint are recommended.

The Wayne Oil Tank & Pump Co. states that in about 99 per cent. of the cases the tank is simply buried in the ground and that a much better way is to spend a little more on the installation and build a concrete base in the bottom of the excavation on which to set the tank. However, according to this authority, this is not necessary except in a few extreme cases. The nature of the ground and the conditions under which the installations are made govern this point to some extent. A tank should never be buried in cinders, ashes, sawdust or anything else that has a tendency to create an acid. If the installation is to be near the coast where the salt water from the ocean will seep into the opening the tank should be set in a concrete vault. If, on the other hand, the tank is to be set in ground that is not affected by any of the elements named, the only procedure necessary is to dig a hole and bury the tank.

2—The sizes of piping used for the tanks will depend largely on the size of the tank itself. The Cleveland company uses a 2-inch iron pipe opening for a filler, a 1-inch iron pipe opening for the discharge pipe and a 1-2-inch iron pipe for vent. The Wayne company states that ordinarily the size of the suction pipe for a pump will be 1.25 inches.

Aligning Reamer for Truing Crankshaft

Editor The Automobile:—As a mechanic of automobile work I would like to have a little information on the subject of truing up crankshafts. As we all know, this is not a hard job when you have a crankshaft grinding machine or a lathe for which you have the proper head and tail stock attachments for throwing your shaft out of center to turn the connecting-rod bearing. It often happens that a repair man will have to go to some small country town and overhaul a motor, and very often he will find a badly scored and cut shaft, and almost always he will find that his main, generally the center and connecting-rod, journals are out of round. I have found them out of round as much as .010 inch and the crankshaft very often sprung, this being more so in older motors. One cannot do a good job, or one that will stand up with the shaft, in this condition, although many men who call themselves repairmen put them up in this condition, and they wonder after the car has run a few hundred miles why the bearings already pound. Very natural—the first thing that I do in a case like this is to take a file and micro-calipers and round up my bearings. This is easier said than done for it is almost impossible to get a perfectly round bearing. Then I take emery cloth and a strap and work out the file marks, then finer emery cloth and oil and polish them. This all takes a lot of time and skill.

Now what I am trying to get at is this—do you know of any tool or method that will accomplish this work? It should be such that it can be used for any length and diameter of bearing, can be easily carried and handled and still do a good job. If you or any of your subscribers do know of any such tool I wish you or they would give a description of same and that you would publish it in the Rostrum of THE AUTOMOBILE. I think this would interest more than only myself and be of great help to many of us in our work. I wish the repair men would make more use of this section of your paper. I know it would help to solve a lot of our hard problems and make it better for us all around.

Pittsburgh, Pa. A. R. T.

—In Fig. 4 is illustrated an aligning reamer that will take care of this work for you. It can be carried about in a case and its use will result in bearings which are correctly bored.

Dry Batteries Should Be Used

Editor THE AUTOMOBILE:—I have a 1914 Regal T with starter and generator. I have never had any trouble with the storage battery of any kind, but have had a good deal of trouble with the four ignition dry cell batteries. I would like to know whether I could not substitute the 6-volt storage battery for the four dry cells, possibly using an extra switch to be held in by hand when starting to insure against the storage battery running down if the coil switch happened to be left on?

2—Would the difference in voltage be too great to connect without extra resistance?

San Francisco, Cal. C. P. GRIFFIN.

—Rather than go to the expense of a storage battery for this work, it would be probably better for you to use more batteries and connect them in parallel. The quality of current from the storage battery would be apt also to burn out the points of the breaker mechanism.

2—The difference in voltage would probably be quite noticeable and would result in the pitting of the platinum points.

Ohio Law for Licensing Chauffeurs

Editor THE AUTOMOBILE:—What examination does one have to pass to get a chauffeur's license in Ohio?

Scarboro, Me. L. C. H.

—Section 6302 of the Ohio automobile law states that: "A person operating a motor vehicle as a chauffeur shall file an application for registration in the office of the secretary of state accompanied with a registration fee of $2. Such application must contain the name and address of the applicant, a statement that he is competent to operate a motor vehicle, the trade name and kind of motor power of vehicles he is competent to operate, and whether or not such applicant has been convicted of violating a provision of this chapter, or the penal statutes relating thereto, giving the date and place of such conviction and the provision of law so violated."

Before any certificate of registration is granted to a chauffeur in the state of Ohio, according to section 6302 of the Automobile law, the applicant shall pass such examinations as to his qualifications as the secretary of state shall require. The secretary of state shall appoint examiners and cause examinations to be held at convenient points throughout the state as often as may be necessary.

Rattle Comes from Idle Pinion

Editor THE AUTOMOBILE:—I have a 1914 Cadillac and whenever I go down hill with the clutch out, or go over a rough spot with the clutch out, the universal joints rattle. What is the cause of this?

2—Can this be remedied?

Brooklyn, N. Y. L. W. E.

—Probably the rattle does not come from the universal joint but from the idle pinion on the rear axle. On this model Cadillac there is a two-speed rear axle which has two bevel pinions constantly in mesh. One of these is always running idly and the particular gear which is delivering the power from the motor depends upon the position of a dog clutch. When the car goes over a rough spot with the clutch out, there is a tendency for the drive shaft to revolve at an unequal rate of speed due to the inequalities of the road with the result that the idle pinion is alternately thrown backwards and forwards against the bevel gear with which it meshes thereby giving the rattling sound. There is always a certain amount of back-lash in these gears and the amount of noise will naturally depend on the amount of this play. There is no serious side to this as the noise only occurs at rare intervals and then is not the indication of something which is out of order.

2—It will be unnecessary to replace any of these parts but simply to have the gears readjusted bring these close enough together to overcome some of this back-lash. This adjustment was explained in the instruction book shipped with each 1914 Cadillac. These gears will run satisfactorily with a back-lash of from .004 to .008-inch only.

Wants a Test for Platinum

Editor THE AUTOMOBILE:—Some of the worst troubles that the repairman must meet with today are magnetos, coils and various other electrical devices in which someone has used imitation platinum contacts in place of genuine. The only way we have of judging whether the contacts are real platinum or not is to file them level and if they pit again in a few hundred miles running we blame the contacts, only to find occasionally that the trouble is elsewhere.

Can some chemist give us a simple test that will tell us the composition of the contacts or at least whether the platinum content is high or not?

New Bedford, Mass. F. S. F.

—The acid test can be given for platinum as it is not soluble in nitric acid, hydrochloric acid nor sulphuric acid. It dissolves, however, in nitro-hydrochloric acid combining with it to form the acid

$$H_2PtCl_6.$$

Iridium with which platinum is often alloyed is not soluble in nitro-hydrochloric acid unless it is in a very finely divided state.

Formula for Liquid Flow Through Jet

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for February 4, the statement is made, "If we have a jet of known dimensions we can calculate the rate of air flow past it that will be necessary to withdraw a definite quantity of gasoline per second."

Would you kindly give me the above formula?

Steelton, Pa. G. P. V.

—The basic formula for the flow of a liquid through a jet is $V = \sqrt{2gh}$. Where V is the velocity in feet per second, g the acceleration due to gravity and h the head due to the difference in pressure.

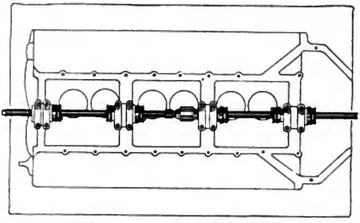


Fig. 4—An aligning reamer made for the purpose of properly aligning the main bearings in repair work

6-Volt Single-Wire Lighting Leads

Used on 86 Per Cent. of American Cars—12-Volt Used on 10 Per Cent. and 18-Volt Systems on 3 Per Cent.—Ford Uses 8-Volt Lamps

THAT practice often settles mooted questions is proved by the records of lamp and electric lighting practice as now in vogue among American automobile manufacturers. At the recent meetings of the Society of Automobile Engineers the question of the 6- vs. 12-volt lighting system and the corresponding debate on whether or not the lamps should be single or double contact have taken up hours of the valuable time of the annual sessions of the society. A study of the accompanying table shows that the 6-volt system predominates, having a percentage of 86. The single contact is also far in the lead, being found in more than 60 per cent. of the installations. The typical American car, therefore, will have a 6-volt system with a single-point contact.

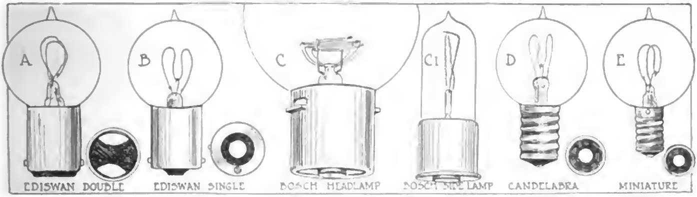
Voltage Varies

The voltage of the lamps, as far as rated capacity is concerned, varies considerably, even though the nominal voltage of the system be the same. Thus in the 6-volt system the use of 7-volt lamps is quite common. Also in the 12-volt system the use of 14-volt lamps will be found quite usual on many prominent makes. The multiple of 7 carries through the entire field, the corresponding voltage for lamps on the 18-volt system being 21.

The use of the 12-volt system has grown slowly since its inception and if the examples found in the tabulation below can be interpreted to cover the entire field, it is now used on approximately 10 per cent. of our cars. The 18-volt system is used on 3 per cent. The Ford car, due to its unusual generating apparatus, requires a voltage different from any of the other cars to prevent the lamps from being blown out through

Car	HEADLAMPS			SIDE LAMPS			TAIL LAMP			DASH LAMP			Make of Lamp	Socket	Wiring	Dimmer	Method of Focusing	Remarks
	Vol.	Am.	Cp.	Vol.	Am.	Cp.	Vol.	Am.	Cp.	Vol.	Am.	Cp.						
Allen	6	2.5	18				6	.42	2	6	.42	2	Ed.&Jones	Edswn D.	Single	Resist	Set-screw adj.	
Ames	6	3.5	20	6	.75	4	4	.5	2	4	.5	2	McCandls	Edswn D.	Double		Socket adj.	
Athens	6		20	6		6	6		4	6		6			Double	Resist	Sliding sleeve	
Apperson	6	5.5	18				6	.5	3				Badger	Edswn D	Double	Series	Outside adj.	
Auburn	6	2.5	16	6	1	4	6	.5	2	6	1	2	Solar	Edswn S.	*		Thumb-nut	*6-40 & 4-36 single; 4-43 & 6-47, double.
Austin	6		18	6		6	6		2	6		2	E.&Jones*	Edswn S.	Single	†	Adj. socket	*Also Badger; †double bulbs in Ed & Jones, special controller on Badger
Briscoe	7	4	18	14	.5	2	14	.5	2				Brown	Edswn S.	Single		Adj. socket	
Buick, C24, C25	6.2		16				6		2	6		2	Corcoran	Edswn D	Single			
C36, C37	6.2		18				6		2	6		2	Corcoran	Edswn D	Single			
C54-55	6.2		21				6		2	6		2	Corcoran	Edswn D	Single			
Cadillac	6.5		18	7	1.9	6	3.5	.37	2	3.5	.37	2	Br.-Marsh	Edswn S.	Single		Screw adj	
Cartercar	7	2.5	18	7	1.75		7	.42	2	7	.42	2	Corcoran*	Edswn S.	Single	Resist		*Tail lamp, Copeland; dash lamp Culver-Stearns
Case	6	2.25	15	6	.75	4	6	.4	2	6	.6	2	Badger	Edswn S.	Single		Sliding socket	
Chadwick	6		20	6		4	6		3	6		2	E.&Jones*	Edswn S.	Single			*Tail lamp, Solar
Chalmers, 26B	21	1.75	21		.6		21		2	21		2	*	Edswn D	Double	Series	Adj. bulb	*Model 29, Badger; Model 26B, Ed & Jones
29, 32	6		16				6		2	6		2	Ed.&Jones.	Edswn S.	Single		Adj. socket	
Chandler	6	3.5	18	6		4	6		2	6		4	Solar*.	Edswn†	Single		Ratchet socket	*Dash lamp, Culver-Stearns. †Models 15 and 16—dash lamp double, all others, single
Chevrolet	6		18	6		4	6		2	6		2	Corcoran*	Edswn S	Single			*Dash lamp, Warren-Douglas
Cole	6	2.5	21	3.5	1.5		4	.42	6	4	.42	6	Badger	Edswn S.	Single	Resist	Adj. socket	
Corbitt	6		16				6		4	6		4	Gemco	Edswn D	Single	Series		
Crow	6	1.5	6				6	.5	3	6	.5	3	Victor*.	Edswn S†.	Double	Resist	Screw adj	*Dash lamp, Connecticut; †dash lamp, double
Davis	6		15				6		2	6		2		Edswn S	Single	Resist	Sliding socket	
Detroiter	6		16	6		4	6		2	6		2	Tulite	Edswn D	Single		Screw adj	
Dispatch	6	2.5	16	6	1.26	4	6	.84	2	6	.84	2	Hall*	Edswn S.	Single	Series	Adj. socket	*Tail lamp, Esterline
Dodge Bros	12	1.75	16				12		2	12		2	Ed.&Jones.	Edswn S	Single	Resist.	Adj. socket	
Dorris	6-7	2	15	6-7	1.33	4	6-7	1.33	4	6-7	1.33	4	Gray&Da.	Edswn S.	Single			
Driggs-Seabury*	6	2	16	6		4	6	.33	2				Indiana	Edswn D.	Double	Series		*Ritz and Twombly
Dudley	6	1.25	6				6		1				Hawthorne	Edswn D.	Double		Adj. bulb.	
Empire	14	4	12				7		2	7		2	Indiana	Edswn S	Single	Resist	Screw adj	
Enger	6-7		16	6-7		4	6-7		4	6-7		2	Gray&Da	Edswn S.	Single	Deflector		
Fiat	6	2.5	15	7	.84	4	3.5	.42	2	3.5	.42	2	Badger	Edswn S	Single			
Ford	8	2	16										*	Edswn D	Single		Adj. socket	*Brown, Edmunds & Jones, Victor and Corcoran
Franklin	14	1.5	21	14	.42	4	7	.42	2	7	.42	2	Hall	Edswn D.	Double.			
Glide	6	2.5	15				6	.5	2	6	.5	2	Corcoran	Edswn D	Single	Series	Screw adj	
Grant	6		15				6		2	6		2	Corcoran	Edswn D	Single	Resist	Adj. bulb	
Gt. Western	6	3.5	15	6	.75	4	6	.5	2	6	.5	2	Ad.-Bag*.	Edswn D	Double			*Tail lamp, Indiana
Haynes	6	2.25	16				6	.5	2	6	.5	2	Guide	Edswn D.	Double	Series	Adj. bulb	
Herff-Brooks	6	4	16	6		6	6	1	4	6	1	2	Indiana	Edswn D.	Double	Series	Screw adj.	
Hudson	7	3	15				3.5	.84	2	3.5	.84	2	Ed.&Jones.	Edswn S.	Single	Resist.		
Hupmobile	14	1.5	15				14	.5	4	14	.25	2	Hall*	Edswn S.	Single	Resist	Adj. bulb	*Tail lamp, Ed. & Jones
Imperial	6	3	16	6	2	4	6	1	2	6	1	2	Gray&D.*	Edswn D	Single			*Also Victor
Jackson	6	2.5	18	6	.84	4	6	.42	2	6	.42	2	Gen.Elec.	Edswn D	Double		Adj. socket	
Jeffery Chesterfield	6.4	3	18				7	.42	3	7	.42	3	Solar	Edswn D.	Double.	Series	Outside adj.	
6-48	7	3	18				7	.42	3	7	.42	3	Solar	Edswn D	Double	Resist	Outside adj	
King	6.5	2.5	15	6.5	.84	4	6.6	.42	2	6.5	.84	4	Br.-Marsh.	Edswn D	Double.		Adj. bulb	
Kissel	6	3	18	3	1.5		6	.5	2	6	2.5	2	Badger	Edswn S.	Single	Series		
Kline	7	4	25				7	.84	4	7	.84	4	Rushmore*	Edswn S.	Single	Resist.		*Tail lamp, Solar

ABBREVIATIONS—Make of lamp: Adams-Bagnall, Ad.-Bag.; Bryan-Marsh, Br.-Marsh; Edmunds & Jones, E. & Jones, Ed. & Jones. Gray & Davis, Gray & D, Gray & Da.; General Electric, Gen. Elec.; McCandless, McCandls. **Type of socket:** Ediswan double contact, Edswn D, Ediswan single contact, Edswn S, Candelabra, candel. **Dimmer:** Resistance, Resist.



excess pressure. The voltage of the Ford lamps is therefore 8, although the nominal rating of the ignition system voltage is 6.

Advantages of Single Wire

The advantages of the single wiring system in the saving of wire and simplicity have made themselves felt among American manufacturers and the time is rapidly approaching when an attempt to secure at least an official recommended practice on the part of the S. A. E. will not be met by the strenuous opposition which was the case at the recent meetings of the society. It is to be regretted that there is such a wide variation in the candlepower, voltage and ampere ratings of the lamps now used on different makes of cars which have electric systems of the same characteristics in other particulars. The sockets most often used are shown in the accomtems, has given ground to the Ediswan double contact type A, which was the most popular in the day of two-point systems has given ground to the Ediswan single point type shown at B. The new Bosch types are shown at C for headlights and C1 for side and tail styles. The latter are familiarly known as the cartridge type. D is the candelabra design to which frequent reference is made in the accompanying table and E is the miniature which is employed for speedometer lights and similar purposes.

Car	HEADLAMPS			SIDE LAMPS			TAIL LAMP			DASH LAMP			Make of Lamp	Socket	Wiring	Dimmer	Method of Focusing	Remarks
	Vol.	Am.	Cp.	Vol.	Am.	Cp.	Vol.	Am.	Cp.	Vol.	Am.	Cp.						
King	6	...	15	6	...	4	2		2	3		2	Hall	Edswn D	Double			
Lambert	6	...	16&24	6	...	4	6		2	6	...	2	*	Edswn D	Single	Series	Focusing base	*Dash lamp, Guide; others Victor and Indiana
Lewis, VI	6	2.5	18	6	.84	4	6	42	2	6	42	2	Ad.-Bag	Edswn D	Single		Adj. socket	
Lex-Howard	6	2	16				6	5	4	6	5	4	Indiana*	Edswn S.	Single	Resist	Adj. socket	*Dash lamp, Culver-Stearns double contact
Locomobile	7	2	21	7	53	2	7	53	3	7	36	2	Br.-Marsh	Edswn S	Single	Resist	Adj. socket	
Lyons-Knight	7	3.5	24	7	.6	4	7	5	3	7	5	4	E.&Jones*	Edswn D	Double			*Tail lamp, Badger
McFarlan	6	4	24				6	75	4	6	75	4	Indiana	Edswn S	Single	Resist		
Marmon	12	...	35	12	1.5	8	12	1.5	8	12		8	Bosch	Bosch	Single	Resist.		
Maxwell	7	2.25	15	4.6	1.5	6	7	5	2				Ed.&Jones	Edswn S.	Single	Resist.	Ratchet socket	
Mercer	12		18	12	...	4	12		4	12		4	Badger	Edswn S.	Single			
Metz	6	2.5	15	6	.84	4	6	42	2				Gray&Da	Edswn S	Single			
Mitchell	7	2.4	15	..	...		7	42	2	7	42	2	*	Edswn D	Double.	Series	Sliding socket	*Head and tail lamps, Brown; side lamps, Adams-Bagnall, dash lamp, Culver-Stearns
Moline-Knight	6		18	6		4	6		4	6		4	Gray&Da	Edswn D	Double	Series	Adj. socket	
Monarch	6		16				6		2	6		2	Victor.	Edswn D	Double		Adj. socket	
Moon	7		15	7	2	15	7		2	7		2	Ad.-Bag*	Edswn D	Single	Resist		*Tail lamp, Rose
Moyer	7	4	24	7	.84	4	7	42	2	7	42	2	Ed.&Jones	Edswn D	Double			
National	6	2.5	15	6	.75	6	6	.5	4	6	35	2	Badger	Edswn D	Double		Ratchet socket	
Oakland	7	2.5	15				7	5	2	7	5	2	*	Edswn S	Single	Resist	Sliding bulb.	*Headlamps, Model 49, and all lamps Model 37 E&J; tail lamp, Model 49, Rose; dash lamp, all models, Post Glover
Oldsmobile, 6	7	...	21				7		4	7		4	Corcoran	Edswn S	Single	Resist.		
4	7	...	21				7		4	7		4	Corcoran	Edswn S	Single	Resist	Adj. socket	
Overland	6	2.5	16	6	.84	4	3	42	2	3	42	2	Auto-Lite	Edswn S.	Single			
Packard	6.4	4.5	29	7	.84	4	7	42	2	7	84	4	Packard	Edswn D	Double.		Screw adj.	
Paige	6	2.5	15	6	.75	4	6	4	2	6	4	2	Gray&Da	Edswn S*.	Single		Screw adj.	*Dash lamp, double
Peerless	6.5	2.5	15	7	.84	4	7	42	2	7	42	2	Guide*	Edswn S	Single			*Dash lamp, Vesta
Pierce-Arrow	7	2.5	21			...	6	1.5	4	6	1.5	4	Howard	Edswn S.	Single	Resist	Adj. bulb	
Pilot	6	...	15	6	...	5	6	2.5	2				Badger	Edswn D	Single	Resist	Adj. socket	
Pathfinder	6	2.5	16	6	1	4	6	1	2	6		4	Hall	Edswn S	Single			
Pratt	6	2	21	6	2	6	6	1	6	6	1	4	Gray&Da	Edswn S.	Single		Adj. socket	
Pullman	12	...	16	12	2.5	8	12	1	2				B&L	Edswn D	Double	Series	Adj. socket	
R-C-H	6	3	16	6	1	4	6	5	2				Hall	Candel	Double*.		Adj. socket.	*Tail lamp single
Regal	6		21	6	—		6		2	6		2	Hall	Edswn D*	Single	Series	Adj. bulb	*Tail lamp single
Remington	12	1	12	—		—	12	25	2					Edswn S	Double.	Series	Screw adj.	
Reo	6.5	2.5	15	..	1.25		3.5	1	4	3.5	1	4	Corcoran*	Edswn D	Double	Resist†	Screw adj.	*Dash, Brown † on 6; series on R
Republic	6	3	15	6	1	6	6	1	4	6	75	2	Gray&Da	Edswn D	Double.			
Saxon	6	...	15	...		.	6		2	6		2	Gray&Da	Edswn S	Single	Resist.	Adj. socket.	
Scripps-Booth	14	1	15	14	.42	4	14	26	2	14	26	2	Hall	Edswn S*.			Adj. bulb	*Dash lamp double
Simplex	6	4	24	6	1	4-6	3.5	5	2	3.5	5	2	Gray&Da	Edswn S*.	Single			*Dash and tail lamps, double
Singer	6	...	21	6	.5	6	6	5	2	6	5	2	Badger	Edswn S.	Single			
Speedwell	6	3	20	6	1	6	6	5	2	6	5	2	Ed.&Jones	Edswn D	Single			
Sphinx	6	2	12	6	.33	2	6	21	2				Guide	Edswn S.	Single		Adj. socket	
Spaulding	21	...	21	21	.19	4	21	.09	2	21	.09	2	Ad.-Bag	Edswn D	Double		Adj. socket	
Stearns	6	...	15	6	.	2	6		2	6		2	Guide*	Edswn S.	Single		Adj. bulb.	*Big 4 & Six, Gray & Da.
Stevens-Duryea	7	...	21	7	.	4	7		4	7		2	McCandls	Edswn S.	Single	Resist	Adj. bulb	
Studebaker	7	2.45	16	3.5	1.25		7	45	2	7	45	2	Hall	Edswn D	Double	Series	Adj. bulb	
Stutz	7	3	15	7	.5	4	7	4	2	7	4	2	Badger	Edswn D	Double.			
Trumbull	6	1	6	6	1	2	6	5	1				Hawthorne	Edswn D	Double	Series	Adj. socket	
Velie	6	2.5	15	6	.5	4	2	4	2	3	4	2	Badger	Edswn S*	Single			*Dash lamp, double
Westcott	7	2.5	18	3.5		9	3.5	1	2	3.5	1	2	E.&Jones*	Edswn S	Single	Resist.	Sliding socket	*Tail lamp, Hall; dash lamp, Culver-Stearns
White	21	1	21	21	.3	4	21	15	2	21	3	4	Hall	Edswn D	Double.			
Winton	6.4	2.5	15	7	.84	4	7	.42	2	7	42	2	Gray&Da	Edswn S.	Single		Screw adj.	
Zimmerman	6	—	16	6	...	4	6	—	2	6	—	2	Badger	Edswn D	Double		Adj. reflector.	

ABBREVIATIONS—Make of lamp: Adams-Bagnall, Ad.-Bag.; Bryan-Marsh, Br.-Marsh; Edmunds & Jones, E. & Jones, Ed. & Jones; Gray & Davis, Gray & D, Gray & Da.; General Electric, Gen. Elec.; McCandless, McCandls. **Type of socket:** Ediswan double contact, Edswn D. Ediswan single contact, Edswn S; Candelabra, candel. **Dimmer:** Resistance, Resist.

Uses of Formula for Dynamic Flexibility as Guide to Best Spring Results

(The Improvement of Spring Systems—XI)

By M. C. K.

THE expression for "dynamic flexibility," $DF = nL : (10 \pm m)$, it was suggested in article X where the term was developed from the formula for the period of oscillation, may be used for describing in one breath the properties of a half-elliptic automobile spring, by inserting the values for n and m which the spring dimensions determine. It was understood that the numerical value of DF (which is a symbol for the suggested term, "dynamic flexibility," but not a product of D and F) is the same as that of F, which is the inverse of f, the coefficient of flexibility, $(Ff = 1)$, and that the value of nL equals that of P, which is the maximum permissible load of the spring or, in practice, the load for which the spring should be dimensioned to continue to work within its elastic limit and with deflections pro rata with loads; also that L is the static load which the spring is actually to carry.

Clash with Practice

The P which would most rationally be chosen for determining the spring dimensions would equal the static load producing the utmost permissible deflection of the spring in the use of the vehicle, but in practice the course has been followed of modifying the meaning of the formulas by which the spring dimensions are determined from a given P, or obversely, with the result that P has become nominally the same as the actual static load L multiplied by a small factor of safety ranging from 1 1-2 to 2, and this practice seems to have influenced spring design, by making it appear as if a suitable automobile spring could be calculated from its static-load figure and the desired flexibility, without reference to the large working capacity required of a spring at high vehicle speeds. According to these methods P becomes rated too low for any given spring, and if this P is used in the formula for the period of oscillation, T, the value found for T is smaller than that really obtained from the spring. And the friction of spring leaves also increases T in practice, so that the discrepancy between the period by formula and that of reality becomes pronounced. But this can be obviated by establishing a sharp distinction between P and L, choosing P according to the severity of the work and returning to actual, instead of doctored, figures for S (tensile strength) in the American formula for P (spring strength) and for k_b (maximum bending stress) in the corresponding German formula. In both cases the modified figures were adopted to get springs from the old formulas which would be strong enough for automobiles—as further referred to in another column—but for looking into the subject with a view to improved practice it is of course necessary to go back to the principles, and these require that an automobile spring should be calculated for a much higher load capacity P (namely, for the static equivalent of the maximum shock) than that indicated by its static load. In the expression for DF it is the factor n whose numerical value should indicate the severity of the work for which the spring is intended, since $nL = P$.

If a spring is so dimensioned as to be characterized by $DF = 3 \times L : (10 + 3)$, the following properties are thereby made known: It is intended for a load of 1,000 pounds; it is figured for a safe load P of 3,000 pounds; its flexibility is $F = 3{,}000 : 13 = 231$ pounds to cause a deflection of 1 inch, or $f = 1 : F = 0.00433$ inch, being 0.433 inch deflection for each 100 pounds of load; its theoretical period of oscillation would be 120 to the minute if the divisor were 10 instead of $10 + 3$, and it is lengthened somewhat in this proportion, making perhaps 100 oscillations per minute subject to further lengthening by friction. More accurately, by applying formula for the period of oscillation,

$T = \pi \sqrt{\frac{P . f}{g}}$, in which $P = 3{,}000$ and $f = 0.00433 : 12$

one finds T to be about 0.57 second, corresponding to 105 oscillations per minute. How much this would be reduced by the friction of spring leaves and vehicle parts, or by a spring damper, would depend on the details in these elements. If a coefficient of friction of 20 per cent. could be assumed the practical length of period T might be found directly by introducing it in the formula, making this

$$T = \pi \sqrt{\frac{P . f}{g\ (1 - 0.20)}} = \pi \sqrt{\frac{3{,}000 \times 0.00433}{12 \times g\ (1 - 0.20)}}$$

It is further known that a spring whose $DF = 3 \times 1{,}000 : 13$ will be deflected 4.33 inches from molecular equilibrium under its actual load of 1,000 pounds and will have a range of action within its capacity of 8.67 inches additionally.

Providing Accessories in Advance

While this manner of describing spring properties depends for accuracy upon using a formula for P in which there are no fictitious values, it is perhaps clear that the general use of this mode of description would soon develop empiric rules for the selection of springs for different classes of vehicles. It might become recognized that a fast car's spring suspension should be made to correspond to $DF = 2L : 20$, that of a delivery wagon to $4L : 15$, that of a truck to $3L : 10$, and when it was found that springs corresponding in their dimensions to the desirable equation, in each case, would be of inconvenient size and that it would be necessary to use springs of different dimensions, the problem would be squarely put of supplementing such springs with devices calculated to bring the factors n and m, in which P and F are implied, into conformity with the requirements—in addition to what other useful function such devices might perform.

Helping the Designer

In any practical instance, when it might be desired to use the DF formula for finding out, independently of previous practice, what condition should be materialized in the spring system of a vehicle whose working conditions are known, P could be decided upon from the known L and the desired flexibility, in conjunction with knowledge of the maximum deflection for which it is possible to provide in the vehicle. As spring dampers can always serve to lengthen the period of oscillation and to strengthen a spring against shock, a suitable compromise of the figures can always be arrived at by shaving n and $10 \pm m$ to relatively low values, provided it is not static overloads which are mainly to be feared. These call absolutely for a large *n* and large range of action, or else for springs of progressive resistance.

It was understood that tests might show another figure than 10 best adapted for expressing the most desirable theoretical period of oscillation (meaning by "theoretical" a period which will be lengthened in practice by friction), but if such a modification should be found advisable, the formula would undergo no other change than one relating to the understanding of its meaning. The new figure, be it 11 or 12 or 9, would simply be the one to be aimed for, the one which the spring dimensions should express, or which should be realized by the combination of the spring and auxiliary devices.

Revising Old Formulas

In now comparing the requirements expressed in the formula with their realization in the spring dimensions, it is necessary to see that the dimensions produce the correct P and the correct F with the use of the formula $P = Z \,.\, 4Nbt^2 \div 6l$, in which Z is a factor which is usually termed S and is taken as identical with the tensile strength of the spring material, hardened, but which probably should be taken at a somewhat lower value where alloy steels, for springs, are concerned; a suitable figure for each of the standard spring steels is yet to be ascertained by tests. The other formula to be used, and in which the variables, *b*, *t* and *l*, have to be brought to the same values as they hold in the P formula, is that for flexibility, usually $F_1 = Sl^2 \div 4Et$, where F is the deflection caused by P and in which the Z value found suitable for the P formula should take the place of S. Whether the modulus of elasticity of the material, E, should also be changed for alloy steels may be open to questioning.

As one has $F_1 : P = 1 : F$ or $F = P : F_1$, it is seen that the value of F in the DF expression becomes $(Z4Nbt^2 \,.\, 4Et) \div (6l \,.\, Zl^2) = (16Nbt^3 \,.\, E) \div 6l^3$, in which Z is eliminated; as it should be, since simple flexibility is determined independently of the strength.

From these formulas with a Z value only slightly smaller than the known tensile strength of the spring material—whose tensile strength thus must be known to the automobile manufacturer if he shall be able to judge by this method of the product furnished him by the spring maker—it should be possible to form an idea in advance of how near to a suitable spring suspension it is possible to get for a given vehicle design with simple half-elliptic springs and to what extent it should be necessary to supplement such springs with other devices or to change to springs of a different type.

Unaided Half-Elliptics Doomed

As in practice half-elliptic springs made to take care of their loads properly at high speeds on uncertain roads are much longer and heavier than it is desirable to have them, in consideration of other factors in vehicle design, one of the most practical uses for the DF formula should be that of determining the nature of the means most suitable in each case for getting good work from springs which are not in themselves suitable but fit the design and the popular expectations of the appearance of springs. As a rule such springs are both too stiff and too weak; their DF is small because *n* is small. They have not been made for a P sufficiently much larger than the actual static load. They can even then have the right period of oscillation—which however is the feature which if wrong can be most easily corrected by dampers—but the *n* value will show that they will not be safe springs for taking care of large oscillations, and least so on the rebound. In springs which are both weak and stiff, both *n and* $10 \pm m$ are reduced in value, and the arithmetical value of DF therefore remains unchanged, as it must do, since arithmetically DF means only simple flexibility, while it shows the working capacity of a spring and its period of oscillation when its component factors are looked into separately and in their mutual relations.

In the case of C-springs and platform springs it is evidently possible to figure with them as spring units producing a single P and a single F, though with some complications which it would be too lengthy to enter upon here, but with regard to their periods of oscillation, the element enters that the quarter-elliptic and the transverse springs may be made to have a different action from that of the half-elliptic, with the purpose of breaking up the periods and perhaps accomplishing greater comfort in this manner for certain road conditions. It may even then be assumed that for normal travelling the average period of the different spring elements should come close to the same figure which spells one condition for comfort with plain half-elliptic springs.

For cantilever springs, on the other hand, a different DF formula should be developed, but it is the object here only to indicate in a general way a method for designating spring properties which, it seems, could be followed up, and which has been lacking in the past, the need for it having become urgent only in the case of automobile springs, of which so much is asked while the limitations of weight and dimensions are drawn much more sharply than in any other line where springs are employed.

Temporizing Methods

The difference in the German and the American methods in calculating springs throws some light on the indefiniteness in both proceedings, arising no doubt in both instances from the need of keeping the formulas open to practical modification so long as spring steels and automobile requirements were continually undergoing changes whose end could not be seen. But these methods of patching the formulas up with concessions have kept spring mechanics outside of the public ken and made figuring with spring problems difficult.

The manner in which the old formula for safe spring load, with S for the tensile strength of the material as a factor, has here been made to answer has been developed by balancing the new and severe requirements made of springs in automobiles against the new and better spring steel properties which steel makers have learned to turn out. By taking 80,000 pounds to 100,000 pounds for S, while using steel whose tensile strength runs up to at least 150,000 pounds in the hardened condition, the nominal value of P has been kept down while the actual carrying capacity of a spring with given dimensions has been brought nearer to the automobile demands, as these were developed in practice.

One Compromise Accusing the Other

But the allowance thus made still does not compare with that made in German tables of k_b values, which are given in three classes, among which the third one is applicable to automobile springs and gives figures which represent only about one-third of the full static maximum bending stresses of the materials. Figuring with these tables the Germans should thus get P even closer to L than is done here, and it may perhaps be assumed that on this basis they may be able to get along with fewer approximations at other points. As however no superiority in the spring equipment of German automobiles is observed in practice—all relying on dampers and auxiliary springs—the true demand is for a sharp distinction between P and L values rather than for compromises which merge them.

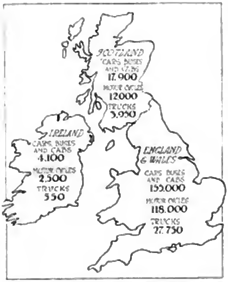
Speaking Terms Wanted

In this respect it seems to the writer that, if the DF formula were developed to finality by experimentally getting a good value for Z and another for the desirable period of oscillation—which is here provisionally figured as expressed by the divisor 10—much would have been done for getting on speaking terms with spring properties in their relations to automobile requirements.

341,250 Motor Vehicles in United Kingdom

136,000 Are Privately-Owned Automobiles—132,000 Motorcycles—4,500 Buses —36,500 Cabs—Of 32,250 Commercial Vehicles, 11,700 Gasoline and 3,500 Steam Trucks Are of 2 Tons Capacity

LONDON, ENGLAND, April 2—There are 341,250 motor vehicles of various descriptions in use in the United Kingdom, according to an estimate given out recently by the secretary of the Good Roads Board. Of these machines, approximately 136,000 are privately-owned automobiles, 132,000 are motorcycles, 4,500 are omnibuses, 36,500 are cabs and the remaining 32,250 are motor trucks of various types and styles. For example, there are 11,700 gasoline machines of over 2 tons capacity and 3,500 steam vehicles in the same class, while of the 17,050 commercial cars having capacities under 2 tons, 14,000 are of four-wheel construction and 3,050 are three-wheel types.



Map of United Kingdom, showing number of cars, motorcycles and trucks

Many Motorcycles

It is specially interesting to note that the motorcycles in each one of the divisions of Great Britain are nearly equal in number to the privately-owned automobiles. For example, in England and Wales there are 118,000 motorcycles as compared with 120,000 automobiles while in Scotland the total of 12,000 motorcycles comes correspondingly close to 12,500 of the larger vehicles. In Ireland there is a difference of 1,000 there being 3,500 privately-owned cars and 2,500 motorcycles. The causes responsible for this condition of affairs are mainly to be found in the high cost of living in these countries as compared with the United States where the number of motorcycles is in much smaller proportion to the number of automobiles. Another factor in favor of the motorcycle is the shortness and excellent surface of roads in Great Britain which render this type of vehicle especially satisfactory for service in these countries.

England and Wales, considered together, lead Scotland and Ireland in every particular, the total statistics for England and Wales being 300,750 vehicles as compared with 33,850 for Scotland and 7,150 for Ireland.

England and Wales Lead

Analyzing the total statistics into the component units by country we find that England and Wales have 120,000 automobiles as compared with 12,500 for Scotland, and 3,500 for Ireland. The percentage of motorcycles is overwhelmingly in favor of England and Wales, their 118,000 making a formidable showing against the 12,000 for Scotland and 2,500 recorded for Ireland. In the omnibus field the same conditions prevail, the leading countries having 4,000 as compared with 400 in Scotland and 100 in Ireland. The 31,000 motor cabs in England and Wales compare with 5,000 for Scotland and 500 for the Emerald Isle.

Analyzing Truck Statistics

Comparison of the statistics in the commercial vehicle field reflect those found in the passenger vehicle class, England and Wales having 10,000 gasoline trucks of over 2 tons capacity while Scotland has 1,500 and Ireland 200. Steam vehicles in lesser proportion keep approximately the same ratio, those over 2 tons capacity numbering 3,250 for England and Wales while Scotland has but 200 and Ireland only fifty.

England and Wales, the leading countries have 12,000 four-wheelers while Scotland has 1,750 and Ireland but 250. Three-wheelers are used in England and Wales to the extent of 2,500 whereas in Scotland there are 500 of these machines as compared with fifty in Ireland.

Estimate of Motor Vehicles in Use in the United Kingdom in February, 1915, Excluding Those Sent to the Continent for Army Use

Class of Vehicles	England and Wales	Scotland	Ireland	United Kingdom
Automobiles	120,000	12,500	3,500	136,000
Motorcycles	118,000	12,000	2,500	132,000
Omnibuses	4,000	400	100	4,500
Cabs	31,000	5,000	500	36,500
MOTOR TRUCKS OVER 2 TONS CAPACITY				
(a) Gasoline	10,000	1,500	200	11,700
(b) Steam	3,250	200	50	3,500
TRUCKS UNDER 2 TONS CAPACITY				
Four Wheels	12,000	1,750	250	14,000
Three Wheels	2,500	500	50	3,050
Totals	300,750	33,850	7,150	341,250

N. S. W. Cars Increase 2,360 in 1914

SYDNEY, AUSTRALIA, March 15—The total number of automobiles in New South Wales in 1914 was 10,001 as compared with 7,641 in 1913, according to statistics compiled by the Motor Traders' Assn. of N. S. W. Since May, 1914, the number of privately owned automobiles has increased from 8,615, while commercial vehicles have increased from 497 to 585. Taxicabs numbered 236 as compared in May, 1914, to 238.

New registrations in 1914 for automobiles amounted to 3,293 and for commercial vehicles, 229. Licenses given to automobile drivers amounted to 5,597. The total number of licensed drivers in 1914 was 16,058, of which 377 were taxicab. Complete statistics follow:

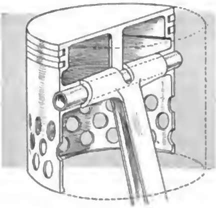
New Registrations for 1914	
Cars	3,293
Commercial vehicles	229
Motorcycles	3,147
New Licenses for 1914	
Drivers	5,597
Motorcycle riders	3,550
Motor Vehicles	
Cars	10,001
Commercial vehicles	585
Motorcycles	6,373
Taxicabs	236
Drivers Registered	
Cars	16,058
Motorcycles	8,095
Taxicabs	377

Sunbeams for Indianapolis

16 Overhead Valves — Two - Piece Ball Bearing Crankshaft—Special Steel Piston

Louis Coatalen, Sunbeam engineer, at wheel of Indianapolis racer

THE two Sunbeam cars which will compete in this year's 500-mile contest at the Indianapolis speedway on May 29 will be similar in general design to the cars built by this company for the French Grand Prix at Lyons last July. The four-cylinder motor has a bore of 3.7 inches and stroke of 6.2 inches, giving 271 cubic inches piston displacement, or well under 300, and is of the extremely high-speed type. There are two camshafts arranged right over the valves, which are located directly in the cylinder heads; no rockers are used, but the cams operate the valves through short, straight push rods of extreme lightness. To each cylinder there are four valves, and they are so light that springs of only moderate strength are required, this being in strong contrast to the heavy springs that would be necessary for a pair of valves giving the same area of opening as the four small ones. The camshafts are driven by a train of spur gears contained in a case on the front end of the cylinder block, ball bearings being used to simplify the lubrication.



Sunbeam type of steel piston

Two-Piece Crankshaft

For the crankshaft ball bearings are used also, and the shaft is made in two halves to permit the easy mounting of the center bearing. Lubrication of these bearings is easy, of course, and the only points requiring special care in this respect are the connecting-rods. For taking oil to these under some pressure a ring is attached to each crank web and oil is squirted into the channel thus created. From one side of the ring a hole is drilled through the crankpin so lubricant is delivered to the bush by centrifugal force. The pressure induced when the motor is running fast is quite considerable. The oil is fed by air pressure from a dashboard tank and returned thereto by a pump which keeps the crankcase always empty.

The type of piston favored by the Sunbeam engineer is shown in the drawing and it is made entirely of steel. In the center of the head a "leg" is inserted, the lower extremity resting upon the center of the piston pin, the idea of this being to carry off heat from the piston head as well as to support it.

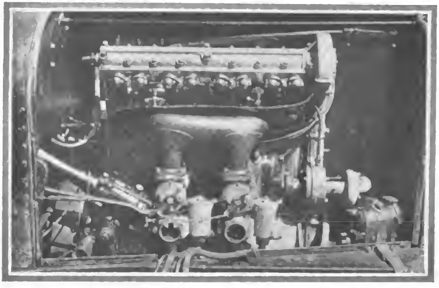
In the chassis there are no departures from standard Sunbeam practice. The clutch is a cone, faced with woven fabric, the gearset provides four speeds and the rear axle is bevel driven. There is a differential, as experiment on the track and on the road has shown that the solid type of rear axle is dangerous to the driver if a rear tire should deflate. The springs take the drive and are half elliptic, and very long, the brakes being in accordance with European practice—one on the transmission and a pair of expanding.

Last year's cars showed a maximum of about 110 miles an hour on Brooklands track and no doubt this will be at least equalled in the new racers.

Porporato to Drive

J. Porporato will drive one of the cars and is now at Brooklands preparing his car for the 500-mile race. There is a possibility of Jean Chassagne being released from military service in France to drive the other machine. Other candidates for the second car are Arthur Duray, Mathis and Hornstead.

PARIS, April 2—Rene Thomas, winner of the Indianapolis 500-mile race last year, has secured an option for the purchase of the Delage grand prix racers. One of the Peugeot 1914 Grand Prix racers built under the 300 cubic inches piston displacement rule has been shipped to the New York branch. This machine, which is doubtless intended for Dario Resta, is the only 1914 Peugeot which has left the factory.



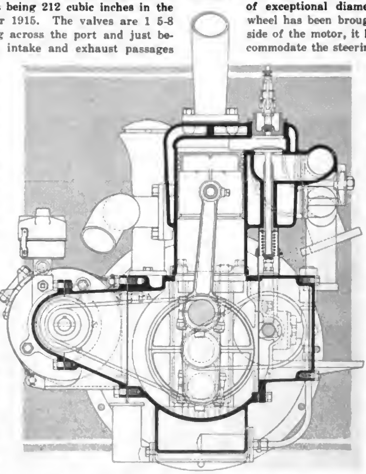
Intake side of Sunbeam motor for Indianapolis race. Note duplex carbureters

Left—Front of Empire for 1916. Right—Side view of touring car. Note mounting of small lamps on headlights in both views

1916 Empire—Larger High-Speed Motor

Various Detail Refinements But No Radical Alterations From 1915 Model—Main Features Continued

MOST conspicuous of the changes in the Empire car for 1916 is in the motor which now has an increased bore, this being 3 7-8 inches as against 3 3-4 inches. There is no change in the stroke which remains 4 1-2 inches, but the larger bore adds 14 cubic inches to the cylinder displacement, the actual volumes being 212 cubic inches in the new model as against 198 for 1915. The valves are 1 5-8 inches in diameter, measuring across the port and just beneath the valve head, so the intake and exhaust passages have each a cross sectional area of over 2 square inches. The peak of the horsepower curve is reached at 2,200 r.p.m. and at this speed the gas velocity through the valve port will be a trifle over 165 feet per second, which is distinctly on the low side. This low velocity means that the cylinder will get a full charge up to quite high speeds and accounts for the high power peak, which is also assisted by the use of light reciprocating parts.



End section through 1916 Empire motor, showing how entire valve-operating mechanism is detachable as the camshaft is contained in a side plate which also holds the push rods. A separate plate covers the camshaft driving chain

A peculiarity of the motor is the great length of the valve guide, which should guard against air leaks when the car has seen long service. The valve springs are small and readily accessible, while they are inclosed separately in brass cases instead of being behind a common plate covering all eight.

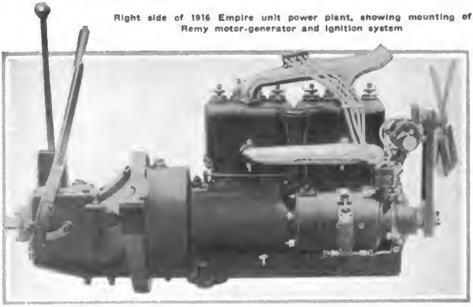
It may be seen in the drawing on this page, and also in the photographs on page 681, that the camshaft is contained in a side plate which also holds the push rods, so the whole of the valve-operating mechanism is detachable from the crankcase of the motor. A separate plate gives access to the chain which is used for driving the camshaft.

Another point to be observed in the photographs is the ample size of the pipes, both water and gas manifolds being of exceptional diameter. Although the steering wheel has been brought from the right to the left side of the motor, it has been found possible to accommodate the steering gear without rendering the valves difficult to reach, as can be seen in the chassis drawings, page 682.

Lubrication is cared for by a plunger pump driven off the camshaft, and located at the rear end thereof. This maintains the level of oil in dip troughs beneath the connecting-rods, by sending lubricant to sight feeds on the dashboard, whence it passes to the main crankshaft bearings and overflows to the gutters. It should be observed that the filtering screen is easy to remove for cleaning, and the oil pump too, can be taken off very readily in the unlikely event of the necessity to clean or inspect it.

Single-Unit Starter

For ignition, starting and lighting a Remy single unit apparatus is used, this following the practice of last year, and it may be supposed that this continuance shows that the Remy outfit has proved itself well capable of maintaining satisfactory performance. The gear ratio of



Right side of 1916 Empire unit power plant, showing mounting of Remy motor-generator and ignition system

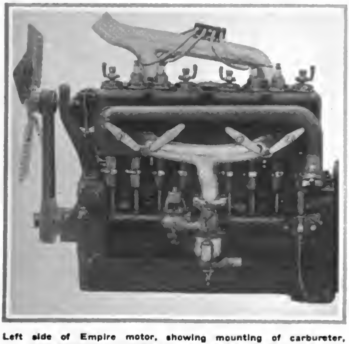
the motor-generator with the crankshaft is approximately three to one and the maximum armature speed is therefore fairly high; it must rise to 8,000 r.p.m. when the motor is turning at its maximum.

Needless to say, the momentum of the armature at such high speeds is considerable and a sudden shutting off of the motor will cause the energy stored in the armature to be delivered to the crankshaft flywheel fashion. This means that the chain which connects the two parts is liable to have stresses in alternating directions imposed upon it, and when a chain is used under such conditions its life is lengthened when the tension is maintained at a degree sufficient to prevent the slack side from developing sufficient looseness to permit "thrashing." In order to make it easy for any owner to care for this, the electrical machine is mounted on a rocking base. Again turning to the section of the motor, it can be seen that the motor-generator rests on a platform and is gripped thereto by a spring steel band and clamping bolt. This band draws the machine down upon the platform and also pulls it against the side of the crankcase where it encounters the end of the adjusting bolt A. With the band clip slacked off, the chain can be tensioned by turning the bolt A which has a lock nut to fix it when the right position is found.

Single Plate Clutch

For the clutch a single plate pattern is used the spring pressure being applied through a system of multiplying levers that give the desired degree of thrust without the need for a heavy clutch pedal action. The flywheel spigot is a ball bearing and the revolving part of the clutch could scarcely be made lighter, so it is to be assumed that the operation of changing gear is extremely easy. It is usually found that ease of gear shifting varies almost directly with the weight of the clutch, though this is not a universal law.

Three forward speeds are provided by the gearset which bolts directly to the crankcase and the clutch is inclosed completely and runs in oil. It may be mentioned that the clutch surfaces are alternate steel and fabric, which is rather uncommon in a lubricated clutch, but it ought to prevent the tendency to stick which is sometimes found in metal-to-metal clutches when the oil is cold.



Left side of Empire motor, showing mounting of carbureter, arrangement of manifolds and accessibility of valves

The gear ratios are thirteen, eight and four to one respectively, but the reverse is extra low, being no less than sixteen to one. The rear axle is of Weston-Mott construction, having a finger nut adjustment for the service brake bands, which is accessible very readily by merely putting a band between the spokes of the rear wheel. Thus the brakes can be taken up in a few moments and without the use of any tools.

To support the driveshafts in the axle, Hyatt heavy-duty bearings are employed, and a New Departure double row is situated behind the differential to support the thrust from the plain type bevel gear.

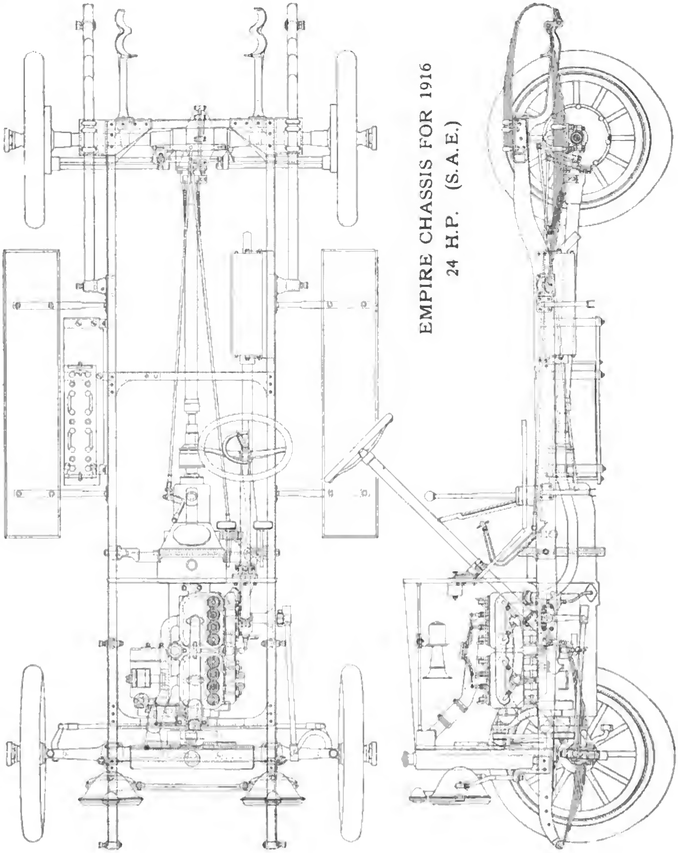
Brakes Are Special Feature

Shown in the chassis drawings and also—to a larger scale —in a separate illustration, is the equalizing mechanism for the brakes which has been cared for particularly. From the pedal and from the emergency lever are a pair of straight rods running direct to the centers of balance beams on the axle. The latter are sufficiently long to give real compensation and there is plenty of surface on the extremities which enter the final brake levers. The levers themselves are also on the long side, so rapid, easy action and plenty of power should be characteristics of this brake system.

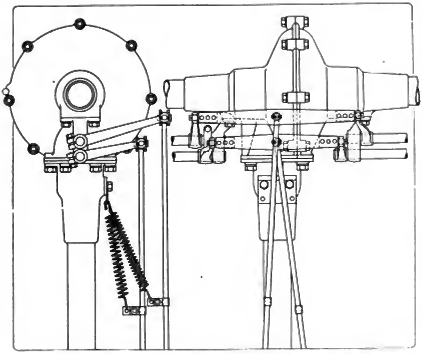
Three-Unit Assembly Method

Assembly of the chassis is carried out on a three-unit system. Frame, springs and front axle make one unit; the power plant with the steering gear and pedals makes the second, while the rear axle is the third. For the power plant there is a bearer on the front cross member of the frame, and two points of attachment to the side rails, these being in line with the clutch casing. At these points are two bolts only, one on each side, and a couple more attach the outboard end of the steering gear. Thus it is easy to see that the power plant goes into the frame with very little trouble in fitting. Attachment of the rear axle and the connection of the driveshaft present no special points, but there are very few bolts to be inserted in order to make a complete chassis from the three main components.

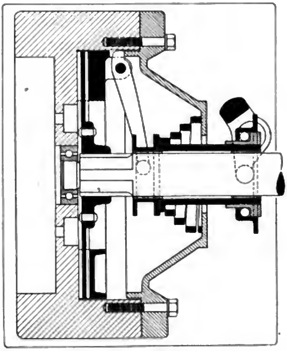
Two minor points that are noteworthy are the location of the battery in a place where it can be inclosed completely and yet be readily accessible, and the strong construction of



EMPIRE CHASSIS FOR 1916
24 H.P. (S.A.E.)



Detail of brake equalizing mechanism on the 1916 Empire, a feature of the design of this chassis. The two straight brake rods run to the centers of long balance beams on the axle and there is plenty of surface on the extremities which enter the final brake levers



Section through the single-plate clutch used on the 1916 Empire, showing one of the systems of multiplying levers. The clutch surfaces are alternate steel and fabric

the corner plates which attach the rear springs to the frame; both these features can be seen in the chassis views, page 682.

Few Changes in Body

In the bodywork there has not been much change. An increase in wheelbase from 108 to 112 inches allows more room in the tonneau and the smooth lines of the body are improved a little by the slight addition to the length overall. The body equipment is on standard lines, with a one person top and quick action curtains.

Stanweld demountable rims are now standard fittings, together with a Stewart speedometer and the usual kit of small things, but the lamps are distinctive and quite new. As may be seen in the front view of the car at the head of this description, each headlight has a small separate lamp above it and the casings are, of course, integral. The list price, $975, includes a spare rim, and the tires are 32 by 3 1-2 inches.

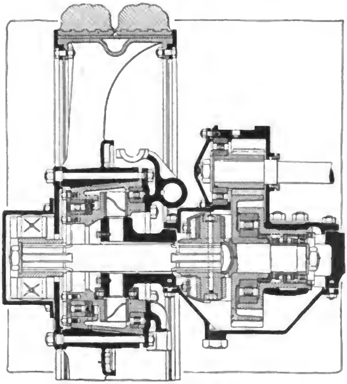
Front Wheel Drive Design

THERE have been many designs for front wheel driving and the subject is one that has formed a basis for many patents. Of these one of the most recent is of British origin, and has for its purpose the minimization of the troubles attendant upon the use of very short universally jointed shafts. It is well known that the effect of a single universal joint is to produce variations in the velocity ratio of two shafts which it connects, unless these shafts are in line axially. By dividing the angular deviation between two joints this difference in ratio can be reduced in extent, and also the amount of work thrown on each joint is less than half that which would have to be done by a single joint.

The idea illustrated is to have a front wheel hub containing a central pivot and one of the two universal joints located within the hub cap while the other is at an equivalent distance inwards of the steering pivot. Connecting the two is a short shaft with splined ends which allow it to telescope within the universal pins for the attachment of the joint pins, but these splines are not used as slides. The proportions are such that the two universals are at equal distances on either side of the pivot and all sliding takes place on the nuts of the outer joint which is within the hub cap.

It should be noticed that the road wheel is detachable, being held up on a conical hub shell by a ring of bolts.

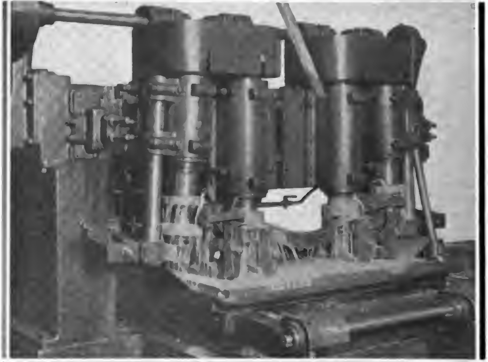
As shown the wheel is arranged to be driven through a spur gear, the upper pinion being on one of the shafts from a differential located centrally upon the front axle, but the patentee also shows that this is not an essential part of the design, since it is possible to attach the inner universal to the differential shaft direct.



Thomas front wheel drive

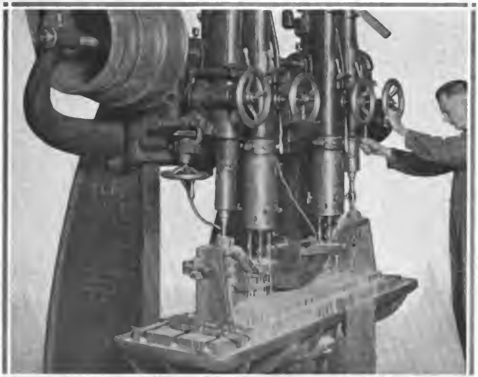
Twin Machines for Packard Rear Axles

A PAIR of twin machines take care of the axle work on Packard cars. One is for drilling and the other is for milling and by their use considerable time is saved in the completion of the front axle. The speeds of the two machines are very nearly equal although the operations, of course, differ essentially. The time required to drill the axle is 18 minutes, to mill it takes 19 minutes. In addition to this, the setting-up time must be included in the estimate but with a new jig which has just been designed, it requires only 2 minutes to mount the axle in either machine.



The Packard milling machine has four cutters in operation at the same time, two of them being double and in reality having two cutting surfaces giving a total of six cuts at a time. The axle is placed in a fixture on the table of the machine and the milling cutters set in operation. The time required to mill the axle is 19 minutes

The drilling machine is of special interest in that it not only does the actual drilling work but also takes care of the taper reaming. Thus, the machine actually does the work of drilling and reaming and when an axle has left it, there is no further work of this nature to be done. With the ordinary multiple-spindle drill it would be necessary to perform two or three operations on each axle and the time required would probably be about four times that necessary with this combined drilling and taper reaming outfit.



To drill the axle requires 18 minutes. With the new jig which is now employed it only requires 2 minutes to mount the axle in the machine. The drilling operation not only includes the actual drilling but also the taper reaming

The milling machine has four cutters in operation at the same time, two of them being double cutters in that they have two cutting surfaces which are actually engaged in one operation. The work done, therefore, is virtually that accomplished by six cutters as six separate cuts are made in one operation. As shown in the accompanying illustration, there is an especially arranged fixture on the table of the machine which need only be clamped in place before setting the machine in motion.

These machines require but one attendant apiece and the work is so carefully timed that the workmen is not permitted to allow any appreciable lapse of time between the finishing of one axle and the commencement of work on the next. The machines do not require as much space as many other milling and drilling machines designed for the same work and furthermore, are practically automatic in their action, giving results of desirable uniformity and working at desirable cutting speeds.

1,500 members of the Sheldon Axle & Spring Co. Relief Assn. with their families who attended the second annual entertainment and social session of the organization

Welfare Work Gains in Sheldon Plant

Axle & Spring Co.'s Relief Assn. Comprises 75 Per Cent. of Employees—Has $7,000 in Treasury

TOTAL receipts of $17,920.53 and expenditures of $11,173.78 with a surplus fund on hand of $7,000 is the record of the Sheldon Axle & Spring Co. Relief Assn. for the 8 years in which it has been in existence. At the annual meeting held early this month the secretary's report showed receipts for the past year of $2,178.48, the death and sick benefits paid to members or their families having been $1,256.35, leaving a surplus for the year $923.13. At the time of this meeting the balance in the treasury was $6,746.75 and the Sheldon company donated $253.25 to make an even $7,000 of which $5,000 is invested in securities netting an annual income of $300, which is equivalent to 100 memberships paying 25 cents monthly dues on which there is no possibility of having to pay any sick or death benefits.

75 Per Cent. of Employees Are Members

At the present time the membership of the association comprises approximately 75 per cent. of the employees of the Sheldon organization. The dues are 50 cents per month for the first year and 25 cents per month thereafter. Sick benefits are paid at the rate of $6 a week for 12 weeks and $3 for the following 8 weeks or $96 in 1 calendar year. Death benefits are $100 for a member of the association; $25 for the death of his wife and $15 for the death of a member's child between the ages of 5 and 14 years.

1,500 at Annual Entertainment

The association holds an annual entertainment and social session each spring for the employees of the company and their families, the cost of the entertainment being defrayed by the company. At the second annual function of this character held March 25 approximately 1,500 employees and their families were in attendance. On the first Saturday of August every year the association holds an annual picnic and field day at which various athletic events are contested, suitable medals and prizes being given to the winners.

Officers of the Relief association are elected yearly and are as follows: President, James Marshall; vice-president, Wilbur Sprung; treasurer, C. A. Ide; secretary, E. A. Jones; auditors, Howard Davis, L. P. Holdsworth and Harry Hemstreet.

An Automobile Course for Women

MILWAUKEE, WIS., April 10—To meet the demand of the growing class of women motorists in Milwaukee for a course of instruction in the construction, care, operation and maintenance of the modern motor car, Prof. E. M. Barrows, Milwaukee district representative of the University Extension Division of the University of Wisconsin, who is in charge of the course established last fall, has arranged for a new course of ten lectures exclusively for women. The men's course is now in its second series, because of the demand that it be repeated. The woman's course will be given each Friday afternoon at 4 o'clock for 10 consecutive weeks. The men meet each Monday evening at 8 o'clock. The courses are given in the University Extension Building, 471 Van Buren street, Milwaukee. Experts of the State university engineering college staff conduct the work and all were formerly connected with motor car or parts factories. The work laid out for the women students does not include actual operations that might soil hands or clothes.

The AUTOMOBILE

PUBLISHED WEEKLY

Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, April 15, 1915 No. 15

THE CLASS JOURNAL COMPANY

Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL

David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES

Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES

United States and Mexico -One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - - -One Year, 5.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.

Member of the Audit Bureau of Circulations.

The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

New York's Speedway

WITH the assurance that Greater New York is to have a 2-mile automobile speedway, the East gives promise of coming back to its own in the racing field, and Long Island, the cradle of automobile racing in America, may, within the near future, be the setting for some of the greatest speedway races in the world. Since the abandonment of the Vanderbilt Cup race years ago there has been constant sentiment that Greater New York is one of the best population centers for sporting contests of this nature and that the automobile industry is suffering an annual loss by not having some contest for its 8,000,000 of population.

Unfortunately, the financing of the new speedway is largely controlled by Wall street interests local to New York as well as allied financial interests from Chicago. To date the automobile industry has taken little part and it is somewhat of a reflection on those who have made their money in the industry that they have not more generally assisted in the promotion of the speedway. The Indianapolis speedway, entirely backed by the automobile industry, is typical of local patriotism and industrial pride; whereas New York, with its overwhelming Wall street interests and its minimum of automobile representation, would have better represented the magnitude of the industry in Greater New York if the automobile element had been considerably higher.

Sheepshead Bay speedway should prove of inestimable value to the automobile industry, not only as a national advertisement, but further as affording a great testing ground in the midst of 8,000,000 population. American manufacturers cannot overlook the opportunity that such a speedway offers them. It should prove one of the great show stands of the world, and with a management as impartial as can be had only the best interests of the industry will be served by this enterprise.

High Motor Speed

IN THE AUTOMOBILE today commences a short series of articles on the design of high speed motors, written by one who has had long experience among the racing automobile firms of Europe. One need not agree with all his deductions, but his facts are incontestable. This series are particularly valuable, because they not only help engineers who wish to make high speed motors of their own, but serve to prove that what we are now calling high speed is a snail to an express train in European practice.

Perhaps there is nothing useful in piston speeds of 3,000 feet per minute. Perhaps this striving after huge power for displacement volume, which has been the main characteristic of European automobile development during the past 10 years, is now being brought to an absurd extreme. It must be remembered, however, that this could have been said any time the past 8 years, and that the average engine as made here today is a long way ahead in volumetric efficiency as compared with the European motor of a few years back. We may not have moved so far as the French extremists, but we have been moving their way all the time.

It is always interesting, and generally useful, to know "how it's done." Mr. Gerster tells us this in the most lucid language, and the mechanical man who has no professional interest will find that Mr. Gerster holds his attention none the less.

Die Castings

ZINC base die castings are not satisfactory for water pump housings. All die cast metal is of a more or less brittle nature and the zinc in the alloy is very easily affected by water which causes it to corrode and deteriorate. It is this deterioration which is the chief cause of the castings giving out.

The use of die-castings is an economy because it cuts down machine work. The castings can be made in the finished state almost as cheaply as the rough casting in bronze or some similar material and then is finished without the necessity of further machining work. The reason that the majority of pump jackets are die-cast is because they can be made cheaply and accurately that way. On account of the fact, however, that these jackets and water pumps are made of a zinc base alloy which is porous in the first place and subject to rapid corrosion in the second, they are out of place. Higher-priced alloying substances, such as tin and copper, with perhaps antimony, are advocated by many as satisfactory, and surely would resist the inroads of water to a much better extent than the zinc base.

The fact that some manufacturers have made thousands of successful die-cast parts for pump housings shows that if the proper mixture is put into the metal, it will stand up, but it requires more than merely sending out broadcast for prices and then selecting the cheapest material regardless of actual value. To make die-castings as they should be requires more time and more expensive alloys than it does to turn them out rapidly from cheaper alloys. Zinc rapidly deteriorates in water and the result of the use of a zinc alloy where actual contact exists with the water is the rapid disappearance of the zinc content, leaving the shell of metal behind which soon crumbles under the slightest stress.

Important Work for S. A. E. in Detroit

Eleven of Fourteen Standards Divisions to Report

NEW YORK CITY, April 13—Eleven of the fourteen divisions or sub-committees of the standards committee of the Society of Automobile Engineers will submit reports which will be either final or of progress at the coming session which will be held in Detroit on April 22.

Among the most important communications which will be made to the committee next week are those of the Electrical Equipment Division, Iron and Steel Division, Electric Vehicle, Research Division, Springs Division, Miscellaneous Division, Carbureter Fittings Division and some of the subcommittees of these divisions.

The Electrical Equipment Division will report on the proper limitations of headlights in the city. In some of the cities ordinances have been passed defining permissible glare of headlights. The S. A. E. committee will attempt to set forth the conditions of proper car illumination, particularly on the relatively dark streets and parks found in many of the large cities. Tests will be made of some of the dimming, shading and screening devices now on the market, as illustrating the principles under consideration. It is also the intention to refine further the standards of bulb bases, sockets and connector plugs for the sake of better interchangeability and consequent improved operation. In addition, the possibility of standardizing the arrangement of engines for attaching starting motors will be taken up.

Iron and Steel Report Expected

New data are expected from the Iron and Steel Division on the physical properties of S. A. E. alloy steels, as well as further recommendations as to specifications of steel castings, and the vanadium minimum limit in vanadium steels. It has been suggested that a standard tooth form for silent chains be adopted. The importance of this is realized by car manufacturers using more than one make of chain. As it is now, it is absolutely necessary for them to have differently cut sprockets for each make of chain, to get proper results. It would be of great advantage if the chain makers would adopt some standard, and a report as to the feasibility of doing this will be made at the coming meeting of the standards committee.

The need of coordinated design and production of electric as well as gasoline vehicles is appreciated. The Electric Vehicle Division of the society made a report involving fundamental considerations last January, but this report was, owing to the development of a marked difference of opinion among the engineers, referred back. A revised report will be made this month on speed and mileage ratings, motor voltage, efficiency tests of solid tires, and number of cells in standard battery equipment.

A subject of considerable economic value which is under consideration by the Research Division of the standards committee, is that of tap drill sizes. A common saying in regard to taps is that 90 per cent. break instead of wear out. This means not only large tap expense but expensive delay in getting new taps and resetting machines, and the costly processes used to remove broken taps and the expensive pieces rendered useless by having broken tap-ends left in or having the tap holes spoiled in an attempt to remove the taps. This waste is almost wholly unnecessary, being avoidable by properly designed taps and proper sizes of tap drill holes. There are many arguments in favor of a tap drill list which can be applied in automobile practice generally. The Research Division has now in preparation an extensive series of tests to be conducted with tapped holes of varying depth of thread, and test pieces of different steels with S. A. E. and U. S. S. threads cut thereon.

The Research Division will also report finally on the matter of a vehicle taxation formula.

One of the most complex elements of car construction is leaf springs.

The Springs Division is now formulating for consideration at the Standards Committee meeting at Detroit next week, a report on:

1. Nomenclature of cantilever springs
2. Test of parallelism of eyes and master leaf of leaf springs
3. Modification of eye and bolt tolerance for leaf springs
4. Frame brackets for leaf springs.
5. Nuts for spring clips of leaf springs
6. Modification of center bolt standards for leaf springs
7. Width of springs for pleasure and commercial cars.
8. Center bolt nuts of leaf springs.
9. Length, opening, etc., of spring clips of leaf springs
10. Spacing of clips
11. Pressure blocks

The Miscellaneous Division will report on:

1. Dimensions of piston ring grooves
2. Hose and hose clamps for cooking systems
3. Flat fan belt widths.
4. Dimensions of mechanically-driven air pumps
5. Sizes of screws and bolts for use in mounting dash-board fittings.
6. Position of number on motors.
7. Thread tolerance.
8. Cotter pin sizes.
9. Speedometer-drive shaft-ends

It has developed that there are a great many unnecessary and immaterial dimensional differences in piston ring widths and thicknesses. Standard sizes of hose and hose clamps will be of great advantage. There is need for specifying a list of flat fan belt widths which would reasonably be used, and of setting forth the permissible variation in these widths, the latter being an apparently simple but not clearly understood point. It has been stated that in the mounting of dash fittings one diameter of screw or bolt with a specified style of head and pitch and thread is sufficient. With regard to the position on a motor of its number, it has been found that in the case of stolen cars, it is important that the police shall know where to look for the number of the motor, which for this purpose should obviously be at an easily seen place. This is an example of advisable recommended practice which is important in one way, while very trivial in another.

Thread Tolerance Unsettled

The matter of thread tolerance of machine screws and bolts is one that has never been settled, largely for the reasons that different grades of work require different standards in this connection, and that in any case an accurate method of thread measurement must be devised, this measurement involving several variables.

It is expected that after settling on a list of sizes, the Miscellaneous Division will report that instead of carrying 200 cotter pin sizes in stock as is now frequent practice, twenty should suffice for any car manufacturer.

There appears to be no good reason why the shaft-ends of speedometer drives furnished by the various instrument manufacturers, should not be standard, so as to interchange on a given make of car.

Several features of carbureter fittings have been standardized by the S. A. E. Subjects now before the Carbureter Fittings Division are:

Exhaust manifold hot-air jackets for carbureter connection.
½-inch and ¾-inch carbureter outlet connections
2½-inch and 3-inch carbureter flanges.
Uniform dimensions from center to face of side-outlet carbureters.

Macao, China, March 10—The Hingkee Auto Garage, this city, desires to receive offers from automobile parts manufacturers for the opening of connections in China.

Court Dismisses Kardo Axle Suit

Holds Co. Is Not Lawfully Organized Under Laws of Ohio as 10% of Stock Is Not Paid In

CLEVELAND, O., April 13—*Special Telegram*—Judge John H. Clarke, in the United States district court, has dismissed the patent infringement suit of the Kardo Co. against Henry J. Adams, dealing as the Reo Motor Sales Co. His opinion, sixteen pages long, held the Kardo Co. not lawfully formed under the statutes of Ohio.

Judge Clarke pointed out that innuendos at the February hearing prompted him to make investigation of the organization.

"Articles of incorporation for the Kardo Co. were signed February 21, 1914, by five men who are members of the law firm of the organization."

The decision reads: "Each subscribed one share of stock; one subscribed as trustee of the American Ball Bearing Co. for 995 shares, payable $9,500 in cash and $90,000 by transfer of patents by the American Ball Bearings Co. to the Kardo Co.

"The Ohio laws differ from the laws of many states in that the mere filing of articles of incorporation in due form does not create a corporation, notwithstanding the provision that a certified copy of articles shall be prima-facie evidence of its existence. The law requires that 10 per cent. of the stock be paid in. This was not done.

"While there is no disposition on the part of the court to impute actual or intended fraud to the parties engaged in this enterprise, yet the law of the case is not different from what it would be if such were the fact."

The suit was brought by the Kardo Co. substituting for the American Ball Bearing Co., in action against Henry J. Adams, former representative for the Reo Motor Car Co., and dealing locally as the Reo Motor Sales Co. The Kardo Co. charged infringement of Patent No. 792,690 issued to Alanson P. Brush, of Detroit, by the use of a compensating mechanism termed a floating spider in the bevel gear of the rear axle on Reo cars. Last month Judge Clark ordered a reopening of the suit, as the first step in a further investigation into the organization and purpose of the Kardo Co.

Cadillac Files Appeal on Austin Two-Speed Axle Decision

CINCINNATI, O., April 10—An appeal was filed in the United States Circuit Court today by the Cadillac Motor Car Co., Detroit, and John M. Van Loon, agent of the Cadillac company in Kalamazoo, Mich., against the decision rendered January 8, in Grand Rapids, Mich., by United States District Judge C. W. Sessions, who held that the Cadillac company had infringed the two-speed axle patent of Walter S. Austin, of the Austin Automobile Co., of that city.

Walter S. Austin started his suit against the Cadillac company and its Kalamazoo agent in July, 1914, claiming that the Detroit manufacturer was infringing upon patent No. 1,091,618, which was issued to him March 31, 1914, concerning two-speed axles.

In his decision rendered January 8, Judge Sessions held the Austin patent claims to be valid.

It is probable that the Cincinnati case will not come up for hearing until fall.

U. S. Supreme Court Denies Petition for Rehearing in Bearing Suit

WASHINGTON, D. C., April 12—An attempt to bring the case of the Hess-Bright Mfg. Co. and Deutsche Waffen und Munitions Fahriken against Hedwig Fichtel and Ernst Sachs before the United States Supreme Court for review and determination by petition for a writ of certiorari has been denied by the Supreme Court of the United States. This undoubtedly marks the termination of this suit.

It will be remembered that the United States circuit court of appeals for the third circuit last month affirmed its decision in favor of the Hess-Bright Mfg. Co. and refused the motion for rehearing as to the right of an accounting made by Fichtel and Sachs.

The suit was brought in 1913 by the Hess-Bright Mfg. Co., of Philiadelphia, and the Deutsche Waffen und Munitions Fabriken of Germany, against Hedwig Fichtel and Ernst Sachs doing business under the firm name of Fichtel & Sachs, charging infringement of the Conrad patents Nos. 822,723 and 838,303 covering the use of a continuous race in a ball-bearing. Judge McPherson, of the U. S. district court in Philadelphia, handed down a decision in favor of Fichtel and Sachs in December, 1913, but on the appeal the circuit court of appeals, Philadelphia, reversed this decision and gave the verdict to the Hess-Bright Co. holding the Conrad patent to be valid and infringed by the F. & S. bearing.

Overland Declares an Extra 5 Per Cent. Dividend on Common Stock

NEW YORK CITY, April 14—The Willys-Overland Co., Toledo, O., has declared the regular quarterly dividend of 1 1-2 per cent. on the common stock and in addition a 5 per cent. stock dividend. Both dividends are payable May 1 to stockholders of record April 22.

The company since its incorporation in November, 1912, has paid 7 per cent. on its preferred stock and 6 per cent. regularly on its $20,000,000 common stock. Furthermore, in August, 1913, an extra cash dividend of 5 per cent. was declared on the common.

Michigan Castings Declares 200% Dividend

DETROIT, MICH., April 11—A dividend of 200 per cent. to the stockholders of the Michigan Steel Castings Co., has been authorized by the directors. It represents a part of the earnings of the concern since it was founded 8 years ago, and during which time the profits were not distributed in order to build up the business. The capital stock will now be increased from $90,000 to $210,000.

DETROIT, MICH., April 12—The J. W. Murray Mfg. Co., which makes car specialties, has declared a dividend of 100 per cent. and increased its capital stock from $60,000 to $200,000. Recently a one-story brick addition 40 by 168 feet was completed, and now a further increase in the size of the plant is contemplated.

Market Reports for the Week

NEW YORK CITY, April 14—Market prices this week were more or less steady with the exception of a few in the metal markets where tin was unsettled yesterday and lead was dull and weaker. Both coppers were strong but dull. Tin this week went up $7.50 per 100 pounds, one of the largest gains shown by this metal. Prices in this metal, however, fluctuated, the highest price being quoted on Friday, when it reached $59.00, after which a drop and then another rise and drop occurred, the closing price on Tuesday being $56.00. Lead went down 2 1-2 cents per 100 pounds. Rubber experienced a fractional gain of 1-2 cent. Tire scrap went down 1-2 cent. There were no changes in the oil and lubricant markets.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.21½	.21½	.21½	.21½	.21½	.21½	......
Beams & Channels, 100 lbs.	1.26	1.26	1.26	1.26	1.26	1.26	......
Bessemer Steel, ton	18.00	18.00	18.00	18.00	18.00	18.00	......
Copper, Elec., lb.	.15⅞	.16	.16	.16	.16⅛	.16⅛	+.00¼
Copper, Lake, lb.	.16¼	.16¼	.16¼	.16¼	.16¼	.16½	+.00¼
Cottonseed Oil, bbl.	6.65	6.55	6.55	6.55	6.55	6.50	—.15
Cyanide Potash, lb.	.21	.21	.21	.21	.19	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.92	.92	.92	.92	.92	.92	......
Lead, 100 lbs.	4.20	4.20	4.20	4.20	4.20	4.17½	—.02½
Linseed Oil	.62	.62	.62	.62	.62	.62	......
Open Hearth Steel, ton	18.50	18.50	18.50	18.50	18.50	18.50	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, Refined	..	..	..	..	..	..	......
Rubber, Fine Up-River, Para	.58½	.59	.59	.59	.59	.59	+.00½
Silk, raw, Ital.	..	3.90	..	..	3.90	3.90	......
Silk, raw, Japan	..	3.55	..	..	3.55	3.55	......
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	48.50	50.00	59.00	54.00	58.00	56.00	+7.50
Tire Scrap	.04½	.04¼	.04¼	.04¼	.04¼	.04¼	—.00¼

Overland Electrifies Enamelling Ovens

TOLEDO, O., April 9—An improvement of much importance to the automobile industry has been installed at the Willys-Overland factory, Toledo. This company recently closed what is probably the largest industrial contract for electric power ever given to a central station. The contract calls for the electrification of sixteen large enamelling furnaces having a volume of 48,000 cubic feet and a capacity of 140 tons of enamelled product every 10 hours. The work put through the ovens consists of various sizes and shapes of steel parts. With the 4,500 horsepower previously required from the same station, the new furnaces will make the total now used by the Overland company approximately 10,000 horsepower load. According to electrical engineers, this is fully as large as the total power required for lighting a city of 225,000 inhabitants.

One Oven in Operation.

One of the ovens which has been in operation for several months has given results far superior to any previously obtained by the Overland company, which formerly used gas in the place of electricity, as nearly all other automobile manufacturers are doing.

The equipment of the ovens makes them almost entirely automatic in operation. When the oven is loaded the closing of its doors automatically throws a switch which turns on the current. A pyrometer which can be adjusted to operate at any desired temperature rings a bell when the proper degree of heat is reached, thus notifying the attendant, and also automatically turning off the current.

With the elimination of flue gases usually found in enamelling ovens, the work is said to be made cleaner and smoother and that a brighter finish is given to the materials. Dirt and spots attendant upon the gases have disappeared and the necessity for ventilation has been reduced to a minimum, reducing air currents and the possibility of picking up dust which may find its way into the ovens and cause a slight flaw in the work.

50 Per Cent. Gain in Efficiency

The volume of work which can be accomplished with the new installation is almost half again as great as was possible with the old equipment. This makes possible a proportionate reduction in the cost of enamelling each unit.

The installation of electrically-heated ovens is said not only to increase the manufacturing efficiency of the plant but also to do away with all of the hazards attendant upon the work. The fire danger is entirely eliminated, explosions are done away with and the safety of the attendants is assured. The non-oxidizing heat cannot scald the operator and the heat of the surrounding atmosphere is materially decreased, making the working quarters entirely comfortable. These better conditions are reflected in a higher grade of work.

Automobile Securities Quotations

NEW YORK CITY, April 13—Securities this week continued their skyward movement. The biggest day of the year occurred on Friday, when many new high prices were made with over 1,000,000 transactions, the biggest public buying in 2 years.

Tire issues showed the largest gains for the week. Firestone common went up 17 points, reaching the high mark of 455; Goodyear common went up 20 points, closing at 240; Goodrich common rose 8 1-4 points while its preferred showed a gain of 3 points; Kelly-Springfield common went up 9 points and its second preferred gained 7 points; Miller Rubber common closed at a 15-point gain; Swinehart closed at 90 with a gain of 10 points for the week and U. S. Rubber common rose 7 3-8 points.

Receipts of large war orders by the automobile manufacturers had a lot to do in the large gains made by several of the automobile stocks. International Motors caused considerable surprise in Wall street when its securities found an open market on the Curb. Its common rose 9 points and its preferred 14. General Motors continues to rise, this week showing a gain of 18 3-4 points on its common and 16 1-2 on its preferred. The common has been the stock on which the public interest has centered. Just 1 year ago that stock sold at 37 3-8, compared with 25 for 1913. Before the end of 1914 it reached 99. Early this year par was crossed; a week ago the price was 126; yesterday 144 3-4 was reached. That means an advance of over 100 points in a year.

Willys-Overland common this week rose to 129 1-2 at a gain of 4 1-2 points. Studebaker made a gain in its common of 5 3-4 points. Both Reo stocks made small gains. Chalmers closed at a gain of 14 points in its common and 2 points in its preferred.

In the Detroit quotations every stock with the exception of Packard preferred, showed gains. General Motors and Continental Motor common showed the largest changes, the former 16 points and the latter 10.

In the inactive stocks Canadian Ford showed a rise of 50 points.

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	200	..	285	..	..
Ajax-Grieb Rubber Co. pfd	99	102	100	..	..
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	82½	86½	75	80	—1
Chalmers Motor Co. com	79	83	94	99	+14
Chalmers Motor Co. pfd	90	92½	92	94	+2
Electric Storage Battery Co.	51	52	50	51	+2½
Firestone Tire & Rubber Co. com	280	287	455	460	+17
Firestone Tire & Rubber Co. pfd	107	109	110	112	..
General Motors Co. com	81½	82	144¾	146	+18¾
General Motors Co. pfd	92½	93½	119	121	+16½
B. F. Goodrich Co. com	25½	26	51¼	52½	+8¼
B. F. Goodrich Co. pfd	86½	89	102½	104	+3
Goodyear Tire & Rubber Co. com	160	170	240	245	+20
Goodyear Tire & Rubber Co. pfd	95	96½	104	105	+1½
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	14½	15½	+9
International Motor Co. pfd		15	32	35	+14
Kelly-Springfield Tire Co. com	..	.	135	139	+9
Kelly-Springfield Tire Co. 1st pfd	.	.	84	85	+¾
Kelly-Springfield Tire Co 2d pfd	..	..	137	141	+7
Maxwell Motor Co. com	7½	8½	46	47	..
Maxwell Motor Co. 1st pfd	32½	33½	84	85½	—1
Maxwell Motor Co. 2d pfd	11¾	12½	39½	40½	—¾
Miller Rubber Co. com	..	..	185	190	+15
Miller Rubber Co. pfd	..	..	101	103	..
New Departure Mfg. Co. com	121	125	138	140	—1
New Departure Mfg. Co. pfd	104	106	106	..	+1
Packard Motor Car Co. com	103	..	80	92	..
Packard Motor Car Co. pfd	94	98	94	97½	+¼
Peerless Motor Car Co. com	15	.	20	21	..
Peerless Motor Car Co. pfd	..	75		55	..
Portage Rubber Co. com	..	25	34	36	
Portage Rubber Co. pfd	..	75	85	95	..
*Reo Motor Truck Co.	7½	8¼	13½	14½	+1
*Reo Motor Car Co.	19½	20¾	32½	33½	+2½
Splitdorf Electric Co. pfd	40	50			
Stewart-Warner Speed. Corp. com	55	60	58	59	—½
Stewart-Warner Speed. Corp. pfd	100	102	102	105	
Studebaker Corporation com	33	33½	66¼	67½	+5¾
Studebaker Corporation pfd	85	87	99½	100½	..
Swinehart Tire & Rubber Co.	60	65	90	95	+10
Texas Company	140	141	138	140	..
U. S. Rubber Co. com	60	60½	72¼	73½	+7⅜
U. S. Rubber Co. pfd	103½	104	108	110	+1½
Vacuum Oil Co.	128	130	208	212	+9
White Co. pfd	107	110	103	108	..
Willys-Overland Co. com	64	66	129½	131	+4½
Willys-Overland Co. pfd	89	94	100½	102	+½

*Par value $10; all others $100 par value

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS					
Chalmers Motor Co. com	79	82	90	93½	+5½
Chalmers Motor Co. pfd	90	92½	92	95	+2½
Continental Motor Co. com	150	..	170	180	+10
Continental Motor Co. pfd	..	75	78	84	+2
General Motors Co. com	81	83	142	146	+16
General Motors Co. pfd	92½	94	104	107	+3½
Maxwell Motor Co. com	7¾	8½	46	47½	+⅜
Maxwell Motor Co. 1st pfd	33	34	84	86	+1
Maxwell Motor Co. 2d pfd	11¾	12½	39	41	—½
Packard Motor Car Co. com	103	..	86	..	+6
Packard Motor Car Co. pfd	94	98	93¾	..	..
*Reo Motor Car Co.	19¾	20½	32½	33½	+2½
*Reo Motor Truck Co.	7¾	8¼	13	14	+½
Studebaker Corporation com	..	..	67	68½	+6½
Studebaker Corporation pfd	..	..	100	103	+2
INACTIVE STOCKS					
*Atlas Drop Forge Co.	..	26	.	21	..
Ford Motor Co. of Canada	..	560	600	..	+50
Kelsey Wheel Co.	195	..	190	200	..
*W. K. Prudden Co.	19	20½	..	21	+½
Regal Motor Car Co. pfd	..	45	12	20	—2
BONDS					
General Motors, notes, 6s, 1915	100½	101½	101	..	..
Packard Motor Co. 5s, 1916	95	98½	..	84	..

---

*Par value $10; all others $100 par value.

Pa. Bill To Double License Fees

Taxes According to Horsepower—Dealer's Tags Also Doubled and Solid Tire Vehicles Affected

HARRISBURG, PA., April 9—A bill has been introduced by Representative Lipschutz, Philadelphia, which will double automobile license fees. This bill taxes according to horsepower. The following table shows the present and proposed automobile fees.

	PROPOSED	PRESENT
Under 20 h.p.	$10	$5
From 20 to 35 h.p.	20	10
From 35 to 50 h.p.	30	15
More than 50 h.p.	40	20

For solid tire vehicles, excepting traction engines, the proposed and present rates are:

	PROPOSED	PRESENT
Less than 4,000 pounds	$10	$5
More than 4,000 but less than 5,000	20	10
From 5,000 to 10,000 pounds	30	15
From 10,000 to 15,000 pounds	40	20
From 15,000 to 24,000 pounds	50	25

On vehicles weighing less than 10,000 pounds trailing after an automobile or solid tire vehicle a fee of $6 is proposed by the bill against $3 under the present act. Trailers weighing between 10,000 and 24,000 pounds must pay a fee of $10 against the present fee of $5.

The cost of dealers' tags is doubled to $20.

Senator Mills yesterday introduced another bill in the Senate which provides that in any civil proceeding for injury done by an automobile the register number displayed on the vehicle shall be prima facie evidence that the owner was operating it.

If he shall prove at the hearing that he was not operating it and reveal the name of the person actually operating it, then the register number evidence is removed and the burden of proof shifted.

Want to Double Fees in Michigan

LANSING, MICH., April 9—There seems to be no end in the desire of legislators to find the automobile—and whoever and whatever is connected or related to it—as the one means of securing more money to the state, the city or the county. The latest proposed new tax was introduced today. This bill provides for the doubling of the automobile tax fees, and does not exempt automobiles from local taxation. The license fee for automobiles would thereby be $6 instead of $3; chauffeurs' licenses would be $3 instead of $2; manufacturers' licenses are to be sold at $20 instead of $10 and for duplicate licenses the charge is to be $3 instead of $2.

The bill is to replace the Smith bill which provided for a state license tax according to weight and horsepower, but exempted automobiles from local taxation. Owing to the strong opposition from the representatives of Wayne county, who claim that this bill would reduce too much the Detroit tax rolls, the Wood bill has been introduced to take its place.

New York One-Inspection Bill Passes

NEW YORK CITY, April 14—The Lockwood bill, which will eliminate many of the duplicating inspections of buildings in New York City, passed the state assembly yesterday. It had previously passed the Senate. The bill tends to concentrate the inspective powers of the city and was strongly backed by the automobile interests.

Chicago Proposing Restrictions of Size and Weight for Trucks

CHICAGO, ILL., April 9—Tentative limits have been drawn up here for an ordinance to restrict truck sizes and weights. Originally, this bill specified 28,000 pounds as the maximum gross weight and 24 feet as the maximum length. Since then, however, the restrictions have been changed to 40 feet in length and 1,000 pounds per inch width of tire, with a maximum allowable load per axle of 12 tons. Aldermen W. J. Healey, G. E. Trebing and H. P. Bergen are the council committee intrusted with the drafting of the ordinance and J. D. Hittle and Mr. Robinson are the engineers who have been appointed to confer with this committee. The first draft has been passed upon for legality by Leon Hornstein of the corporation Counsel's office. The bill is to go to the council for passage at an early date.

N. Y. Truck Restriction Hearing April 19

NEW YORK CITY, April 9—The second hearing of the Mayor's Committee on Street Traffic & Safety regarding its proposed restrictions of motor trucks and horse vehicles in New York City has been called by secretary S. W. Taylor for Monday, April 19, at 2:00 p. m., at police headquarters. The committee will be prepared to hear further arguments in behalf of motor truck and horse haulage interests as to why business vehicles should not be restricted to 24 feet in length, 7 feet 6 inches in width, 12 feet 6 inches in height, 8 miles per hour in speed and 14 tons in total weight.

The first hearing was held in the rooms of the Safety First Society, at the Craftsman Bldg., 6 East Thirty-ninth street, and, at the request of the Motor Truck Club, a second hearing was granted after preliminary arguments from the M. T. C. and N. A. C. C., and others had been heard.

BALTIMORE, MD., April 9—A single drink of liquor imbibed by operators of automobiles will result in licenses being forfeited immediately, provided State Motor Vehicle Commissioner H. A. Roe is convinced that the licensee has been guilty of consuming intoxicants while at the wheel of a car. This edict has been issued by Commissioner Roe and he has spread it broadcast in a crusade his department is waging against reckless driving.

YORK, PA., April 11—The House of Representatives this week went on record overwhelmingly against a bill to require lights on all vehicles after dark.

Delco Co. Business Growth Compels E. A. Deeds to Leave N. C. R.

DAYTON, O., April 13—Owing to the growth of the Delco business within the last year, E. A. Deeds has been obliged to tender his resignation as vice-president and assistant general manager of the National Cash Register Co. in order that he may devote his entire time to the Delco company, of which he is president.

Mr. Deeds has been connected with the N. C. R. for 15 years. He has been vice-president and assistant general manager for the last 6 years.

Several years ago, he and C. F. Kettering organized the Dayton Engineering Laboratories Co. for the manufacture of electric cranking, lighting and ignition equipment for automobiles.

Recently the demands for increased production have been so insistent that more room has become necessary. The six-story factory is pushed to its utmost and is already much too small.

Two years ago, an entire city block opposite the present factory was purchased, and within the last month work on a new building that will more than double the present production was commenced. This will be finished by fall.

About 1,700 men are now employed in the Delco factory, and over 30,000 complete starting, lighting and ignition systems have been turned out since January 1.

PITTSBURGH, PA., April 7—Stockholders of the Youngstown Sheet & Tube Co. have approved an issue of $5,000,000 new stock to provide for additions to the company's plant, including the installation of by-products coke ovens.

KENOSHA, WIS., April 13—The Thomas B. Jeffery Co., this city, has received orders on its trucks in 3 weeks amounting to $4,000,000. Five hundred men have been added to the factory working force, which is working 24 hours a day in three 8-hour shifts.

KENOSHA, WIS., April 9—Charles T. Jeffery, president of the Thomas B. Jeffery Co., was re-elected member of the executive committee of the Manufacturers' Assn. of Kenosha, Wis., at the annual meeting. G. H. Allen, head of the Kenosha works of the American Brass Co., was re-elected president of the association, which operates a mutual employment bureau and clearing house that is at this time rendering invaluable aid to Jeffery and other works having large war orders requiring day and night operation.

WASHINGTON, D. C., April 11—The American automobile has been most popular with the Allies. A total of 4,352 commercial vehicles have been purchased by England, France and Russia in Europ and Asia in the 7 months ended February 28. The value is placed at $12,365,943, an average of $2,841 for each truck.

The greatest number of these trucks were sold to France, 2,277, valued at $6,317,150, being exported in the first 7 months of the war. England is second with 1,559, valued at $4,030,261. Russia in Europe bought 305, valued at $1,280,187, and Russia in Asia 211, valued at $738,345.

NEW YORK CITY, April 14—William R. McCulla, former research engineer of the Packard Motor Car Co., Detroit, Mich., and now assistant chief engineer of the Knox Motors Co., Springfield, Mass., will sail from this city on April 17 on the French steamer Niagara to Bordeaux, France, on a business trip.

Pennsylvania Reduces Prices on Tubes

NEW YORK CITY, April 14—The Pennsylvania Rubber Co., Jeannette, Pa., has reduced the prices on its inner tubes, effective April 15. The following list gives the former and new prices on a few of the tubes: 28 by 3, red tube, former price, $2.60, new price, $2.35; 30 by 4, gray tube, former price, $4.00, new price, $3.60; 32 by 4 1-2, Nugray tube, former price, $4.85, new price, $4.35.

NEW YORK CITY, April 14—G. M. Graham, designing engineer for the Massnick-Phipps Mfg. Co., Detroit, Mich., manufacturer of the Perkins 4- and 8-cylinder motors, of which Mr. Graham is the designer, has taken charge of the purchasing in conjunction with the engineering end.

Walpole Tire Sale Is Confirmed

BOSTON, MASS., April 10—Judge Dodge in the United States district court has confirmed the sale of the Walpole Tire & Rubber Co. to the New York creditors' committee. The committee bid $780,000 for the property at public auction on March 10. The stockholders who bid $775,000 endeavored to have the sale set aside and a new one ordered on an offer of $800,000 on their part. This sum, it was represented, would satisfy all claims of creditors in full. An appeal will be made from the decree of confirmation.

READING, PA., April 11—The S. G. V. Co., Reading's largest manufacturing automobile concern, with offices and factory at 302 North Eighth street, has suspended operations indefinitely, according to a statement given out at the offices of the company. It is said that the firm and plant is being reorganized, but no details were given out.

Marmon 41 on high-gear economy run in congested Chicago

Traffic Congestion Wastes Fuel

Marmon Demonstrates in Chicago's Business Section Effect on Gasoline Consumption

CHICAGO, ILL., April 8—That traffic conditions have a great deal to do with fuel economy was demonstrated clearly today in a unique test when a Marmon 41 was driven through every street of the loop, Chicago's most congested business district, with the gearset lever locked in high. The car criss-crossed the loop in both directions, traveling first through all the east and west streets and then through all the north and south streets, covering 10 1-2 miles in its journey through the section bounded by the elevated railroad structure.

Accurate account of the gasoline used on this trip was taken and found to be 1.355 gallons for the 10.5 miles. This gives a consumption of 7.75 miles per gallon for the congested district. The car was then taken out on the dirt roads of Grant park where the conditions approach very close to ordinary touring conditions. Here the economy was found to be nearly double that obtained in the loop, the car running another 10.5 miles on only .666 gallons, making 15.75 miles per gallon for the road test.

During the 10 1-2 mile journey through Chicago's most congested traffic, sixty-seven stops were necessary in compliance with the traffic policemen's whistles or on account of blocked streets. At other times it was necessary to run at speeds as low as 2 1-2 and 3 miles per hour.

After each of these sixty-seven stops the engine started the car on high, with a steady, even pull and exhibited no tendency to labor even when, as was the case most of the way, seven persons were aboard. In every case the clutch was dropped in and only twice did the driver slip the clutch noticeably.

The test was held under the auspices of the Chicago Automobile Club and was conducted by the club's technical committee. The car used was a five-passenger Marmon 41 having a gear ratio of 3.9 to 1 and with 36 by 4 1-2 Silvertown cord tires. It was equipped with a Stromberg carbureter.

Plant for Dr. Rittman

PITTSBURGH, PA., April 9—Experiments are being conducted here by Dr. Walter F. Rittman, who has evolved methods for extracting benzol and toluol from crude petroleum. The work is being done in a temporary laboratory, but construction of a new plant, which an oil company has agreed to build in order to try out the Rittman discoveries, will begin within the next few weeks. The plant will be situated near the new testing station of the United States Bureau of Mines.

BIRMINGHAM, ALA., April 7—The Woodward Iron Co. will build a benzol plant, the cost of which is estimated at $200,000. Its production will be about 2,000 gallons of benzol a day.

Brewster-Knight Four-Cylinder Chassis Ready for Production

NEW YORK CITY, April 12—The Brewster-Knight chassis of which considerable rumor has been going around throughout the automobile industry will shortly be in a state of actual production. The experimental job which a representative of THE AUTOMOBILE was offered the first opportunity of viewing today has now run 4,167 miles on the roads throughout this vicinity and with few exceptions is a good representation of what the finished job will be.

The new Knight product was designed by Owen Thomas, engineer for Knight & Kilbourne at the Brewster Bros. plant in Long Island City. It incorporates a Knight engine of standard design with its 4 by 5.5-inch cylinders cast in a single block. The Knight characteristics have not been altered in any degree, but the auxiliary fittings have been made to suit this particular mounting. A good example of this is in the arrangement of the water pump and magneto which are driven from a single shaft on the right side of the motor through a leather flexible coupling. The Bosch magneto is tilted slightly in its mounting on the crankcase to bring the armature shaft out far enough to make a suitable connection for the straight line drive of the water pump shaft.

Gasoline will be fed by the Stewart-Warner system which is supplied by an 18-gallon gasoline tank mounted on the rear of the frame. Lubrication is by a full pressure feed with leads to each sleeve bearing surface and through all the main bearings.

Only One Universal in the Drive

The drive is taken by a cone clutch which is faced with fabric and provided with engaging springs to a three-speed gearset. There is only one universal in the drive, this being a leather design at the forward end of the driveshaft. Besides the universal there is a laminated steel plate joint which provides an easy means of adjustment fore and aft in the length of the driving members. Final drive is through spiral bevel gears to a floating axle. The ratio of reduction between the drive pinion and large differential gear is 4.08 to 1 on the experimental car and this reduction will probably be adopted for the final job. The driveshaft is inclosed in a torque tube which takes the drive and the entire drive is floating by the use of a design which includes a rigid connection between the torque tube and the gearbox and a ball joint connection between the gearbox and the frame.

On the experimental car there is a U-S-L starting and lighting system and the probability is that this will be adopted on the final job. There are many other features, however, which are not fully determined. One of these is the springing which although probably a modified Lanchester design, giving a long cantilever having an overall length of 102 inches has not as yet been fully decided upon. The tires will be 34 by 4 1-2 inches, the wheelbase 125 inches, and the turning radius 32 feet. The brakes are connected to the operating mechanism by cable connections.

The price of the stripped chassis will be $4,000 and the body will be of special design to suit the needs of the purchaser, although a few stock bodies will be put through as standardized design. The idea of the Brewster company is to build in this country a medium-size high-priced chassis which will involve all the careful details of manufacture justified by such a price. The company has been dealing in Rolls-Royce cars and will continue to do so where a large car is specified, but owing to the delays in obtaining chassis from foreign makers they have felt the necessity of manufacturing a high-grade medium-priced car suitable for town work which they can rely upon as regards deliveries. One of the members of the firm states that they have received word from the Rolls-Royce company that the latter concern will devote their energies to parts manufacture for the present time.

Ajax Tire Winner Makes 21,985 Miles

NEW YORK CITY, April 9—The second annual Ajax tire mileage contest for employed chauffeurs has come to a close and the judges, Messrs. Alfred Reeves, general manager of the National Automobile Chamber of Commerce; President R. A. Patterson of the Tarrytown National Bank, and L. W. Scudder, certified public accountant, have declared G. C. Jensen in a Cadillac the winner with a mileage of 21,985. Prize drivers averaged 16,509 miles on at least one tire. The winner received a prize of $500. Second prize of $300 went to Frank Gray in a Peerless who covered 21,483 miles. Third prize of $200 went to A. C. Smith in a Cadillac with a mileage of 21,039 miles. There were five prizes of $100 each, the winners of which averaged around 19,000 miles.

Out of the $5,000 offered in prize money, fifty winners received $20 each, while 100 received $10 each. Two hundred and eight of the prize winning chauffeurs averaged 7,722 miles per tire, while thirty of them averaged 16,509 miles per tire; 178 of the minor prize winners averaged 6,241 miles per tire.

The company will renew the mileage contest for the 1915-1916 season with 208 cash prizes totaling $5,000. The judges and rules of the contest are the same as have governed the two previous competitions. Those winning prizes of $25 or over are given below:

MILEAGE	AMOUNT	NAME	ADDRESS	OWNER	CAR
21,985	$500	Garth C. Jensen	Stevens Pt., Wis	John N. Welsby	Cadillac
21,483	300	Frank Gray	Chicago, Ill.	Carl N. Gottfried	Peerless
21,039	200	Alfred C. Smith	Springfield, Mass.	Oliver Smith, Livery	Cadillac
20,910	100	Laurence Ross	Ticonderoga, N. Y.	William Henry	[illegible]
20,075	100	E. C. Bode	St. Louis, Mo.	A. H. Bode, Livery	[illegible]
18,942	100	Albert Nathan	New York City	F. L. Young	Studebaker
18,466	100	H. W. Bode	St. Louis, Mo.	A. H. Bode, Livery	Packard
18,190	100	Herman W. Bushey	Brockton, Mass.	Francis E. Shaw	[illegible]
18,148	50	Anthony B. Silvia	Haverhill, Mass.	Chas. W. Eaton	[illegible]
17,452	50	L. LaFountaine	Brooklyn, N. Y.	Wm. D. Hoxie	Stevens-Duryea
16,662	50	R. L. McNeal	Ticonderoga, N. Y.	James C. Leach	Stevens-Duryea
16,617	50	Merrill W. Garber	Fitchburg, Mass.	Douglas Crocker	Packard
16,461	50	Charles W. Lewis	New York City	Donald McAleenan	Renault
16,384	50	Harry Coghlan, Jr.	Brooklyn, N. Y.	Mrs. Anne Coglan	Ford [illegible]
16,071	50	S. Lichtenstein	New York City	Harris L. Rosenthal	[illegible]
15,782	50	Oscar Krispien	New York City	I. Kutner	F I A T
15,500	50	Adolph Kocher	New York City	David Winkel	[illegible]
15,434	50	H. Christianson	Springfield, Mass.	O. A. Smith, Livery	[illegible]
15,237	25	Walter Wolff	Chicago, Ill.	W. F. Darndorf	Packard
15,225	25	Chas. F. Finfrock	Dayton, Ohio	Maurice Costello	[illegible]
15,101	25	Alfred B. Hovey	Lowell, Mass.	Mrs. F. B. Snedd	[illegible]
14,732	25	Raymond W. Smith	Worcester, Mass.	Mrs. Helen C. Green	Jeffery
14,400	25	Geo. C. Mathis	New Haven, Conn	Mrs. Jno. Day Jackson	Cadillac
14,312	25	Frank Levine	New York City	M. Densen	Cadillac
13,844	25	Wm. H. Bodine	New York City	Bryant Motor Service	Peerless
13,792	25	Cecil Etmire	Logansport, Ind.	John M. Etmire	[illegible]
13,478	25	W. H. Squier	Proctor, Vt.	Vermont Marble Co.	Franklin
13,250	25	A. Nelson	Brooklyn, N. Y.	Wallace T. Jones	Pierce-Arrow
13,155	25	J. W. Simonds	New York City	R. Zeimer	Cadillac
13,090	25	Leo B. Devere	Yonkers, N. Y.	Mr. Jean N. E. St. Cyr	Packard
12,749	25	Philip Haubert	New York City	Bud Fisher	[illegible]
12,655	25	Louis E. Johnson	Campello, Mass.	Mrs. G. H. Thompson	Locomobile
12,531	25	A. Sheehan	Far Rockaway, L. I.	Geo. Walden	Ford
12,462	25	George Lesser	New York City	I. S. Sanger	[illegible]
12,402	25	R. Vlas Blom	Grand Rapids, Mich.	Chas. Trankla Co.	Studebaker
12,028	25	Irving E. Paul	Worcester, Mass.	T. S. Johnson	White
11,752	25	Fred Dickas	Detroit, Mich.	Geo. D. Coleman	[illegible]
11,587	25	Edwin T. Lachman	Reading, Pa.	Reading Eagle	AutoCar Truck
11,040	25	David L. Brown	New York City	Leo Steinfeld	Packard
10,849	25	W. A. Oldenburg	Detroit, Mich.	B. Schroeter	Overland
10,849	25	Robert Bradley	Philadelphia, Pa.	Penn. Hospital for Ins.	Packard
10,843	25	Joseph Goddard	Scranton, Pa.	P. R. Jordan	[illegible]
10,756	25	Roy H. Anderson	Springfield, Mass.	Mrs. Sarah J. Bull	Pierce-Arrow
10,655	25	W. H. Becker	New York City	Mrs. F. A. Schmidt	Pierce-Arrow
10,610	25	Tony Dirorl	New York City	Henry Kelly, Jr.	Columbia
10,492	25	Neil O. Bouman	Proctor, Vt.	Vermont Marble Co.	Franklin
10,177	25	Roy E. Olsen	San Francisco	Union Iron Works Co.	Packard
10,043	25	Mead H. Kimball	Scranton, Pa.	Miss M. F. Pauli	Locomobile
9,937	25	T. A. Kane, Jr.	Philadelphia, Pa.	Dusel Goodlee & Co.	[illegible]
9,625	25	Jos. E. Kennelly	Jersey City	Dr. F. J. Short	Cadillac
9,607	25	Robert W. Hamilton	New York City	W. A. Parke	Pierce-Arrow
9,587	25	Alfred Lofton	New York City	Arthur Israel	Cadillac
9,532	25	James McDermott	New York City	Harry N. Hempsted	Premier
9,285	25	Frank Walquist	Hibbing, Minn.	Oliver Iron Mining Co.	[illegible]
9,233	25	A. Walstine	Jacksonville, Fla.	A. G. Hartridge	Overland
9,227	25	Edward Snyder	Oak Park, Ill.	Jos. R. Noel	Pierce-Arrow
9,126	25	Chas. N. Peck	New York City	W. F. Tighe	Packard
8,734	25	Carl Bischoff	Sheffield, Mass.	Miss Sophia Curtis	Locomobile

Developments in the Jitney Bus Field

Dallas Traction Co. Estimates Yearly Loss From Jitney Competition at $500,000

AUSTIN, TEXAS, April 8—The interurban and street railways interests in Texas of the Stone & Webster Engineering Corp., Boston, Mass., are suffering heavy losses from jitney competition that now exists in Dallas, El Paso, Houston, Galveston and Beaumont, where the company operates street railway lines. The interurban line that runs between Dallas and Fort Worth is now up against a competing jitney automobile service between the two cities, and jitneys are soon to be put on between Houston and Galveston and between Beaumont and Port Arthur in opposition to the interurban lines of the Stone & Webster Engineering Corp., it is announced. E. T. Moore, head of the traction companies in Dallas, states that the jitneys in that city are responsible for a loss of about $1,370 per day, which will amount to a total of $500,000 per year in the revenue of the street railway lines there. In Houston the daily loss of revenue to the street railway company on account of the jitney competition is about $1,200, and in Beaumont, Fort Worth and El Paso the loss is several hundred dollars per day for each city. In a statement of the effect of the jitney service upon the traction companies in Dallas Mr. Moore said:

"In January there were so few jitneys that their effect on the street railway company's earnings was almost negligible. For the month of February the total jitney earnings are estimated at $14,600, or an average of a little more than $500 a day. The decrease in passenger revenue of the traction company in February, 1915, as compared to February, 1914, was $31,300, but of this amount $5,000 is attributed to the corn show and $11,700 to the natural decrease due to business depression. The March figures, taken from the earning sheet of the car company, prove that the decrease in the traction receipts is growing. In March, 1914, the earnings amounted to $107,229.45, while in March 1915, the company's receipts totaled $64,745.88, showing a loss for the month of $42,483.57. According to the figures the company's receipts are this year $1,370 less per day than one year ago, or at the rate of more than $500,000 per year. A portion of this loss may be chargeable to business depression, but most of it is undoubtedly due to the jitneys."

Los Angeles Jitney Fees Reduced 50%

LOS ANGELES, CAL., April 7—The report of the finance committee recommending that the license fee for jitney buses in Los Angeles, be reduced from $15 per quarter to $7.50, was unanimously adopted. The report, constituting a $6,000 cut in the city's revenue from this class of vehicles, was a present to the city's treasurer. It was necessitated by the ruling of the city attorney that the jitney buses had been assessed under an improper interpretation of the license ordinance. The interpretation of the ordinance as to what a jitney bus really is, was asked for by the council in order to pave the way for action to compel the bus operators to conform to one standard of business and stop competing with taxicabs. Demand to this effect has been made by the taxicab concerns. The taxicabs have to pay $15 per quarter and the owners contend that if the buses engage in the taxi business, charging 75 cents an hour and upwards, the buses should be compelled to pay the same.

Another Ordinance for $5,000 Bond

ROCK ISLAND, ILL., April 9—The jitney bus business in the Tri-Cities will be given a death blow if the ordinance submitted to the city council of each should be adopted. Under its provisions, jitney bus men must deposit a $5,000 bond before embarking in business. The license fee, will be advanced from $10 per annum, as at present, to $100. Jitney bus men must present a certified map of their routes when securing permits, and will be required to adhere strictly to them. No digressions or encroachments upon other routes will be tolerated. Buses must be equipped with proper lights at night. They must operate continuously from 6 a. m. until 11 p. m. The application which must be filed out by the owner of a car, gives all particulars concerning the driver or owner, whether or not the car is paid for, the amount of property of the owner which is exempt from execution; requires references, length of residence, age, previous occupation, together with other personal information. Unless the various blanks are filled out to the satisfaction of the mayor, a permit is withheld.

Montreal's First Jitney Service Opens

MONTREAL, CAN., April 10—Next week the initial unit of the jitney bus service of Montreal will be put into operation. The first jitney bus service will include a dozen or more cars on one of the principal routes where traffic is the heaviest. This service will be operated under the auspices of the Jitney Bus Assn. of Montreal and will consist of individual car owners who are members of the association deriving benefits therefrom in payment of weekly dues just as a club member benefits by the organization. The profits from his car above his weekly dues are his own. The fare will be 5 cents and six tickets for a quarter. The plans of the jitney associations include the placing of 100 cars on the streets of Montreal before May 1.

Jitney Bus Line for Newark

NEWARK, N. J., April 13—This city will have a jitney bus line, according to a statement made recently by F. J. Griffin, promoter of the proposed local jitney system. In all likelihood there will be eight or ten routes radiating from Broad and Market streets from Park Place, those being the most congested points. No franchise is necessary, as the company will operate its buses on public hack licenses. Should traffic conditions warrant it 500 vehicles will be put into action. It is planned to carry passengers 3 miles for a nickel.

JEFFERSONVILLE, IND., April 9—The city council of Jeffersonville has decided to regulate jitney buses. The city attorney has been directed to prepare an ordinance to force every operator of a jitney bus to provide a bond of $2,500 before being permitted to engage in the business. The first jitney bus line in Dubois County has been established by Heath's garage at Huntington, Ind.

DENVER, COLO., April 5—An ordinance permitting the operation of jitney bus lines in a restricted way has just been passed by the city council of Pueblo, the only Colorado city thus far granting any jitney permits. The ordinance requires a license fee of $50, a bond of $10,000 and the filing of a draft showing the exact route to be traveled by all cars for which permits are issued. It provides further that the cars shall be allowed to stop only at alleys, that all drivers must be at least 21 years of age and that no car shall be allowed to carry more passengers than there are seats.

MILWAUKEE, WIS., April 9—Milwaukee's list of jitney buses was increased from 235 to 344 during the week ending April 10. The city treasurer reports that only 297 of the 344 who have taken out licenses have paid the $5 semi-annual fee and the chief of police has set a squad of patrolmen at work to determine how many jitneys are being operated without proper credentials. The tremendous growth of the number of jitneys is being made evident by the occurrance of accidents and the liability insurance problem is taking on a serious aspect. Insurance agents report that their home offices will not accept applications for indemnity contracts on jitney buses even at the high rate of $200 per $1,000 of liability. The question of whether or not the jitney bus is a common carrier or a public conveyance as contemplated in accident insurance policies issued to individuals has not yet been settled.

Philadelphia Jitney Bus Assn. Formed

PHILADELPHIA, PA., April 10—To forestall adverse legislation, to co-operate with the police in enforcing traffic regulations and for mutual benefit, the Philadelphia Jitney Bus Assn. has been organized by the jitney bus owners in this city. The association has appointed a committee to confer with counsel to determine the legal status of the jitney. Routes of cars have been extended and definite rates of fare between certain points fixed.

There are now about 100 cars in operation, including one woman driver, who has for the past week been driving a jitney on the pay-as-you-enter system.

Plans are under way for the establishment of lines to the different baseball parks and to Fairmount Park and the 21st Ward Board of Trade has advocated the formation of a line to connect Roxborough with the City Hall, the fare to be 15 cents each way.

WINNIPEG, MAN., April 9—It was learned today that twenty-two cars will be taken off the daily service on the streets of Winnipeg the middle of this month. About sixty employees will be thrown out of employment. The jitneys which are daily increasing in numbers are responsible for this reduction in the number of street cars.

BALTIMORE, MD., April 10—Plans to regulate the jitney bus service in this city are being considered by the Public Service Commission. The rapid growth of the industry in Baltimore has led to W. Cabell Bruce, general counsel to the commission, being asked for an opinion as to the extent of the commission's jurisdiction in the matter. As soon as this opinion is rendered the commission will take up with the engineering department the practical phases of regulation. One of the first questions to be considered will be whether the buses will be permitted to operate only during the rush hours, paying little attention to schedule during the hours when traffic is light.

The commission also probably will decide whether more than one jitney service will be permitted to cover the same route.

Hartford Jitneyized in 2 Weeks

HARTFORD, CONN., April 9—In less than 2 weeks Hartford has become thoroughly jitneyized. This morning there are over forty jitneys operating along the trolley lines. Friday the Capitol City Auto Co., which operates the largest fleet of taxicabs in this city, turned all its vehicles loose. In less than 1 hour 100 people were transported on Franklin avenue alone. So strong has the jitney already taken that a business house found it necessary to label a light open car, "This is not a jitney." The trolley company is wailing. The jitney operators make their stops at the trolley terminals and have no trouble in picking up a good load. A car designed for seven passengers is carrying twelve and fourteen persons. The drivers are making an average of from $12 to $15 a day. The trolley company wants special legislation for the control of the jitneys.

CAMDEN, N. J., April 10—So rapidly has the jitney craze grown that the City Council is considering the advisability of assessing a license fee of $35 on each car in addition to providing for their regulation. Such action on the part of the City Councilmen, however, is being strenuously opposed by the general public on account of the popularity of the little bus.

WASHINGTON, D. C., April 13—Conrad Syme, corporation counsel of this city, who is making an extended tour of the country studying the jitney bus situation, has sent a report to the commissioners on his observations in New Orleans. He says the jitney bus has come to New Orleans to stay and that Washington offers as favorable an opportunity for its operation as the Southern city.

"The desire is strong here," said Syme in his New Orleans report, "to have the jitneys confined to certain routes. I think this will be difficult and that so far as jitneys run by individual owners or operators are concerned they should and will only be confined to the routes indicated on the card. The regular jitney bus lines, with regular cars carrying about 20 persons, will probably desire defined routes. It seems very essential that each car should display on the interior the name and number of the owner or operator, so as readily to identify the same in case of accident. There are in New Orleans about 400 individually owned jitneys, comprising cars of all types. There is also a jitney mobile line of 6 or 8 cars, capacity 20, going over a regular route of 2 1-2 miles long. The individual jitneys are licensed at $30 per year. They are not publicly regulated as to routes."

Oklahoma 2-Day Meet April 20-22

To Make Race an Annual Affair—Raise Fund of $10,000 —Grandstand for 15,000 Planned

OKLAHOMA City, Okla., April 9—With practically every detail now in the hands of various committees and nearing completion, the 2-day automobile race meet to be held here April 20-22 under the auspices of the Southwest Auto Racing Assn. now gives promise of being a success. Members of the association are raising a fund of $10,000 to put Oklahoma on the gasoline map.

Officers of the association are: E. R. Carhart, Oklahoma City, president; J. T. Rutherford, vice-president; J. P. Brough, secretary; C. W. Boggs, treasurer. Directors: Joseph Huckins, Jr., B. F. Burwell, J. B. Burwell, Harry Baker and Charles Knight, all of Oklahoma City, and John Kroutil, Yukon.

For the 200-mile race to be held April 22 for a purse of $5,000 with a $1,000 bonus for a new world's record, entries to date are as follows:

Barney Oldfield, Maxwell; Billy Carlson, Maxwell; Earl Cooper, Stutz; Dave Lewis, Stutz; Bob Burman, Peugeot; Louis Disbrow, Simplex; Eddie Hearne, Case; another Case whose driver has not yet been announced; Elbert Strigel, Stafford; George Clark, Mercedes; and A. F. Scott, Tulsa.

For the 99-mile race to be held April 20 for a purse of $1,000 and the silver trophy donated by the Chamber of Commerce, entries are:

Earl N. Swan, Knox; C. L. McLester, Franklin; Jake Strickler, Buick; J. B. Chandler, Buick; J. Roy Sloan, Overland; M. J. Main, Mercer; Paige-Detroit, whose driver has not yet been announced; Roy G. Thomas, Weston; and Charles Schaffstall, Studebaker.

It is planned by the association to make the races an annual affair and for this reason the 2.409-mile course is being worked into the best condition possible. That portion of Linwood boulevard which comprises a part of the track is being resurfaced. The turns on the track have been banked with a 10 per cent. grade and experts say that a speed of from 40 to 50 miles an hour will be possible without danger to the drivers.

Practice on the race course will begin April 14, a week before the first day's program. The practice will be limited to 2 hours a day and will be held from 6 to 8 o'clock each morning at which time the entire course will be patrolled by special guards. Foot bridges are being constructed over the track in order that there may be no liability of school children being injured while crossing the track during the races.

Local contractors are building a grandstand to accommodate 15,000 people.

3 Stutz and 1 Bugatti Enter 500-Mile Race

INDIANAPOLIS, IND., April 9—Three Stutz cars have been added to the field in the next Indianapolis 500-mile race, raising the total of entries for that event to fifteen.

Barney Oldfield will drive George Fuller's Bugatti in the race. Fuller's car was driven in the Vanderbilt Cup and grand prix races at San Francisco and in the Venice race, March 17, where it finished fourth, by J. B. Marquis. Marquis is the driver who turned over in the Sunbeam in the 1914 Grand Prix, on the Santa Monica course.

DETROIT, MICH., April 8—The first sod for the proposed Detroit motor speedway at Sibley, Mich., was turned this afternoon.

Two Speedways Promised for St. Paul

ST. PAUL, MINN., April 9—This city is again promised two automobile speedways. This comes about through the incorporation today of the Twin City Motor Speedway Co. by H. E. Habighorst, C. W. Van Orsdol and J. F. Sperry. The capital is $1,000,000. These three men were formerly part of the Twin City Motor Speedway Assn., a rival of the Minnesota Motor Speedway Assn., which two organizations a week ago were said to have reached an agreement whereby there was to be only one speedway plan and only one track, when originally each organization announced it would have a speedway somewhere between St. Paul and Minneapolis.

Then more complications arose, with each side claiming it was to be the surviving organization. Out of this tangle comes the incorporation of the Twin City Motor Speedway Co., backed by the above men, who were associated with W. D. and J. D. Hogan, Minneapolis; Dr. C. E. Dutton, Minneapolis, and F. H Wheeler, Indianapolis, in the Twin City Motor Speedway Assn.

H. C. Moore, fiscal agent for the Minnesota Motor Speedway Assn., stated that final financial arrangements had been made for his company to remain in the field and build a speedway on the site near Lake Josephine, as the original intention of the organization.

The site on which the Twin City Motor Speedway Co. states it will build a track is conveniently situated between St. Paul and Minneapolis, farther south than the Lake Josephine site of the other concern. This track, it is said, will be completed in time for races expected to be held next Labor day.

Cincinnati Motor Speedway Co. Formed

CINCINNATI, O., April 12—Talk of a local track which has been going on for some time has resulted in the formation of the Cincinnati Motor Speedway Co., which purposes to construct a 2 1-2-mile speedway which also will include the usual country club idea.

The organization meeting was held Friday at the Business Men's Club and was presided over by Dr. Charles L. Bonifield, president of the Cincinnati Automobile Club. It was decided to form a stock company with a capitalization of $5,000, and seven directors were elected. E. W. Edwards, president of the Edwards Mfg. Co., and former president of the Business Men's Club, was chosen president. Among the other officers are James P. Orr of the Potter Shoe Co., Julius Freiberg of the Freiberg Realty Co., Andreas Burkhardt of the Burkhardt Co., and George Balch of the Sinton Hotel Co. All these men belong to the progressive element of the city and their names undoubtedly will inspire confidence in the project.

While the Cincinnati Automobile Club as an organization may not be actively identified with the scheme, yet Dr. Bonifield declares that he expects every one of its fifteen members of the board of governors will take stock and assist individually.

Options have been secured on several good tracts of land, but the final decision is up to the board of directors. One that is favored is on the Reading road, which is one of the main highways leading out of Cincinnati. It starts near the court house and leads up a valley to the hill-top, where it becomes the main street of Avondale, one of the most fashionable suburbs. From there it runs through Reading and on to Lebanon, where it connects with another pike leading to Dayton. The Big Four Railroad from Cleveland and Columbus passes the proposed site, while the Chicago branch of the Pennsylvania is very near it.

Steel—Its Pathology—Part II

(*Continued from page 663*)

find a combination of two alloys which in themselves are often classed as an impurity on the part of the silicon and a medicine for the manganese. Yet when used in the proper proportions the hardening effect of the silicon and the purifying effects of the manganese, which also neutralizes in part the effect of the silicon, results in a steel that, when properly heat-treated, forms one of the best spring steels known. The composition of a sample silico-manganese spring steel is from 1.5 to 2 per cent. silicon, from .50 to .80 manganese and from .45 to .55 carbon. Beyond 1 per cent. an increase of manganese seriously affects the ductility of the metal, but the neutralizing effects of the silicon render the resulting structure one which is admirably adapted to take the heat treatment necessary to produce a spring.

Robert Hadfield, a noted metallurgist, is responsible to a large degree for the use of manganese steel. The special steel he evolved contains about 13 per cent. of manganese and 1 per cent. of carbon. As would be expected from the knowledge that manganese is a great hardening agent this steel will be hard whatever shortcomings it may have. This is indeed the case, but in addition to its hardness, when used as a casting the steel is very strong and tough and has to be somewhat softened by a heat-treating process. The extreme hardness of the product renders it practically impossible to be machined and as a result it is only used in such positions as rock-crushing apparatus and similar work where extreme hardness and resistance to wear are demanded.

Titanium a Deoxidizer

Titanium is another of the elements which occur very widely and abundantly in nature and which are often found in the iron as it comes from the mines. There is a great deal of uncertainty among metal experts as to what the true effects of titanium really are. Its principal use is as a deoxidizing agent and most authorities claim that when sufficent has been added to react with the oxygen and nitrogen present it has no further effect. Its property as a nitrogen remover due to its strong affinity for that gas makes it very valuable in iron work. It is added to cast iron quite frequently for the purpose of removing to a large extent the danger of blowholes. Titanium is not an old alloy, having been isolated only as lately as 1895. It is one of the few elements which readily unites with nitrogen and is very peculiar in that when its oxide is heated in an atmosphere of nitrogen in an electric furnace the resulting product is a bronze-yellow mass, which is titanium itself, practically as hard as a diamond. It is one of the rather uncertain medicines which the doctor of steel has at his disposal and at the present time many experiments are being conducted with a view of showing its exact effects in different directions.

Molybdenum is a hardener like tungsten and its effects are very similar to those of the latter except that they are more pronounced. Prominent metallurgists assert that molybdenum has 4.5 times the results of tungsten and when used in this proportion can be substituted in the ratio of 1 per cent. for every 4.5 per cent. that would be used of tungsten. This strangely follows through not only the high speed tool use but also for permanent magnets, although while it is claimed that for the latter use it is even better than tungsten, our large magneto manufacturers hold closely to the tungsten.

These alloys form the basis of special steel practice as it applies to the principal industries today. To sum up:

We have nickel, the increaser of the elastic limit, hardness and ductility. It is the muscle and vitality builder.

Chromium, the bone-builder, allows a hard steel to resist great shocks.

Vanadium the vitalizer, allows steel to resist fatigue.

Silicon a hardener, which ordinarily seriously affects the strength, but, when purified by manganese forms a great spring steel.

Aluminum is a deoxidizer.

Titanium also removes the oxygen besides combining with the nitrogen.

Tungsten is the great hardener, and retainer of magnetism.

Molybdenum is also a hardener and a retainer of magnetism, forming what may be called the understudy of tungsten. It also enables steel to resist rusting.

Four-Cylinder Ingot to Enter Field

CALUMET, MICH., April 12—A four-cylinder touring car, to be known as the Ingot, is to be made either in this city or in Houghton. The new concern intends to make the price of its car between $700 and $1,000 and employ 200 men the first year. The car will be assembled, the parts and accessories to be purchased principally in Detroit.

Factory Miscellany

DOUBLE-TREAD Tire's Factory—The Double-Tread Tire Co., of Indiana, Indianapolis, Ind., has established salesrooms and a factory at 609 North Illinois street. The company was recently incorporated under the laws of Indiana for the reclamation and reconstruction of automobile casings. B. E. Griffey and J. A. Gavin are backing the new company. In the reclamation process, or "economy system process," two old casings are utilized to make one casing. Tread-worn, rim-cut, blown-out casings which are no longer of service are combined. A casing with a good bead and side wall is repaired and strengthened so as to hold the inner tube; another with a fair tread is put over it. The bead is trimmed and the two are lock-stitched together. Two rows of stitches, made with a heavy gum-treated flax cord, hold the two casings beyond the possibility of slipping, and at the same time make a water and dustproof seam. The double-tread casing produced is practically puncture and blow-out proof. Officers of the company say it is serviceable for from 2,500 to 10 000 miles, according to the condition of the casings reclaimed.

Tire Factory for Fort Madison—The Perfection Tire & Rubber Co. will establish a factory in Fort Madison, Ia.

Winton Doubling Time—The Winton Motor Car Co., Cleveland, O., employing 2,000 workmen, has started day and night shifts.

Galion to Add—The Galion Motor Car Co., Galion, O. (E. P. Rayl, proprietor), is preparing to make a 50 by 150-foot addition to its plant.

Plant for Connolly Co.—Plans have been prepared for the construction of a 50 by 120-foot concrete plant for the Connolly Motor Co., Mandan, N. D.

Drednot Truck's Plant—The Drednot Motor Truck Co., Ltd., Montreal, Que., has secured a factory at Wellington and Nazareth streets, and will install machinery.

Victor Rubber Adds—The Victor Rubber Co., Springfield, O., has awarded a contract for adding a second story to the addition to the plant now under construction.

Ford Factory in Charlotte—The Ford Motor Co., Detroit, Mich., will build a factory in Charlotte, N. C., to cost about $250,000. The plant will employ about 2,000 men and will be ready for business in about a year.

Columbus Buggy Sells Shop—The Columbus Buggy Co., Columbus, O., has disposed of the one-story building used as a blacksmith shop to the Corrugated Container Corp. of New York City, which will use it to manufacture containers.

Perfection Tire's $90,000 Plant—The Perfection Tire & Rubber Co., of Chicago, will build a factory at Ft. Madison, Ia. The buildings and equipment will represent an outlay of about $90,000. It is the intention to have the plant in operation by the last of July.

Working on Swinehart Addition—The work of constructing a three-story office building and factory by the Swinehart Tire & Rubber Co., Akron, O., has begun. The addition is being erected on North street, in the rear of the present buildings. The cost will be in the neighborhood of $50,000.

The Automobile Calendar

April 16	Manchester, Eng., Show, Ice Palace, North of England Motor Shows, Ltd.
April 20-22	Oklahoma City, Okla, Road Race, S. W. Auto Racing Assn.
May 15-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17	Spokane, Wash., Show, Davenport Hotel.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4-5	Tacoma, Wash., Road Race.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.

Packard's Three-Story Addition—The Packard Motor Car Co., Detroit, Mich., will build a three-story addition to its plant on Concord avenue. The structure will be 52 by 113 feet in size and of reinforced concrete. It will cost about $10,000 and become the heat-treating department. In the main building the show or display room will be completely altered at an expense of $5,000.

Republic Payroll Largest in Its History—This week there were 200 men on the pay-roll of the Republic Motor Truck Co., Alma, Mich., the largest number in the history of the company. This force will be increased to 250 or 300 by the end of May. Orders in March were 60 per cent. over those received in April and more than triple the number received last year in March.

Baker to Increase Production—The Baker Motor Vehicle Co., Cleveland, O., which recently reduced the prices on three of its models, will greatly enlarge the scale of production on its light electric coupé. By concentrating upon this model and producing it in quantities never before undertaken, the company has reduced the manufacturing expense, as well as the general expense per car.

Studebaker Plant Has Over 1,000.000 Sq. Ft.—According to a very recent investigation the total floor space of the different plants of the Studebaker Corp., Detroit, Mich., and in South Bend, Ind., is 1,500,000 square feet. At the South Bend plant the motor castings, springs, several small castings and complete bodies are made. At the foundry 160,000 pounds of castings are produced daily, also 90,000 sets of springs.

Figures on E-M-F and Flanders Production—The total number of E-M-F 30, Flanders 20 and Studebaker cars, which had been made and sold up to July 1, 1914, was 134,023. The first two named cars were made by concerns which were taken over by the Studebaker Corp., Detroit, Mich. In 1913 the Studebaker cars made totaled 34,107. During the first 6 months of 1914 the production totaled 19,809; and while the total figure for the year is not yet known, it is estimated at over 40,000.

Ohio Convicts Build Trucks—Five new 3-ton trucks have been finished at the Ohio penitentiary, Columbus, O., by convict labor. The trucks are to be used in the state service at the various institutions. A year ago the convicts of the state prison turned out their first truck, which proved a big success. The prisoners have started to work on five additional trucks. It is claimed that they have cost $1,000 less each than could be purchased from manufacturers.

Work Begun on Truck Factory—Active operations were begun on the new plant of the Beech Creek Truck & Automobile Co., Beech Creek, Pa. The industry will be located on East Main street. The company has also made arrangements to purchase 10 acres in addition to the 4 acres. The first building to be erected is the office and draughting room combined, in all 12 by 22 feet, facing the street. Next week work will begin on the construction of the first building, 30 by 60 feet. P. J. Smith, the inventor of the new type of four-wheel drive trucks, and the superintendent and general manager of the company, arrived there from a business trip to Pittsburgh and Buffalo, where he acquired the necessary machinery and tools with which to equip the plant to begin active operations.

Mt. Wolf's Automobile Plant—York county, Pa., will have another automobile manufacturing plant. The plant will be known as the Mt. Wolf Motor Car Co. and will be located at Mt. Wolf, about 8 miles northwest of York. Several meetings of stock subscribers and interested persons have been held and a site for the factory is now being considered. The company will be incorporated at $50,000, later to be increased to $150,000. The proposed new plant will start operations with about fifty men, the number to be increased as the business warrants it. The plant will devote its attention to the manufacture of touring as well as commercial cars. A new device that will be tried out, according to plans, will be the construction of a touring car with a detachable body, which, when the body is removed, can be converted into a car for commercial use. The plant will be under the management of J. C. Krout.

The Week in

the Industry

Motor Men in New Roles

ANDREW Joins Remy—F. W. Andrew, formerly designing engineer for the Dayton Engineering Laboratories Co., Dayton, O., has affiliated with the engineering staff of the Remy Electric Co.

Needham Jeffery Advertising Mgr.—M. H. Needham has been appointed advertising manager of the Thomas B. Jeffery Co., Kenosha, Wis.

Howell J-M Advertising Mgr.—A. R. Howell has been appointed advertising manager of the H. W. Johns-Manville Co., New York City, succeeding F. J. Low, who has resigned.

Seibert Studebaker Mgr.—C. K. Seibert, formerly auditor of the Studebaker Corp., South Bend, Ind., has been appointed acting manager of the Studebaker branch at Salt Lake City.

Moore Appointed Mgr.—North Moore has been appointed manager of the Trenton Motor Co., St. Louis, Mo., Mercer distributor. He succeeds J. L. Nugent, who has resigned on account of poor health.

Dill N. J. Automobile Commissioner—W. L. Dill, of Paterson, N. J., has been appointed Commissioner of Motor Vehicles of New Jersey to succeed Job. H. Lippincott. He will also act as Assistant Secretary of State.

Gerspacher Overland Mgr.—C. G. Gerspacher, formerly assistant manager of the Omaha (Neb.) branch of the Studebaker Corp., has resigned, to take the position of manager for E. A. Brandes, Overland distributor of Overland cars in Hastings, Neb.

Messinger Republic Truck Mgr.—C. J. Messinger, long associated with the automobile business in Tacoma, has assumed the sales management of the Republic truck department of the Griffith Motor Car Co., which is also Tacoma, Wash., distributor for the Dodge cars.

Morse Representing Grossman—E. H. Morse has been engaged to represent the Emil Grossman Mfg. Co., Inc., New York City, among manufacturers in the territory west of Michigan, including Indiana. Mr. Morse recently conducted a car agency and supply house in Providence, R. I.

Haggerty Succeeds Earle—W. E. Earle, manager of the Indianapolis branch of the Ajax-Grieb Rubber Co., has been succeeded by C. J. Haggerty, of Brooklyn, N. Y., who has assumed his new duties. Mr. Earle has been transferred to the New England States, where he will travel.

Matheson Dodge Service Mgr.—C. M. Matheson, until recently New York district representative of Dodge Bros., Detroit, Mich., has been appointed manager of the concern's service department, with headquarters in Detroit. Mr. Matheson was formerly president of the Matheson Motor Car Co.

Harrison Chalmers Advertising Mgr.—J. R. Harrison has been appointed advertising manager of the Chalmers Motor Co., Detroit, Mich., succeeding Newton A. Fuessle, who resigned owing to ill health. Mr. Harrison comes from the Burroughs Adding Machine Co., where he has been assistant advertising manager during the last year and one-half. Previous to that connection he was with the National Cash Register Co., Dayton, O., being confidential secretary to Lee E. Olwell, who now is general manager of the Chalmers company. Before going to Dayton, Mr. Harrison was in the advertising business in Chicago.

Recent Premier Changes—J. E. Levi, of the Premier Motor Manufacturing Co., Indianapolis, Ind., in addition to his southern territory, will cover the states of Montana, Idaho, Wyoming, Utah, Colorado, Arizona and New Mexico. J. B. Dub, formerly in the southwest for Premier, is now located in the east for this company, with headquarters in New York City. C. I. Lowd has been appointed factory representative for the company in New England. He makes his headquarters with the Premier Boston dealers, the Premier Motor Co., 885 Boylston street. E. E. White has been appointed purchasing agent for the company. E. E. Westman, late purchasing agent for Premier, takes charge of the Premier technical department.

Garage and Dealers' Field

New Detroit Accessory Store—H. S. Wagnits has opened an automobile supply and accessory store at 680 Woodward avenue, Detroit, Mich.

Warner Gear's Detroit Branch Moves—The Detroit branch office of the Warner Gear Co., Muncie, Ind., has been moved from the Ford Bldg. to 967 Woodward avenue.

Royal Equipment in New Office—The Royal Equipment Co., maker of Raybestos brake linings, clutch discs and linings, etc., is located in its new office, 1613 Dime Bank Bldg., Detroit, Mich.

New Garage in Santiago—Pancorvo Bros., commission merchants, exporters and importers in Santiago, Chili, and with offices at 17 Battery Place, New York City, recently built a fireproof garage in the South American city, with a capacity for 200 cars.

Detroit Westinghouse Moves — The Detroit, Mich., offices and service station of the Westinghouse Electric & Mfg. Co. has moved into its new quarters at 1211 Woodward avenue. A complete stock of repair parts for the various Westinghouse products is kept in stock.

Opens New Garage—J. P. Muller, president of the advertising company bearing his name in New York City, has incorporated the Thoroughfare Garage Co., Inc., of Elmhurst, L. I., which on April 1 opened a fireproof brick and concrete garage at Queens and Paris boulevards, that city.

Krit's New Detroit Service Dept.—The service department of the Krit Motor Car Co., Detroit, Mich., is now located at 584 Franklin street, which is also the service station for the cars made by the following concerns, all of which are now bankrupt: American Voiturette Co., Henderson Motor Car Co., Michigan Motor Car Co.

Right Shock Absorber in Minneapolis—The Kleckner Shock Absorber Co. has taken over the distribution of the Right shock absorber for the states of Minnesota, North and South Dakota. Its headquarters are at 1514 Hennepin avenue, Minneapolis, Minn. The Right shock absorber is a special shock absorber for medium-weight cars.

Baltimore's New Tire Shop—The Tire Shop, according to an announcement made, is the successor to Eldred B. Quarles & Co., Charles and 20th streets, Baltimore, Md. Those interested in the Tire Shop are W. C. Floyd and W. Rydstrom. In addition to the Dayton airless tires and the Braender tires, it is announced that the Shop will carry Batavia tires.

Handles Silver's Used Car Business—All the used cars taken in trade by the C. T. Silver Motor Co., New York City, distributor for the Overland and Peerless cars, will be handled by the Rodney K. Haines Co., that city. The company has the exclusive agency for all used cars taken in trade by the Silver company. Salesrooms have been opened at 1739 Broadway.

Accessory Branch for Colorado Springs — R. I. Lemon, for the last 4 years connected with the MacFarland Auto Co., of Denver, Colo., and Wyoming distributor for the Buick and Packard cars, has gone to Colorado Springs and opened an accessory store under the name of the Colorado Springs Auto Equipment Co., a branch of the Denver Auto Equipment Co.

Locomobile Used-Car Sale—The New England branch of the Locomobile Co. of America inaugurated a Spring sale this week at its salesrooms in Boston, Mass., that is being watched with interest by the other dealers. The quarters will be kept open from 8.30 a. m. to 10 p. m. every day from Monday to Saturday, and advertisements in the newspapers call attention to the sale of cars taken in exchange for new Locomobiles. While Locomobiles are the feature of the sale, other cars will also be sold. The keeping open of salesrooms on Commonwealth avenue until 10 at night for an entire week for the sale of used cars is an innovation.

New Autocar Service Station—The Autocar Sales Co., New York City, has opened its new truck garage and service station at 557 West Twenty-third street. The building is of fireproof construction throughout and runs from Twenty-third to Twenty-fourth street, where are located the main garage entrances and exits. The sales and show rooms are at the Twenty-third street front, and the entire rear of the ground floor of the building is given over to garaging space. On the second floor are the road service department, which maintains spare cars for rental to owners for emergency haulage; completely equipped repair shops, offices and stockrooms.

Automobile Agencies Recently Established

PLEASURE CARS

Arkansas

Bentonville	Metz	H. S. Hess

California

Glendale	Oldsmobile	E. Bennett, Jr
Isleton	Oldsmobile	C. K. Cook, Netherland Garage
Los Angeles	Moline-Knight	Moline Automobile Co.

Colorado

Berthoud	Grant	Berthoud Garage Co
Coaldale	Chevrolet	Phillip & Perry
Coaldale	Monroe	Phillip & Perry
Colo. Springs	Pilot	W. W. Price
Denver	Haynes	E. J. Johnson
Denver	Hercules	South Denver Garage Co.
Denver	Dort	J. S. Morrison Auto Co.
Denver	Hupmobile	J. S. Morrison Auto Co.
Denver	Chandler	A. T. Wilson Auto Co.
Denver	Pilot	Elmore Auto Co.
Fort Collins	Chevrolet	Ben Mosman
Fort Collins	Monroe	Ben Mosman
Greeley	Hupmobile	Schoonmaker & Lee Bros. Hdw. Co.
Montrose	Pilot	J. Hodges
Pueblo	Pilot	E. I. Crockett
Trinidad	Moline-Knight	D. H. Gottlieb

Connecticut

Danbury	King	A. C. Penny
Derby	King	W. C. Gilbert
Hartford	Pilot	J. J. Molloy
New Haven	King	W. R. Moore
Shelton	Pilot	H. L. Stilphen

Illinois

Aurora	Moline-Knight	Sprinkel & Bromley
Aurora	Pilot	E. J. Ellie
Bushnell	Moline-Knight	S. H. Robinston
Bushnell	Oldsmobile	D. B. Carithers
Cambridge	Moline-Knight	P. A. Johnson
Chicago	Chevrolet	Chev. Motor Co. of Ill.
Chicago	Moline-Knight	The Austin Garage
Chicago	Moline-Knight	Moline Auto Co.
Dixon	Kissel	R. Nelson
Farmington	Moline-Knight	C. A. Negley
Freeport	Moline-Knight	G. W. Brokhausen Automobile Co
Freeport	Franklin	D. E. Sunderland
Forreston	Moline-Knight	Abels & Korf
Galena	Moline-Knight	K. V. Johnson
Hillsdale	Moline-Knight	J. F. Butzer & Son
Joliet	Moline-Knight	Long Bros
La Salle	Dort	J. E. McCabe
La Harpe	Pilot	B. N. Byler
London Mills	Moline-Knight	White, Latourette & Sampson
Milledgeville	Dort	E. C. Miller
Morton	Moline-Knight	H. F. Zelle
Murphysboro	Pilot	G. E. Craine
New Boston	Moline-Knight	D. S. Prentiss
Peoria	Moline-Knight	J. E. Whitten
Ransom	Moline-Knight	Richards & Weber
Rock Island	Moline-Knight	Sauermann Motor Co.
Springfield	Moline-Knight	Seidler & Keener
Tuscola	Pilot	F. Wilson
Wyoming	Moline-Knight	S. Wilkinson

Indiana

Elkhart	Chevrolet	W. H. Keeth, Jr.
Evansville	Chevrolet	Fuchs & Angermier
Farmland	Oldsmobile	Earl Burnworth
Fort Wayne	Oldsmobile	Shryock Auto Co.
Hartford City	Oldsmobile	A. W. Tindall
Huntington	Pilot	D. E. Lauferty
Indianapolis	Scripps-Booth	E. H. Wilson
Indianapolis	Oldsmobile	Wildhack Co.
Logansport	Pilot	J. I. Barnes
Marion	Chevrolet	J. V. Shugart
Monon	Pilot	H. B. Rull
Muncie	Oldsmobile	Bowman & Shaffer Sales Co.
North Vernon	Pilot	Litchfield Bros.
Seymour	Oldsmobile	H. Chambers
Terre Haute	Oldsmobile	Miller & Stein
Tipton	Pilot	F. U. Campbell
Vincennes	Pilot	J. C. Hetlert
Waynetown	Oldsmobile	C. A. Snyder & Son

Iowa

Avoca	Moline-Knight	Wm. Pratt
Carroll	Enger	Carroll Motor Co.
Carroll	Carter	Carroll Motor Co.
Cedar Rapids	Kissel	KisselKar Co.
Cedar Rapids	Moline-Knight	J. A. Wicke
Cherokee	Moline-Knight	Lamont Bros.
Clinton	Moline-Knight	Model Auto Co.
Des Moines	Chevrolet	W. A. Oldfield
Durant	Moline-Knight	A. F. Schiele
Dysart	Moline-Knight	Dysart Motor Co
Fort Dodge	Dort	Hansen & Tyler Auto Co.
Ida Grove	Kissel	J. M. Rees
Kalona	Moline-Knight	Louck & Boehme
Leon	Metz	C. Snyder
Manning	Moline-Knight	Herman Gotch
Mason City	Dort	Snyder & McCall
Modale	Metz	Southside Garage
Sioux City	Grant	J. W. Ohlman
Sioux Falls	Kissel	Levitt & Reiley
Tama	Moline-Knight	Grau & McKeen
Tama	Dort	Grau-McKeen Co
Tipton	Moline-Knight	Barcley & Smith
Van Horn	Moline-Knight	E. J. Woltersdorf
Villisca	Haynes	H. C. Evans
Washington	Pilot	J. E. Griffith
Waterloo	Dort	Burd Auto & S. Co
Waterloo	Moline-Knight	C. Bisler

Kansas

Concordia	Oldsmobile	H. L. Austin
Ford	Oldsmobile	D. C. Cook
Topeka	Regal	Independent Auto Co.
Topeka	Marmon	Independent Auto Co
Topeka	Chandler	Independent Auto Co

Kentucky

Duckers Station	Pilot	J. D. Smith
Shelbyville	Oldsmobile	Sol Hopkins

Louisiana

New Orleans	Oakland	Canal Auto Co

Maine

Caribou	Pilot	Pitcher & Briggs
Portland	Scripps-Booth	Franklin Motor Car Co.

Massachusetts

Boston	Pilot	Johnson Hayes Co
Boston	Moline-Knight	H. Turner
Great Barrington	Kissel	Conolly & Minard
Haverhill	Moline-Knight	Renton Motor Car Co.
Littletoncommon	Pilot	Thomas Moore
Lynn	Haynes	F. L. Witherell
Pittsfield	Ford	F. A. Minkler
Salem	Kissel	C. W. Williams
Somerville	Pilot	E. O. Hayes
Springfield	Reo	Reo Springfield Co.
Waltham	Metz	Metz Automobile Co.

Michigan

Blissfield	Dort	Hass & Hill
Clare	Chevrolet	J. T. Brown & Son
Davison	Dort	Downer & Fairchild
Detroit	Ross	McKenney Devlin Co.
Detroit	Chandler	Gordon Auto Sales Co.
Evart	Dort	Sanberg & Allison
Fenton	Dort	J. H. Cox
Flint	Chevrolet	C. T. Mines
Flint	Chevrolet	Flint Patter & F'dry Co.
Greenville	Maxwell	Hansen & Lyman
Houghton	Pilot	E. Mih
Jackson	Hollier	H. B. Crosier
Lennon	Dort	W. L. Conald & Co
Marcellus	Dort	King & Goodes
Milford	Chevrolet	T. H. Padley
Manistee	Chevrolet	National Garage & Sales Co
North Star	Dort	F. N. Selby
Portland	Dort	Barton Bros.
Redford	Dort	H. A. & G. A. Miller
Saginaw	Dodge	F. L. Black
Stockbridge	Dodge	Wilbur Ostrander and Casper Glenn
Washington	Chevrolet	Wright & Haughton
Williamston	Dort	G. W. Akers

Minnesota

Minneapolis	Chevrolet	Minnesota Motor Car Co.
Minneapolis	Dort	La Crosse Implement Co.
New Ulm	Kissel	E. H. Retzlaff
Stillwater	Oldsmobile	L. C. Kriesel

Missouri

California	Moline-Knight	W. Kuhlmann
Kansas City	Chevrolet	W. S. Hathaway Motor Co
Kansas City	Milburn	Electric Car Sales Co
Kansas City	Regal	Myers-Ebersole Motors Co.
Nevada	Pilot	W. F. Norman
St. Louis	Argo	Weber Implement & Auto Co.
Springfield	Chevrolet	Yandell Motor Co.

Montana

Brookville	Pilot	A. C. Miller & Co.

Nebraska

Albion	Haynes	J. H. Moore
Alliance	Haynes	H. Ellis
Ashland	Metz	W. A. Fowler
Bancroft	Metz	J. H. Munderlon
Beneroft	Metz	T. F. Tighe
Bartley	Grant	L. A. Russell
Callaway	Metz	H. Rudder
David City	Grant	E. D. Cuckler
Fremont	Grant	Zapp Auto Co
Grand Island	Grant	J. P. Dugan
Hastings	Grant	Stephen Schultz
Hastings	Haynes	W. J. Swanson
Holdrege	Grant	Lyle & H. Young
Humphrey	Grant	H. J. Breunig
Lincoln	Grant	P. W. Rathbun
Louisville	Carter	A. R. Standar
Merna	Carter	C. Hipsley
Norfolk	Auburn	Paswalk Co
Norfolk	Metz	Wilson Bull Tractor Co
Omaha	Moline-Knight	Moline Automobile Co
Ord	Grant	F. Beran
Osceola	Grant	C. E. Hansen
Paxton	Cartercar	F. L. Burt
Plymouth	Metz	A. W. Weichel
Polk	Grant	R. H. Theung
Prague	Grant	J. Pabian
Ravenna	Grant	R. Harrington
Rulo	Metz	F. Winterbottom
Seward	Metz	H. A. Hershberger
Stamford	Grant	D. Elder
Stanton	Grant	G. Lund
Stanton	Moline-Knight	J. R. Stucker
Swedeburg	Grant	A. J. Olson
Trenton	Grant	A. H. French

Nevada

Reno	Pilot	C. P. Burns

New Hampshire

Dover	Pullman	G. O. Athorne
Newport	Fort	Kidder Garage Co

New Jersey

Collingswood	Pilot	J. T. Monaghan
High Bridge	King	G. H. Cramer
Jersey City	King	W. H. Dykeman
Newark	King	Stutz Motor Car Co. Inc.
Perth Amboy	King	Perth Amboy Hardware Co
Trenton	King	J. R. McCardell & Co.
Westfield	King	Abrams & Sheild

New Mexico

Santa Fe	Pilot	N. Salmon

New York

Brooklyn	Pilot	J. S. Frazee
Canajoharie	Pilot	W. J. Woser
Corinth	Pilot	J. I. Johnson
Dobbs Ferry	Pilot	P. J. Carpenter, Jr
Elmont	King	Hoeffner's Garage
Far Rockaway	Dort	J. M. JGarage, Inc.
Ferndale	Pilot	M. M. Schulz
Flushing	King	J. H. Seager
Katonah	King	Dickinson's Garage
La Grangeville	Pilot	W. J. Northrup, Jr
Manchester	Stutz	E. Reed
New York	Pilot	J. E. Kunkely
Olean	Dort	Mazza & Questa
Olean	Kissel	Lester & Thomas
Plattsburgh	Pilot	J. A. Lynch
Poughkeepsie	King	H. Sague & Son
Quogue	King	Louis Muley
Rochester	Moline-Knight	C. H. Washburne

North Dakota

Cando	Franklin	Bonawitz & Tallman

Ohio

Ashland	Buick	Topping's Fireproof Garage
Bowerstown	Buick	W. H. Penn Co
Canfield	Buick	C. S. Dodd
Cleveland	Chevrolet	Hamilton Motor Car Co
Cleveland	Carter	Cartercar Sales Co
Cleveland	Pierce-Arrow	Weaver Brownlee
Cleveland	Kissel	Eiseman Auto Co
Clyde	Kissel	W. A. Roush & Son
Columbus	Chevrolet	Winders Motor Sales Co
Coshocton	Haynes	Fifth St. Garage
Delaware	Ford	J. J. Neville
Delaware	Buick	J. J. Neville
Eaton	Chevrolet	S. Brower
Frazeysburg	Buick	A. T. Wood
Huron	Dort	G. E. Rhinemiller
Lodi	Buick	Sanford & Hahn
London	Buick	E. P. Chenoweth
Mt. Gilead	Buick	Wilson & Bradford
Mt. Gilead	Franklin	H. B. Wood
Mt. Vernon	Buick	Sapp Bros. & Ward
New Concord	Buick	J. H. McKinney
Norwich	Buick	W. C. Guyer
Oberlin	Buick	L. B. Williams
Toledo	Dort	Francke Motor Sales Co
Toledo	Chevrolet	Bunnell Auto Sales Co.
Uniontown	Oldsmobile	C. A. Bodemar
Warren	Buick	W. H. Marsh
Warsaw	Buick	E. M. Wright

Oregon

Portland	Chevrolet	Northwest Chev. Motor Car Co

Pennsylvania

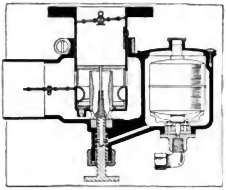
Butler	Chevrolet	C. & L. Motor Co
Indiana	Chevrolet	W. Stewart
Lancaster	Kissel	W. S. Baker
Reading	Dort	Lance 3rd Commercial Car Co.
Scranton	Kissel	Central Auto Co.
Washington	Dort	Wylie Ave. Auto Co.

Rhode Island

Providence	Monroe	Longley Motor Sales Co
Providence	Moline-Knight	G. F. Cook

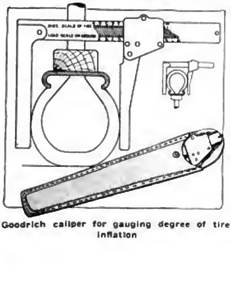
ACCESSORIES

THE Brad-Kent carbureter is a simple pattern of automatic instrument designed with particular thought as to the requirements of the Ford car motor. As can be seen from the sectional view, there is a venturi with a central jet, and a metering pin partly closes the nozzle. Surrounding the venturi is an annular piston which uncovers eight square air ports as it rises, the piston being pierced with holes to correspond to these ports. Air for lifting the piston when the suction is sufficient is admitted through the ball valve seen at the bottom of the piston chamber on the left. To adjust the nozzle the jet can be raised or lowered by means of the finger nut at the bottom of the carbureter, there is a hot air muffle and also a starting choke throttle in the air pipe. It may be noticed that the float chamber and air pipe are clamped to the central portion of the carbureter by a split ring, so the flange can be turned into any position that suits the manifold. Complete with hot air stove, flexible pipe, etc., the price is $12.50.—Frost Mfg. Co., Kenosha, Wis.


Section through Brad-Kent carbureter

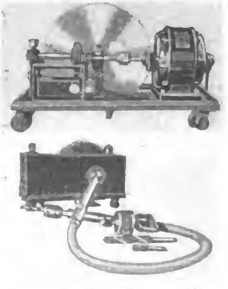
Goodrich Tire Caliper

An ingenious instrument for gauging the degree of inflation of a tire is the special caliper manufactured by the B. F. Goodrich Co. The operation of the caliper is based on the fact that the amount of bulge in the side walls of a tire, at the point where the tire rests on the ground, bears a definite proportion to the diameter of the tire at the top where there is no weight to cause bulging.


Goodrich caliper for gauging degree of tire inflation

The caliper, which is of nickeled steel, consists of a bar with a leg projecting at right angles at one end of it and a second leg, parallel with the first, sliding on the bar. On the bar are two scales, one above the other, marked with letters. The lower scale begins at a point further from the stationary leg than the upper scale. In other words, A on the upper scale is nearer the stationary leg than A on the lower scale. The difference between the two A's is the proper difference between the diameter of the tire at the top and the bottom.

To use the caliper it is first adjusted to the tire at the top, the sliding leg being moved until the tire just fits between the legs. The mark of the top scale is then noted and the sliding leg moved until it stands the corresponding mark on the lower scale. The caliper is straddled over the tire and rim at the bottom, where the tire is bulged from the weight of the car; if the bulge is just sufficient to fit snugly between the caliper legs the inflation is perfect. If the caliper is loose on the tire the tire is too hard and air should be let out until the space is filled, while if the bulge is so great that the caliper will not go down, air should be pumped in until the proper diameter is produced. The device is intended for use with any make and type of pneumatic tire. Both legs fold on the main bar and the whole tool goes into a leather case 10 1-2 inches long. The price is $1.—B. F. Goodrich Co., Akron, O.


Peerless portable electric power outfit

Portable Power

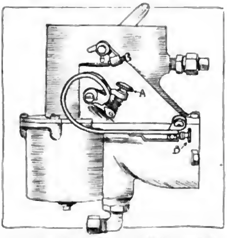
In a repair shop, in a large stockroom and in many other places it is useful to be able to tap a source of mechanical power and electricity has made it possible to take the tool to the work instead of moving the work to the tool. In repairing it may easily save many dollars if it is possible to drill a hole without pulling down anything, but the average garage man can hardly make it pay to equip with a great variety of pneumatic or electric hand tools.

To overcome this difficulty the "Peerless" outfit has been produced. It comprises an electric motor mounted on a wheeled stand, and provided with a friction driving gear so that a flexible shaft can be set to revolve at any required speed. There is an adjustment for the friction gear to take up wear and to vary the degree of contact, while the gear allows the tool to be stopped without switching off the motor. Several sizes are made from 1-4-horsepower up to one horsepower, and the latter size will operate a 1 1-2-inch drill. Six speeds of tool shaft are given by the gear, and attachments will increase this range to eighteen speeds. The motor is a Westinghouse, and is supplied for either direct or alternating current.—United Mfg. Co., Kansas City, Mo.

Ford Shock Absorber

This is a new design of supplementary spring which has as its main feature an adjusting cap so that it can be set to suit runabouts, touring models or delivery wagons. The absorbers are double acting and can be fitted to both the front and rear springs.—Oxygen Generator Co., Troy, N. Y.

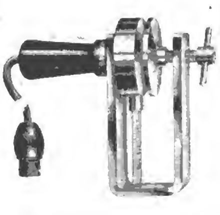
Thermostatic Control Carbureter



J-B carbureter with thermostatic control

The idea of fitting a carbureter with an automatic control to adjust the mixture to suit temperature variations is a popular one and the J-B system seems to be about the extreme of simplicity. The carbureter is a simple pattern having a plain jet in the mouth of which there hangs a metering needle. This is suspended from a lever on the inner end of the shaft to which the thermostat is attached; the latter causes the shaft to twist as it expands or contracts, and so lowers the needle further into the jet, or lifts it out.

In the illustration A is the inner end of the thermostat and the screw sets the position of the metering needle when the motor is normally cold—when it is at a temperature of about 60 degrees say. The screw B limits the degree to which the thermostat can lower the needle and is thus the high speed adjustment.



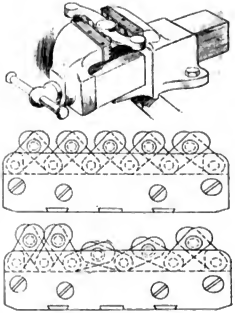
Corbett & De Coursey small electric vulcanizer

There is an air valve with an independent control, so the carbureter works much like the usual kind, but with the difference that a hot motor automatically gets a leaner mixture than a cold one.—J-B Carbureter Co., Los Angeles, Cal.

Small Electric Vulcanizer

The thing which keeps most motorists from doing their own repairs to punctured air tubes, is the trouble of the process, but the electric type of vulcanizer certainly helps to minimize this. One of the simplest, lightest and smallest machines is the Corbett & De Coursey which works off any six volt storage battery and so allows repairs to be made on the road. It should be quite easy to vulcanize a tube while running the car, as the vulcanizer is so light that it could be held by any passenger without fatigue. With the machine is a thermometer which allows the temperature to be controlled, and also a length of flexible wire furnished with a socket to fit the usual inspection lamp holder on the dashboard. It sells for $5 and needs no extras except vulcanizing compound.—Corbett & De Coursey Co., Pittsburgh, Pa.

Self-Adjusting Vise



Self-adjusting vise jaws. Above they are shown mounted on a bench vise. In the center with the members in normal position and at the bottom with members disposed to fit an object of irregular shape

Every mechanic knows the inconvenience of the ordinary vise when it is desired to hold some piece that is awkwardly shaped, and the illustrations show a very ingenious way of getting over the trouble. This is the invention of G. E. Storey, an English tool maker, and the idea is to make the jaw of the vise accommodate itself to the shape of the thing to be gripped. To give this quality the usual jaw is done away with and replaced by a short length of chain, fixed at both ends, but with the individual links free. Normally the links stand at right angles and offer a straight surface, but if they are pressed on an uneven object they will slide until they wedge against the object and each other. The action is made quite clear by the drawings and it appears to be a simple notion that may have far-reaching effect. If the vise acts as efficiently as it apparently ought to do, it should find worldwide application.—C. D. Burton Griffiths & Co., London, England.

Catalogue and Pamphlet Review

Electric Horn Fittings—The Benjamin is a special horn-button made with a large, rounded top, and pressure on any part thereof makes the cotnact. The button does not have to be felt for and can be clipped on the steering wheel or attached to the body. The maker of this button also manufactures a variety of complete horns at prices varying from $4 upward. The special button alone costs 60 cents.—Benjamin Electric Mfg. Co., New York City.

Electric Horn—The Newtone horns are well known as examples of sound electrical types, but a recent circular draws attention to a cheap pattern selling for $3.50 called the "Apollo." This is a vibrator horn, while other Newtones are of the motor-operated sort.—Automobile Supply Mfg. Co., Brooklyn, N. Y.

Electro-Mechanical Horn—The Garford is a motor-operated electric warning signal with a special style of cam which is claimed to give it unusual durability. The makers state that their method of arranging the striking mechanism which vibrates the diaphragm is such that the bearings of the shaft that carries the little cam are subjected to much less stress than usual. Another feature is an easily removable rear-end cover which allows the owner to take off the protecting cap and so oil the mechanism without disturbing any electrical connections.—Garford Mfg. Co., Elyria, O.

Goggles—A new pattern of goggle is the Zylbox, which has a light frame of imitation tortoise shell and a self-adjusting nose bridge of four-ply silk. It is claimed that this soft material rests gently against the wearer and cannot possibly chafe or irritate. This special construction is said to allow the goggles to fit closely on any face, so closing every crack through which dust could possibly find its way to the eyes of the wearer.—T. A. Wilson & Co., Reading, Pa.

Kerosene Carbureter Tests—Recent tests of a W. G. kerosene carbureter are described in a small book issued by the makers. These comprise tests made on a Fiat, a Ford and a Chevrolet car and also on one of the Fifth avenue buses. The tests all showed good economy and good action generally.—W. G. Kerosene Carbureter, New York City.

Kick-Switch Lock—This switch is designed to fit on a Ford metal coil box in place of the original one and in appearance is simply an ordinary kick switch. With it is incorporated a Yale lock, however, and it is necessary to turn the key to obtain either the "on" or "off" positions. This gives considerable security to the owner, who thus finds the advantages of a kick switch and a lock combined in one article.—New York Coil Co., New York City.

Garage Jacks and Presses—Good-wheeled jacks for moving a car by lifting the whole axle are almost essential garage equipment. The Weaver garage jacks are made in several sizes and patterns to suit different classes of service, and there is also a two-wheeled jack with a long lifting handle, called the "auto ambulance," for crippled cars. The same manufacturers turn out other articles of value to the repairer, including small hand presses and drill chucks.—Weaver Mfg. Co., Springfield, Ill.

Inexpensive Portable Garage—The Kolb company make all sorts of portable buildings and specialize on inexpensive garages for private use. One of these sells for as little as $85, and measures 10 feet by 14 feet. This is, of course, a small size, but the upward range embraces all dimensions.—Kolb Portable Building Co., New York City.

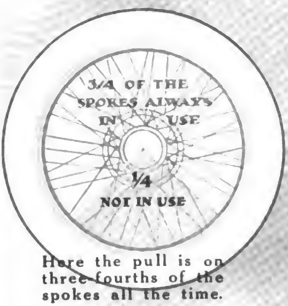
Tire Pumps and Oil Guns—Despite the growing use of compressed-air lines and engine-driven tire pumps there is still a large demand for good hand inflators of the accepted and time-tried kind. Bridgeport pumps are in this class, and are made in single-action style of compound two stage. Special features are the method of attaching the pump cylinder to the foot and the use of the best class of material. The oil guns made by the same firm are of accepted pattern, well finished, and with good, large handles.—Bridgeport Brass Co., Bridgeport, Conn.

Ford Honeycomb Radiator—A special hood of taper form adds perhaps a good deal to the appearance of an old Ford, and this is still more greatly enhanced by a V-shaped honeycomb radiator. The radiator also gives greatly more cooling surface than the standard kind, which is an advantage of real practical value. A very smart hood and a well-made radiator known as the "Superior" are supplied for $52.65, or the hood alone for $11.40, while $8 is allowed for the old Ford radiator regardless of its condition.—Superior Lamp Mfg. Co., New York City.

Care of Electrical Equipment—Of the several periodicals which we receive from manufacturers dealing with their products in a magazine style there is none more interesting than the Delco. This contains various stories not closely connected with electric starters and generators, but it also has hints on the easy and simple upkeep of Delco outfits in particular and electrical machines in general. These hints are expressed in language free from technicality and should be appreciated by the average user.—Dayton Engineering Laboratories Co., Dayton, O.

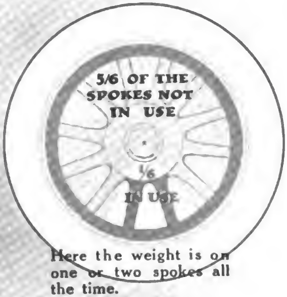
How strong are the Spokes?

Each spoke will carry 3200 lbs. Three-fourths of them are always in use and would carry a combined load of over 80 tons.



3/4 OF THE SPOKES ALWAYS IN USE
1/4 NOT IN USE

Here the pull is on three-fourths of the spokes all the time.



5/6 OF THE SPOKES NOT IN USE
1/6 IN USE

Here the weight is on one or two spokes all the time.

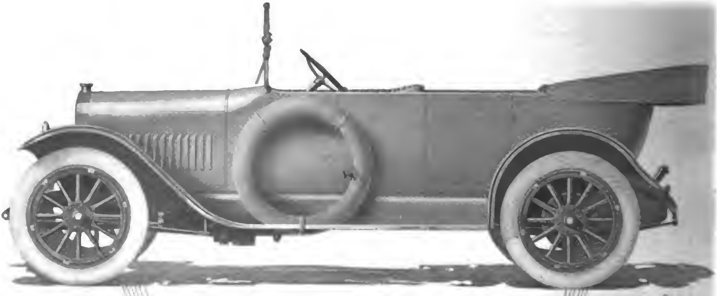
HOUK DETACHABLE WIRE WHEELS

It seems almost inconceivable but we have never even had a broken spoke let alone a wheel that collapsed under any other circumstances than that of complete wreck to the car.

are so terrifically powerful that it seems childish to even compare them with even the best wood wheels.

Ask your dealer. He can probably furnish you with a set for this summer's tour and relieve all mental anxiety concerning the most insidious of all car weaknesses, namely, dried-out wheels.

HOUK MANUFACTURING COMPANY, 1700 Elmwood Ave., Buffalo, N.Y.



Get Out of Competition's Rut

Secure For Your Territory

The Standard "Eight"

$1735

Write for the agency of the Standard "Eight" now while Eights are scarce.

The Standard "Eight" closely approaches mechanical perfection. Its action has gained the approval of men whose life work and entire resources have been devoted to producing better transportation machines

Standard "Eight" Specifications

Eight Cylinders; 3" bore, 5" stroke, "V" shape, unit power plant with three point support.

Wheel base, 121"; seating capacity, seven passengers; tires, 35x4½"; weight, 3200 pounds.

Send today for our territorial agreement and our illustrated descriptive folders.

Get the details of the big advertising campaign we have in course of preparation. Decide to get out of the rut of competition.

Start **now** with the Standard "Eight" and **you** become a leader

The Standard "Six"

is a larger car, built to combine supreme refinement and great power at a fair price. Six cylinder motor, 4" bore, 5½" stroke; unit power plant with three point support. Wheel base 126", tires 36 x 4½, demountable rims, weight 3800 lbs

Standard Steel Car Co.
Pittsburgh, Pennsylvania

STANDARD · STEEL · CAR · CO.
STANDARD
PITTSBURGH · PA.

These Standards are the Keystones of Efficiency

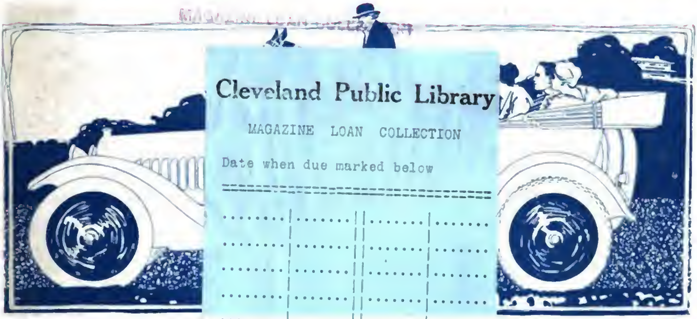
Automotive JUN 18 10538
MAGAZINE LOAN COLLECTION
REFERENCE
Carnegie
West
Branch
4-Vt
DEC 28
2558

The AUTOMOBILE

Vol. XXXII
No. 16

NEW YORK, APRIL 22, 1915

Weekly
Price Ten Cents



Cleveland Public Library
MAGAZINE LOAN COLLECTION
Date when due marked below

C.P.L. Form 1218 Reading

New C $1400

Chalmers Dealers Boost "New Six"

"We have received our 'New Chalmers Six' and it is a dandy. It certainly is full of life and pep and rides fine.

"Prospects are good for a prosperous season, and we will need a good many Chalmers cars before the snow flies again.

"This 'New Six' is going to be a 'whirlwind' seller.

Sheagren-Hunt Co.,
Chalmers Distributors,
Burlington, Iowa.

Dealer's Note: The agency for this car in your territory might be open. Write for particulars.

Quality First

ly and deliveries are being

ialmers Company has ever
ırkable.

ːful—typically Chalmers—
point. It has forty horse-
power, [illegible] and 120-inch wheel base.

Everything about the "New Six" will strike you as being distinctive without the slightest suggestion of freakish design.

Examine it—ride in it. If you're a dealer, you'll be interested in it because of its selling qualities. If you want it for pleasure or business, see if it does not give you all that you expect to get at the price you have in mind.

Chalmers Motor Company
Detroit

BOSSERT QUALITY *means* CAR SATISFACTION

IF IT CAN BE DONE—WE CAN DO IT

Quality and prompt deliveries have made "The Bossert Way" mean something definite to users of pressed steel or other metal parts.

Your production depends largely on the service you receive from the parts maker. If you have placed your order with us you can safely arrange your schedule with the knowledge that our deliveries will be made exactly as promised. We do not accept explanations or excuses from our various departments. The goods will be shipped on time. This we guarantee.

In the most modern plant which brains, money and experience can devise we make over two hundred pressed steel and metal parts, including Axle Housings, Brake Drums, Hub Caps, Hub Flanges, Ball Cups and Retainers, Step Hangers, Running Boards, Torque Arms, Clutch Arms, Clutch Discs, etc.

Try "THE BOSSERT WAY."

The Bossert Co.—Utica New York

54 B

Vol. XXXII New York—Thursday, April 22, 1915—Chicago No. 16

The AUTOMOBILE

Most Accurate Automobile Part

Methods of Ball Bearing Manufacture Call for Microscopic Inspection of Material and Product

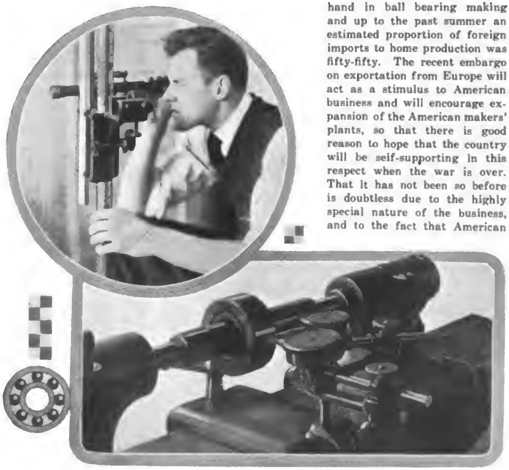
By A. Ludlow Clayden

THE ball bearing and the automobile are reciprocal in that the former has reached its present high state of efficiency by reason of the automobile makers' demand, while the efficiency of the motor car is due in a considerable degree to the friction eliminated by bearings having rolling instead of sliding friction. Yet few people who benefit by the modern bearing can have much idea how delicate a process its manufacture has become. Probably the largest factor in ball bearing efficiency is accuracy of dimension, and this is already such that a ten thousandth of an inch is the limit of error. Makers of bearings aim at an ever-increasing accuracy and it is anticipated that bearings will be made to much finer limits than this, as knowledge is gained concerning processes and materials.

It is easy to say one ten thousandth of an inch, but it is not easy to realize what an excessively small dimension this is; it is possible to get an idea by thinking of the sixty-fourth of an inch marked on most engineers' scales and then remembering that dividing this into a hundred parts would give units considerably larger than those to which ball bearing makers have to work.

To obtain this accuracy it has been necessary to devise special machines, to discover special materials and special methods of treating those materials, and, above all, to train inspectors and workmen to use gauges such as ordinarily are found only in scientific laboratories. This work has been done by various manufacturers in different parts of the world, and the development has mostly been along independent lines, though the results are similar.

America was admittedly behindhand in ball bearing making and up to the past summer an estimated proportion of foreign imports to home production was fifty-fifty. The recent embargo on exportation from Europe will act as a stimulus to American business and will encourage expansion of the American makers' plants, so that there is good reason to hope that the country will be self-supporting in this respect when the war is over. That it has not been so before is doubtless due to the highly special nature of the business, and to the fact that American



Upper—Watching through a telescope the movements of the tiny mirror that shows how a steel ball flattens under load. Lower—A finished double row bearing being tested for circularity and truth of face simultaneously. Each of the two gauges shown will indicate much less than a half thousandth of an inch variation from proper size.

makers have had to train themselves and their men before they were ready to produce equally good bearings. This they are now able to do and can, therefore, prepare to expand their factories to supply the home demand completely and ultimately this will carry competition abroad.

Highly Special Material Used

The essentials of a ball bearing material are hard surface and tough core, but beyond this the hardness of every spot on every part must be even. Extra hard places mean inaccuracy in the grinding operations and increased rapidity of wear in use. The New Departure Mfg. Co., Bristol, Conn., whose process of manufacture is dealt with in the following pages, has had difficulty in getting sufficiently pure steel from other than Swedish sources of supply, but is now obtaining American made steel that is proving good. Three forms of material are used, bar for making small bearing races, tube for making larger races, and drawn wire in various sizes for making the balls. For the moment we will neglect the races and deal solely with the manufacture of the balls.

Balls Made Automatically

This commences with the annealing of the steel wire which is performed in large furnaces designed and made specially for the company so that the coil of wire is heated evenly and also protected from the atmosphere or other scale-forming gases. After the annealing process the next operation is to draw the wire again, so reducing its diameter slightly and consolidating the steel. The New Departure Co. find they can get better results by doing this final drawing in their own plant than by taking the wire as it comes to them, and since they have only to make slight reductions in diameter four drawing mills are able to take care of the whole output, dealing with some 15 tons of material daily.

From the moment that the wire leaves the building in which it is annealed and drawn the making of the ball is automatic. In an adjoining building special machines automatically cut off "slugs" from the coil of wire, and each slug is dropped between a pair of cup dies which stamp it into a roughly spherical form. Although the dies which do the stamping make the ball roughly there is left a fin or ragged edge of metal round the junction of the dies, and this is removed before the balls go to the heat-treating furnaces, by a rough grinding process.

Returned to the heat-treating plant the balls are poured into iron trays and placed in a gas-fired furnace where they are raised to a very exact temperature before hardening. For control of this temperature the best and most accurate electric pyrometers are used and connections are made from each furnace to a central board located in a separate room. Here one man spends his days checking the temperature of one after another of the row of furnaces over and over, each furnace being tested for heat every few minutes. Should it be too hot the movement of a switch lights up a lamp suspended over the furnace in error, and should it be too cold, a different switch turns current through a lamp of different color. Thus when neither lamp is alight the temperature is correct and all the foreman has to do is to give attention to those above which the lamp calls for either more or less heating.

As the balls are made of steel that is hardened completely they have no casing process to go through.

Ball Grinding Is Slow Process

After hardening, the balls are fairly round but have a black exterior, so there remains a good deal of metal to be removed. The way in which this is done and the ball brought finally to within a ten thousandth of an inch of correct size is by causing the balls to roll in a vee groove in the presence of an abrasive material. In the ball finishing shop are rows of machines with horizontal spindles bearing the grinding plates, and these plates have spiral vee grooves cut in their faces, so that balls may be fed to the center of the plate and taken from the outside continuously. The process is automatic since the balls leave the bottom of a hopper, pass through the grinding groove and return to the hopper; every now and then a man takes a ball from the machines and checks it on a gauge to see what progress is being made, but the steel is so hard that it takes hours to bring an average hopper full of balls down to finished dimensions.

Sorting Machines Are Automatic

Even when this process is over the balls are seldom exactly the same size, variations of tiny fractions of an inch being detectable by delicate gauges; however, before they are sorted and graded into size, the balls are put in tubs mounted on shafts at about 45 degrees to the horizontal, mixed with small bits of leather. As the tubs are revolved the balls roll over against each other in their efforts to keep to the bottom of the tub, and this continued friction against the leathers puts on the high polish which one associates with a bearing ball.

The next process is to sort for grade so that a load of balls with a maximum inaccuracy of a ten thousandth may be sifted into lots with still smaller differences. Again the balls are put in a hopper whence they issue one by one and fall on a pair of vee edge pieces of steel. Beneath these strips is a sort of worm with a deep square thread and a pitch slightly greater than the ball diameter. The thread takes hold of the bottom of the ball and pulls it along the strips where, since the outer ends of the strips are a fraction wider apart than the inner ends, the ball presently falls through between them; the larger it is the nearer it has to be drawn to the outside, and the smaller it may be the shorter the distance it travels. The ball drops into one or another of four or five different boxes, according to the exact spot where it slipped through the runway and these boxes are used separately in assembling bearings, so that there shall be the minimum deviation in size between all the balls in any particular journal. The sorting machine can also reject balls over or under the limits of size permitted.

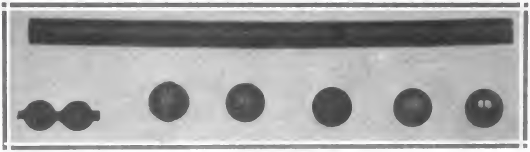
Human Eye Is Final Test

Finally the balls are given to girls skilled in examination by eye; placed in wooden trays some dozens at a time it is just possible to see faint differences in color due to slight difference in hardness. So skilled are these girls that they can pick out a ball which is wrong almost before the tumbling, glittering spheres have come to rest in the tray, and it is interesting to see that a good many balls not quite right do manage to get through even the rigorously careful processes we have dealt with. Of course the percentage is extremely small, but obviously the makers wish to run no risks whatever and prefer to waste a good many balls rather than risk one bad one in a bearing.

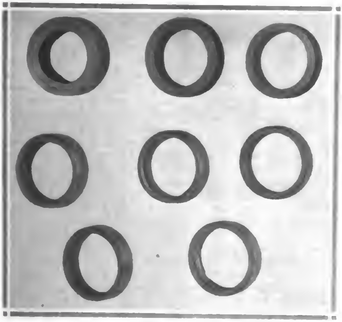
Roughing the Races

So much for the balls, the most accurate and the most difficult to make of ball bearing parts. The races are comparatively a simple job, the skill of the craftsman showing up more in the hardening furnaces, perhaps, than in the machine shops. For these races either bar or tube stock is used according to the size, and there is one big shop full of automatics which make the inner and outer parts of all the New Departure bearings. Some of the immense races made for special heavy jobs far outside the automobile range of sizes need hand turned races, but these are only a very few.

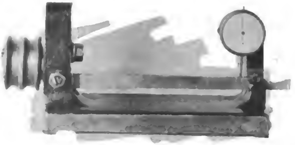
High speed production is the order of the day in the automatic room, because great accuracy is not important since all this appears in the grinding processes which follow case hardening and tempering. Judged as a machine shop process



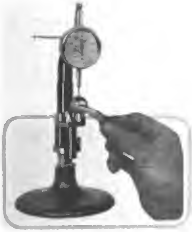
Steps in making steel balls. At top is alloy steel wire, then, reading left to right, portion of string of rough forged balls, ball separated from string, with flash removed, rough ground ball, same after heat treatment, finish ground ball and polished ball finished and ready for service



Operations in machining single row cup. At top is a piece of chrome steel tubing. Reading from left top, we have blank as cut off from tubing, blank faced and bored, outside diameter turned, cup shaved all over, ball race formed, cup stamped, heat treated, face ground; outside diameter finished ground and ball race ground



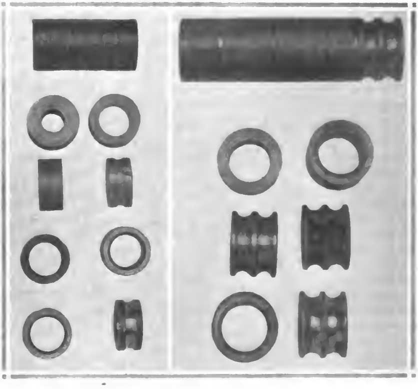
Multiplying indicator gauge for measuring cone bore. Multiplication about 10 to 1. A .0001 inch variation in cone will register one graduation on dial

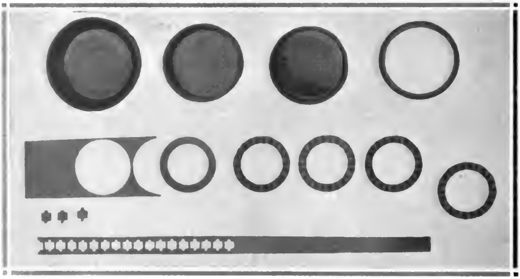


Showing dial indicator fixture for testing size and sphericity of New Departure steel balls. Each graduation shows 1/10 of .001 inch variation. The ball is held in a pair of horn tipped tweezers so the heat of the hand will not cause it to expand

Below—Left—Operations in machining single row cone. At top is a piece of tubing. Below, reading from left top, we have blank cut off, blank bored, blank outside diameter turned, ball race and milling groove machined on blank, cone heat treated, face ground, bore ground, ball race ground

Right—Operations in making double row cone. At top is shown piece of chrome bar stock with cone as formed by automatic machine before cutting off. Below it, at left top, cone after cutting off, after facing and chamfering, shaved all over, heat treated, bore ground, and, finally, cone with ball races ground





Showing stages in making pressed steel parts used in New Departure ball bearing construction

Top—Reading from left to right shows the stages of pressing out from sheet steel the external case which incloses the double row bearing. Beneath is the cage for single row bearings, in its several stages of pressing, and the bottom series shows the little rivet used to connect the two halves of the cage

the roughing of the races is about as simple a job as could be devised.

It is also true that in the grinding rooms the machines used have no special ingenuity in design; rather they are very rigid and delicate of adjustment. Given a machine that can be trusted to work within minute fractions, it is left for the skill of the operators to produce good work. Each man has a limit gauge which is so close between the "go" and "not go" that great care is necessary, and on most of the tools there is also a registering dial gauge which can be held against the work so as to show any deviation from roundness as the bearing ring is revolved slowly. Naturally the upkeep of these gauges calls for a minute inspection of them and quite a small works is kept going on the making of new gauges to replace those that wear out, as many of them do fairly rapidly.

For case hardening and tempering the raceways the same pyrometric plant is used as that described in dealing with the balls, and the same degree of care is observed.

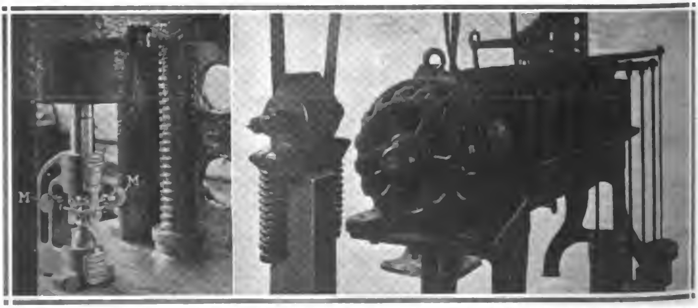
Assembling Most Important

Though a man skilled in the use of machines can appreciate the wonderful skill of the New Departure operators, whether in grinding shop or heat treating plant, it is in the assembling bays that the average man would find it easiest to appreciate the procedure. The balls come hither sorted in the way described and they are used up a boxful at a time. For the single row bearings the balls go in between the two races while the latter are held eccentric, and when the full complement of balls has been introduced the race is passed on to another operator who separates the balls and uses a machine that clips the retaining cage in place. This cage is made of sheet steel and is produced by stamping.

For the Radax bearing for thrust, which is practically a cup and cone bearing, the balls can be clipped in the cage separately, as the bearing can be taken apart at any time. These processes are not peculiar to the New Departure company, but there is a special scheme in use in this plant whereby single row journal bearings are assembled so that the balls are always gripped at the same "tightness" between the inner and outer races. Thus a boxful of balls a microscopic fraction over size will not make tight bearings, nor will a boxful of slightly small balls produce bearings in which the balls are loose. This is important because the life of a bearing depends upon the proper original tightness to a very large extent.

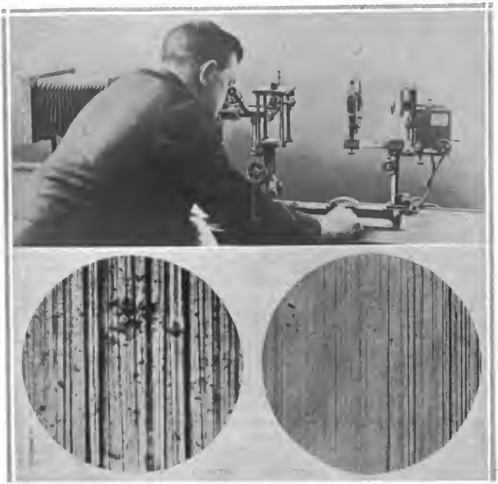
Special Feature of Double Row Bearing

For the double row bearing which is the New Departure specialty quite a different assembly scheme is followed. Turn-



Left—Machine for testing elasticity of balls. Three balls are mounted one above the other so as to give point contact for the center one. As this is flattened by load a tiny mirror reflects a spot of light to a scale 10 feet away. The telescope shown on page 701 reads the scale and a deflection of less than one ten thousandth of an inch can be seen. This test determines the elastic limit of a ball and so the safe load for service. Right—A machine for testing eighteen bearings under load. Center—A smaller machine which applies both radial and thrust load. These machines give much valuable data and are in constant use in the laboratory ing to the picture of this bearing, page 705, it can be seen that the cage is a solid piece of metal instead of being a steel pressing. To be accurate, the cage is two pieces of brass, one serving for each row of balls, this being done to allow one row of balls to revolve faster than the other if any difference in size or load should produce conditions where this would be the tendency.

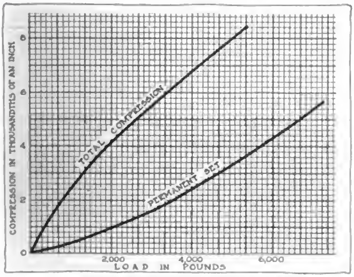
Having got the two outer races, the inner double race, the balls and the cages, the remaining part of the double row is the outer shell. This is pressed into cup form from sheet steel of a softish sort and the bearing is put together by dropping the parts into this cup in proper sequence; first an outer race ring, then the center member, the two cages and all the balls, and finally the second outer ring. These parts are held tightly by the outer shell, since the rings have to be pushed in by a small press, and the next stage in assembly is to mount the bearing on a lathe and spin over the open end of the cup of soft sheet steel.



Examining the finish of ball bearing raceways with a microscope. Beneath on left is a poorly finished race magnified 1,000 times; on right, a well finished race magnified 1,500 times. The finish has a great effect on bearing durability

When the spinning is done the bearing looks like the finished article, but it is very tight indeed, so tight that it cannot be turned, and to render it just sufficiently loose it is gripped in a chuck and a man bears on the outside with a sort of burnisher. This heavy pressure on the soft steel causes it to flow, just as the end did in being spun over, and the harder the pressure the greater is the deformation of the case. Squeezing the rim in this way causes the spun-over end to slacken its grip, and a few moments suffice to loosen the races so that the bearing spins freely.

We now have the finished bearing, but the outside of the case is scored where the burnisher was used to loosen the inside parts, so the next thing to be done is to grind the outside in order to remove the tool marks and bring the diameter of the complete bearing within the prescribed limits of size. Since this is liable to introduce small quantities of grit to the races the bearing is put on the last machine of all, which washes it out by forcing oil under pressure through it. It is then ready for final examination, oiling and packing in grease proof paper and the familiar cardboard box.



Elasticity test of New Departure steel ball

Laboratory Equipment Elaborate

Not the least interesting part of the New Departure plant is the elaborately equipped laboratory where steels are tested both physically and chemically and the finished bearings or their parts are tried out for durability or load capacity. The nature of the product makes it imperative that material be checked very closely indeed so the number of samples taken from steel stock is far greater than that thought necessary in ordinary manufacturing. Naturally, microscopic examination plays a big part, and this is used extensively in watching the hardening and tempering processes also. Several different machines are installed for imitating various conditions of service, and the bearings are run to destruction under circumstances that are close to those of actual use.

If the same care were taken in the mounting and use of ball bearings as is taken in their manufacture we should seldom hear of unexpected failures, but as this is a subject worthy of separate treatment we propose to leave it for the present and deal with the usage of ball bearings at another time.

It may, however, be remarked that there are very few bearings used on automobiles which receive proper treatment by the users, and, satisfactory though ball bearings are, they would be infinitely more so if their treatment was as good as they are themselves.

Steel—
Its Pathology

Part III

Heat Treatment Alters Intermolecular Structure and Governs Physical Characteristics

By J. Edward Schipper

HEAT treatment is the final step in the preparation of the steel. The bath of flame is now called upon to do its work and second the efforts of the elements which went into the formula for the steel. The formula determines the chemical specifications but the heat treatment determines the physical.

Thus far it has been shown how the metallurgist, the doctor of steel makes changes in the characteristics of steel by the addition of this medicine or that tonic. The metallurgist, like the physician, has, by the writing of the proper prescription, treated his patient and cured the ills due to impurities in his system or given him the strength needed to meet the daily tasks. The final chapter, heat-treatment, is the most wonderful. It is the fiery furnace and the marvels of transformation which it performs which really allows the metallurgist to fully reap the results of his careful arrangement of the ingredients in the prescription.

It can readily be understood how adding a substance of certain qualities will produce changes due to the inherent nature of the substance added, but here we have wonderful changes which are wrought by heat alone. By a proper manipulation of temperature, a steel can be taken which is diamond hard and rendered soft enough to be beaten into any desired shape with a hammer, or, inversely, a steel which is soft and pliable can be raised to a high temperature and plunged into ice water and rendered hard and brittle.

There is no analogy for heat-treatment in medicine. The physician cannot plunge his patient into a high temperature and then by suddenly chilling him in water produce health. The metallurgist, on the other hand, is compelled to use this treatment if he will obtain the full benefit of the ingredients in the steel. Nothing is added and nothing is taken away, and yet, by heat alone, steels of the same composition can be given such widely varying characteristics that it is almost unbelievable that they are in any way related to one another.

Changes Structure

The reasons for the changes made by heat-treatment in the character of steel are directly concerned with the structure of the metal. Steel like sugar, salt and granite, is a crystalline, as opposed to amorphous, substance like flour, wood, paper, etc. The knitting together of the crystals which go to make up the structure of the metal into different shapes and combinations has everything to do with the strength and physical characteristics of the metal. If we have a few coarse crystals, relatively speaking, the steel will be hard and brittle. If we have a large number of very fine crystals generally it will be strong and tough.

Heat treatment alters the sizes of the crystals, changes their entire arrangement and hence definitely controls the physical characteristics of the metal.

The crystals comprising the interior or inter-molecular structure of the steel are not all of similar composition but vary in their nature. Thus, if there is a preponderance of soft crystals, the resulting composition will be softer than if the preponderance were of the harder ones. One of the methods by which heat treatment alters the conditions and characteristics of the steel is by changing the number of hard crystals in relation to the softer ones and again this process can be reversed and made to work either way.

Steel is composed of carbon and iron which ingredients intermingle in various ways, the iron alone being soft but certain combinations of iron and carbon being as hard as the diamond. Heat controls the iron-carbon combinations, which in turn influence the entire structure of the metal. Thus by adding nothing but merely by changing the inter-relationship of the molecules, which go to make up the structure of a metal the fiery heat-treating furnace can be said to literally perform miracles.

Three main divisions of heat treating exist. They are annealing, hardening and tempering.

Annealing is for the purpose of effecting a rearrangement of the molecules after they have been distorted and deranged through working the steel at a temperature in which the displacement of the molecules is possible.

Hardening which is generally employed to prevent parts wearing is accomplished by quickly quenching the steel in cold water or some other liquid bath after it has been raised to such a temperature that the carbon is in solution with iron.

Tempering is practically a compromise between annealing and hardening and accomplishes to some degree what both the other two do. It is accomplished by quenching in a slow-cooling medium, and is for giving parts desired strength.

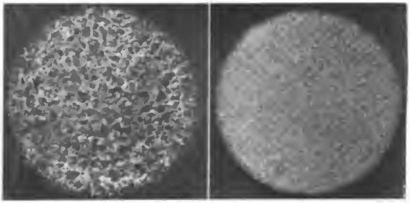
The explanation of the processes which permit annealing, hardening and tempering involves many mooted points, but there are certain well-defined principles generally accepted.

Iron, the Foundation of Steel

Iron, in steel, is the foundation. In steel it may be compared with the metal skeleton in the sky-scraper building. It is the basis of the entire structure of crystals of which the steel is composed. Take away the iron and we would have left only a mere shell, and hence, changes in the condition of the iron would naturally be supposed to make marked differences in the condition of the steel. It is like the blood in the human being. When it is thin and watery an anaemic condition results, so with the iron when it is in certain conditions, the resulting structure is weak and lifeless.

In metallurgy, iron exists in three distinct conditions which are governed by its temperature. These three are known as alpha, beta and gamma or Greek A. B. C.

Alpha iron is iron in the familiar condition at atmospheric temperature. It has well defined crystalline structure, it has the quality of being able to be rendered magnetic, and in many steels can be seen through the microscope as a light gray formation in practically pure condition.



Left—Chrome-nickel steel in the normal condition as rolled. Right—The same steel after having been heat treated by raising to 1,525 degrees and quenching in water followed by 1,000 degrees draw.—United Steel Co.

If however, iron be heated to about 760 degrees centigrade, it undergoes a distinct change of condition. It becomes practically non-magnetic and possesses various other physical characteristics not previously possessed. It is now in the beta condition.

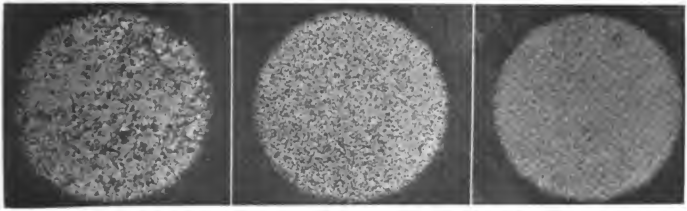
If it be still further heated until 890 degrees centigrade, it becomes gamma iron, where it again changes in many of its physical characteristics becoming entirely non-magnetic and having the quality of being able to take up carbon in solid solution. The temperatures at which these changes take place are known as the critical points and the alpha, beta and gamma conditions are only seen in the laboratory during the periods of transition in heating the metal.

Since steel is so largely made up of iron, the changes which take place in the iron at the critical points have a marked effect on the qualities of the steel. Thus if a steel were heated to a temperature well above the point where iron passes into the gamma stages its structure and quality would be altogether different from what they were at atmospheric temperature. During the period of heating the iron would pass through the alpha, beta and gamma stages and consequently the steel itself would have passed through well-defined conditions due to the varying qualities of the iron at these temperatures. If the steel were then allowed to cool slowly at the time it again reached atmospheric temperature, it would have returned to its original state practically without change. During the cooling, however, the steel would have passed through each of the well-defined stages, A. B. C. that it had during the heating, except in inverse order.

If the steel, instead of being allowed to cool slowly, were plunged into ice water and almost instantly cooled, the changes would not revert themselves in the same order that they did during the slow cooling, but on the other hand, the steel would remain in practically the same condition as it was when plunged into the water. It would be frozen instantly, and the condition of transition rendered permanent.

Owing to the nature of steel in taking on certain well-defined forms at different temperatures, a series of laboratory names for these condition or arrangement of the iron-carbon crystals are in common use among metallurgists although not employed commercially. It is part of the art of heat-treating to hold the steels by different varieties of quenching and heating in these definite conditions. The highest temperature condition is Austenite. As the steel cools it breaks up into various other named forms which will be described. Different kinds of quenching and different kinds of heating enable the metallurgist to hold the steel in these definite states. The alloys also do their parts and by their use enable the metallurgist to keep the steel as near the state of Austenite which is the highest point as he desires or to bring it lower down the scale to the other points if this be what is wanted. Generally speaking the higher the steel or nearer towards Austenite the harder it is and the further away from Austenite the softer it is.

When the temperature of the steel is raised to the gamma point, the iron in it has the property of being able to take carbon into solution. This solid solution of carbon in gamma iron is known in the laboratory as Austenite. Steel in which the Austenite exists is known as Austenitic steel and under the microscope the grains of Austenite can readily be recognized by their tendency to take up regular polygonal forms. If the steel were allowed to cool below the critical gamma point the Austenite would tend to break up, since the iron



Three steps in the refinement of chrome-vanadium steel. Left—Steel in normal condition as rolled. Center—Same steel annealed at a temperature sufficiently high to recrystallize. Right—The same steel after a complete heat treatment. The transition from the coarse grains to the fine is marked.—United Steel Co.

Heat treating furnace which is used for small parts, as manufactured by the Brown & Sharpe Co.

would begin to lose its ability to hold the carbon in solid solution. The Austenite breaks up into pure iron, Ferrite and an iron carbide (Fe_3C) known as Cementite.

The change from the Austenite to the Cementite and Ferrite is not a sudden one, but there are three phases of transition each possessing structural peculiarities which determine the qualities of the resulting metal. The first stage is Martensite. This is a hard, brittle substance which on account of these qualities is of practically no use. Martensitic steels are hard and brittle. They cannot be worked and possess few if any qualities that render them fit for use.

The next stage of transition is Troostite. This is a brief stage and possesses finer crystals than the Martensite, giving the steel much better qualities. Steels having a large percentage of Troostite can be used where a great hardness is desired without a high elastic limit.

The third and final stage is Sorbite. This structure is largely composed of very finely divided mixtures of Ferrite and Cementite. It has very fine crystals and, due to this fine structure, possesses great strength and toughness. Sorbitic steels are highly desirable for work where strength and elasticity are required.

Pearlite a Definite Structure

Owing to the fact that Ferrite and Cementite have a marked tendency to inter-stratify, the structure which is formed by this inter-stratification has been given a definite name. It is called Pearlite, because, under the microscope, it has the appearance of mother of pearl in long thin streaks. Pearlitic steel is perhaps the most common of structural steels having a desirable amount of uniformity with a fair amount of strength of elasticity, due to a fairly equal distribution of the crystals.

To sum up, Austenite is the condition in which steel is found when heated to between 700 and 1,100 degrees Centigrade. As the steel cools, the next stage it passes through is Martensite, then Troostite, Sorbite and finally breaking up into Ferrite and Cementite. A certain definite mixture of Ferrite and Cementite is practically always existent, due to the carbon content of the steel, and this formation is known as Pearlite. The definitions of these terms follow:

Austenite—A solid solution of iron carbide in gamma iron.[*] Austenite and Cementite are found between 700 and 1,100 degrees Centigrade. On cooling Austenite splits up into Ferrite and Cementite.

Martensite—The first stage through which metal passes in changing from Austenite into Ferrite and Cementite. It is very hard because of its large content of hard, brittle iron and is generally too brittle for practical use.

Troostite—The second stage through which metal passes in changing from Austenite into Ferrite and Cementite. This and

Sorbite—the third and final stage in the change seem to be chiefly very finely divided mixtures of Ferrite and Cementite. Because of this fineness in molecular structure Sorbitic steel has a remarkable combination of strength and elasticity.

Ferrite—Is iron free from carbon and forms almost the whole of a low-carbon steel.

Cementite—is a definite iron carbide, Fe_3C. It is harder than glass and nearly as brittle. One per cent. of carbon in a steel implies that 15 per cent. of the soft, ductile Ferrite is replaced by glass-hard Cementite and hence the cause of the vast influence of carbon on steel.

Pearlite—is the result of inter-stratification of Ferrite and Cementite in the ratio of six parts of Ferrite to one of Cementite.

If, instead of allowing the metal to cool gradually, it is cooled quickly, or quenched, the changes which have taken place during the rise of temperature are not able to revert themselves and to a large extent the resulting material will

---

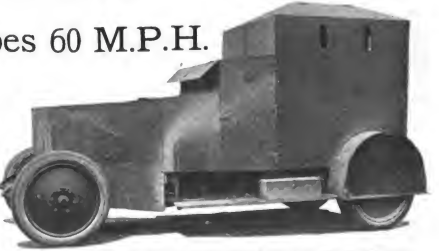
[*] Gamma iron is the unmagnetic form of iron found between temperatures of 770 and 900 degrees Centigrade with the carbon content below .5 per cent.

(*Continued on page* 730)

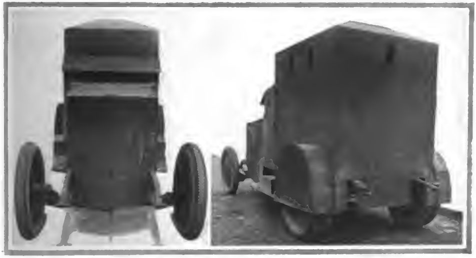
Control board of the heat treating furnaces at the Packard Motor Car Co.'s plant in Detroit

War Truck Does 60 M.P.H.

Double-Steer, 80-Horsepower Gobron Can Also Attain 20 Miles Per Hour on Reverse—Four-Cylinder, Double-Piston Motor—Carries Four Machine Guns



Gobron 80-horsepower armored car, the most powerful in the French army. Is capable of over 60 miles an hour and mounts four machine guns



Left—Front view of Gobron armored car with radiator-protecting doors closed
Right—Rear view, showing openings for three of the guns. Note inclosed rear wheels

PARIS, April 2—Capable of more than 60 miles an hour ahead and 20 miles an hour on reverse, having double steering, carrying four mitrailleuses, with armor plating impervious to rifle bullets fired at almost point blank range, the latest French type of armored automobile is a formidable weapon of attack. The design of this vehicle is largely the work of Count de Lambert, the first pupil of the late Wilbur Wright, and of Paul Tissandier, a pioneer French aviator and engineer, who also took his first lessons in flying from the Dayton air pilot.

80-Horsepower Chassis

The chassis employed is an 80-horsepower Gobron having a four-cylinder double piston motor of 4.3 by 9.8 inches bore and stroke. Although the motor differs from the standard type by reason of the use of two pistons per cylinder, there is nothing experimental in the chassis. Double piston motors have been made by the Gobron company for about 12 years and were very successful in the early racing days. The chassis has a four-speed gearbox and chain drive. Combined with the ordinary steering gear is a supplementary control of the front wheels by means of stout steel cables brought to a boat-type steering wheel in the rear of the car. The driver remains at the steering wheel at all times and always has control of the motor, but when it is necessary to go astern a second man takes the wheel at the rear of the car, obtains a view of the road through a small eye hole, and directs the course of the car while giving directions to the man behind him. Owing to the high power of the motor, which makes possible a speed of 65 miles an hour on the level, it has not been necessary to modify the gearbox, for the ordinary reverse gives a speed of 20 miles an hour.

While detail improvements might be possible in the control and reverse, practical experience has shown that this type of vehicle is thoroughly satisfactory. Nothing has to be changed on the ordinary design, and the addition of double steering does not interfere with any of the existing features of the car. This is most important when cars have to be produced under war conditions and in the shortest possible time. The chassis is of much stouter construction than those employed up to the present, but it is found that this extra strength is needed for rough work at the front.

A special steel body built of plates 4 millimeters thick is carried on the chassis, the protection extending forward over the top and sides of the motor and radiator, and steel doors capable of being opened or closed from the interior are hinged in front of the radiator. The body forms a single compartment, with entrance on the left-hand side. The driver is placed low, is completely incased on sides and top and has a forward view under a hinged steel shutter. When the car is under fire this shutter is closed and a view of the road ahead is obtained through an opening a couple of inches in diameter.

PARIS, April 2—Writing from the Argonne district of France, where he is serving as automobilist on the headquarters staff, Albert Guyot says: "At the present time the Argonne track is taking up so much of my time that I am unfortunately unable to come to Indianapolis. Please tell Messrs. Fisher, Sedwick and Beecroft that I hope to be with them next year."

Since the beginning of August Albert Guyot has been driving the commanding officer of the Fifth Army Corps. During the whole of the winter he has been stationed in the Argonne district, where fighting has been more severe than on any portion of the front.

"The automobile is rendering inappreciable service to the army. The American trucks have now arrived and are proving entirely satisfactory. Packards in particular are highly spoken of by men who are no novices in automobile matters, and I have several friends in the mechanical transport sections who tell me they have not experienced the least trouble."

Having passed the military examination second out of 110 competitors, it is probable that A. Guyot will shortly be promoted from the rank of sergeant to that of sub-lieutenant and put in charge of an automobile convoy.

European High-Efficiency Motors

Part II—Value of Compression—Relation of Gas Velocities and Intake Passage Section—Use of Two Carbureters—Valve Design for Racing

By S. Gerster

COMPRESSION should be high, enough to ensure sufficiently rapid combustion at high motor speeds, but it should be kept as low as possible to guard against the danger of premature ignition. In estimating compression it is useful to employ the factor P.

Let

V = volume displaced by one piston,
V_c = volume of compression space,
P = compression factor.

Then

$$V + V_c = P \times V_c$$

Or

$$V_c = \frac{V}{P - 1}$$

For racing motors a good value for P is 5.2, and for touring car motors of high efficiency P may equal 5.

After having designed and calculated the volume of the combustion chamber, the careful engineer should make a wood model and test it in a vessel containing water. This is the best way to obtain the assurance that both the calculations and the drawings are correct.

Proportioning Gas Passages

Let us now consider the gas passages and the gas velocities. Gas velocities have a most important bearing on high-efficiency motors, and it is particularly in the valves that the designer meets with difficulties; the cause of the limitation of the motor speed is frequently to be found here.

The necessity for preserving a correct form of combustion chamber makes it impossible to adopt exaggerated valve diameters. The inertia of the valve makes it impossible to increase the lift beyond certain limits.

The expression gas velocity is really only a relative value. We understand by the expression the velocity of the gas if it had a constant flow through a given section, taking as our base the speed of the piston, and as our ratio the surface of the piston and the section through which the gas passes. When the following values are applied:

S = Surface of the piston in square centimeters; or square feet;
f = Section of the gas passages in square centimeters; or square feet;
V_g = Velocity of the gas in the section, in meters per second; or feet per second;
v_p = Piston speed in meters per second; or feet per second;

we obtain

$$V_g = \frac{S \times v_p}{f}$$

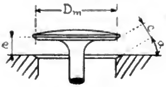


Fig. 9—Valve lift factors determining gas passage

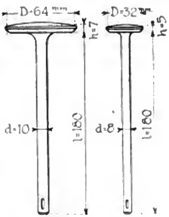


Fig. 10—Dimensions of the poppet valve as regards length of stem, diameter of head, etc.

In the calculations for a particular motor SV_p becomes a constant. For a racing motor the gas velocity in the intake passages is

V_g = 55 to 60 meters or 180 to 196 feet per second.

We have here to deal with motors turning at 3,500 to 4,000 r.p.m., and it is obvious that if the revolutions drop to 2,000 the gas velocity in the intake pipes becomes insufficient. Gasoline condenses on the walls of the gas passages, with the result that the motor misses at low speeds and loses its flexibility.

Attention was first of all paid to the carbureter, and by reason of experiments it has been improved in a wonderful degree. Good results have been obtained by the use of two carbureters with separate intake pipes uniting near the valves. For motors with two intake valves there is a more simple solution. All the right-hand intake valves are united to one carbureter and the left-hand valves of each cylinder to the second carbureter. By this arrangement one carbureter is used for slow running and the two together for high speeds. For high efficiency motors on touring cars it is advantageous to have the two valve sections and the gas passages of different diameters. Patents have been secured for this device.

The gas velocity from the carbureter outlet to just below the valves is constant, and the section should not vary, except for six-cylinder motors where the gas passages must be designed with particular care according to principles laid down after experiments with this type of motor.

In practically all modern motors the gas velocity around the exhaust and the intake valves is

V_g = 50 to 55 meters per second (164 to 180 feet).

It is calculated in the following manner:

D_m = Average diameter of the valve;
e = Valve lift;
c = $e \sin \alpha$;
α = Angle of the valve;
n_s = Number of intake valves per cylinder.

See Fig. 9.

The gas passage f becomes—

$$f = D_m \times \pi \times c \times n_s.$$

The velocity of the gases becomes—

$$V_g = \frac{S \times v_p}{D_m \times \pi \times c \times n_s}.$$

Formerly the valve angle was 45 degrees. In high speed motors 30 degrees is often preferred. Certain manufacturers prefer to have a rather lower gas velocity around the exhaust valves than around the intakes, and in order not to have two types of valves they make the exhaust valve cams a little higher so as to reduce the gas velocity of the exhaust 5 to 10 per cent. in relation to that of the intake.

The velocity of the exhaust gases at the ports is generally maintained at 40 to 45 meters (131 to 147 feet) per second, and the velocity in the exhaust pipes at 20 meters (65 feet) per second; this gives an exhaust pipe diameter, for a four-cylinder motor, practically equal to the cylinder diameter. These remarks refer to racing motors. For other motors, to be used on touring cars or for aviation purposes, the gas velocity in the pipes can be made 30 to 40 meters (98 to 131 feet) per second.

We now have to deal with multiple valves—two intakes and two exhausts per cylinder, and shall have to examine the effects of inertia, so prejudicial to the satisfactory operation of these organs.

Supposing a valve of 64 millimeters (2 1-2 inches) diameter (see Fig. 10), is replaced by two valves of 32 millimeters diameter (1 1-4 inches), the gas passages, the valve lift being the same in each case. Then for the one big valve

$$f = D_m \times \pi \times c \times n_s = 6.4 \times 3.14 \times 0.8 \times 1 = 16.2 \text{ cm.}$$

The section of the gas passages of the two small valves is

$$f = D_m \times \pi \times c \times n_s = 3.2 \times 3.14 \times 0.8 \times 2 = 16.2 \text{ cm.}$$

The two sections are alike, but as we shall see the valve weights are not.

The weight, P_g of the big valve becomes

$$P_g = \left(\frac{D_m^2 \times \pi}{4} \times h + \frac{d^2 \times \pi}{4} \times l\right) \times a = \left(\frac{6.2^2 \times 3.14}{4} \times 0.7 + \frac{1^2 \times 3.14}{4} \times 18\right) \times 7.5 = 276 \text{ grammes.}$$

The weight of the two small valves becomes

$$P_g = \left(\frac{D_m^2 \times \pi}{4} \times h + \frac{d^2 \times \pi}{4} \times l\right) \times a \times 2 = \left(\frac{3.2^2 \times 3.14}{4} \times 6.5 + \frac{0.8^2 \times 3.14}{4} \times 18\right) \times 7.5 \times 2 = 196 \text{ grammes.}$$

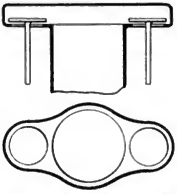
The big valve weighs 276 grammes whilst the two small ones of equal section only weigh 196 grammes. It is obvious that the two small valves are preferable. The effort required to operate them is less, while their inertia is not a very important factor.

As to the position of the two valves in the cylinder, we may turn to Figs. 11 and 12, if the valves are operated from below. Fig. 11, which represents the single valve, shows a combustion chamber spread out too much, while Fig. 12 shows a more compact combustion chamber with twin valves better disposed for high-speed work.

In overhead valve motors the difference in the shape of the combustion chamber, whether fitted with one or two valves, has a lesser importance; but the difficulties resulting from the weights exist in both cases, and we shall see later the value of adopting two intake and two exhaust valves in this case also.

Effects of Valve Weight

Let us now examine the efforts exerted on the valves and their operating gear, due to the inertia of the moving parts. Fig. 13 shows the shape of a cam operating a valve weighing 98 grammes, fitted with a valve spring collar of 20 grammes, and operated by a tappet weighing 55 grammes. It is now necessary to discover the effort required to move a valve, in order to be able to calculate the dimensions of the camshaft. In the design of each motor it is necessary to examine in this way the cams and the other moving parts, as shown in the following example.



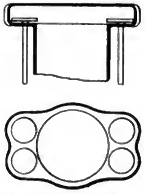


Fig. 11—Single valve with widely spread out combustion space
Fig. 12—Double valves showing more compact combustion space

The cam shown in Fig. 13 is an admission cam revolving at 2,000 revolutions per minute. The line b — b is the track of the roller around the cam. The diagram shown in Fig. 14 is the development of the lifts in abscissae, and of the angles in ordinates. The line a — a is only the development of the distance covered by the axis of the roller. The line c — c is the tangent of the greatest inclination or the line of the greatest velocity of lift of the cam; with these indications it is easy to find the effort necessary to move the valve with its pushrod. Thus; if

P = Effort on the cam at the moment of the greatest lift of the valve.

P_s = Weight of the valve spring.

P_p = Weight of the tappet spring.

P_{is} = Effort of inertia of the valve.

P_{ip} = Effort of inertia of the pushrod.

we obtain

$$P = P_s + P_p + P_{is} + P_{ip}$$

P_{is} becomes equal to the mass of the valve M_s multiplied by its greatest acceleration j or

$$P_{is} = M_s \times j.$$

The mass M_s is equal to the weight of the valve and of its valve spring collar divided by g, or

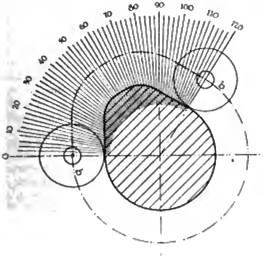
$$M_s = \frac{0.098 + 0.020}{9.81} = 0.0119\dagger$$

The maximum acceleration j becomes, if v_c is the velocity

---

†Note—In the following examples the metric values have not been converted because they serve equally as well as American standards to show the effect desired. This calculation is in the nature of a proof rather than a working task.

(*Continued on page* 729)



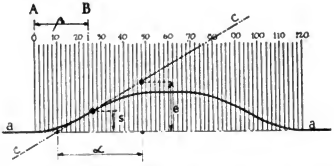


Fig. 13—Left—Cam shape for valve weighing 98 grammes

Fig. 14—Right—Diagram of valve lifts and angles

Chain Camshaft Drives Bound to Come

Pros and Cons of Roller and Silent Type Chains—Adjustment Advisable

By A. Ludlow Clayden

THAT the chain for camshaft driving came to be taken up so quickly in Europe was due mainly to the acumen of one English chain maker who, having had the order for chains for Knight motors forced upon him, had the foresight to see therein the nucleus of a great business. It is undoubted that the advent of the chain in motor construction was due to Chas. Y. Knight, who refused to use gears in his English Daimler motors, because their liability to bum or sing destroyed the quiet action of the Knight sleeve valves. Thus Europe owes the chain-driven camshaft, with which she is well satisfied, to the instigation of an American inventor.

When the chain was first put out as an essential feature of the Knight motor all sorts of dire predictions of early failure were made. Again, when the chain had proved its worth for driving sleeve valves, it was said that the more jerky action of a camshaft for poppet valves would destroy the chain even if it did stand up in the Knight motor. Again, it was the optimists that were proved correct. But let this not be taken as meaning that there were no troubles, for there were plenty in the early days and are still some now. Firstly, it was discovered that the chain had to be large. Practically it could not be too wide for the job, and it was price that fixed the limit. Next it was soon found that a great deal depended upon the exact tension with which the chain was mounted in the first instance and that it was advisable not to let the chain become too slack; otherwise fracture was not improbable.

Adjustment or No Adjustment?

This much-vexed question remains still to be settled, and it is not too easy to discuss it without showing personal prejudice. The writer has run a chain without adjustment in a small high-speed motor for a distance corresponding to at the lowest possible estimate 60,000,000 revolutions, probably 100,000,000 is really more nearly true. At the end of this time there was no appreciable slack in the chain. To save the trouble of conversion it may be added that this represents 15,000 miles running of a little car with small wheels, much of the time being spent in mountainous districts with a great deal of low-speed climbing. Still the writer, despite this experience, is inclined to prefer adjustment, because it allows the chain to be set correctly before the car leaves the factory.

In England the largest manufacturer of automobiles is the Wolseley company, which makes a high-class car at the rate of something under 5,000 per year. After experiment they decided to use no adjustment, but instead to subject each chain to a run. Chains are measured carefully and all those over a certain length are rejected. The remainder are run under load for lengths of time which vary for each chain, the run being continued till a certain length is reached by stretching. This is costly, but thought to be cheaper than an adjustment as part of the motor, while it also removes the danger of some unlearned owner tightening up the chain too much and so stressing not only the chain itself, but the camshaft and the bearings.

The purpose of adjustment is to provide the correct tension; the use of the tension is to keep the slack side of the chain—the side not pulling—from fluttering or swinging. If the loose side of the chain is free to swing the driven sprocket will have backlash and it will be possible for the chain to move freely against no load and then be brought up with a bump at the end of the slack. This means that the inertia of the parts driven can subject the chain to very heavy blow-like stresses.

Slight Slack Shortens Chain Life

One might easily think that this sort of action could not take place until the chain had become quite slack, but this is not true; a very small degree of slack will suffice to shorten the life of the chain a great deal. Yet all that we have to do is to prevent the side which is not loaded from jumping about.

So far the writer has been considering only the so-called silent chain, but the roller chain has been used also for camshaft driving, and with good success. It is much cheaper than the silent chain, it is almost as durable—some say more durable—and it is not perceptibly less quiet in operation if the sprockets are well cut and the lubrication is copious. The outstanding advantage of a roller chain is that it can be bent both ways, it can have one side in mesh with one sprocket, and the other side with the next, which means that, if we have a slack roller chain connecting the crankshaft and camshaft, we can put a jockey sprocket behind the slack side, and maintain the tension with a spring. It is not essential to use a sprocket for this purpose as a plain pulley with a smooth surface will do if its bearings are so free that there is no possibility of it seizing and letting the chain "skid" over it instead of turning it. Two European makers of large quantities of automobiles have used this system, Belsize in England with the plain pulley idea, and Mathis in Alsace-Lorraine, with the jockey sprocket. Both have been most successful and among the 1915 models of European touring cars that were passing out of experimental departments last June, there were several imitators.*

High Speeds Make Gears Noisy

One maker with whom the writer was in close touch, found some trouble in obtaining the desired degree of quietness, but the noisiest of roller chains is less noisy than the quietest of spur gears. Remember, it is the high revolution speeds of 2,000 and over that are now common in Europe which have made the distributing gear noise an acute manufacturing question. Racing cars like the Peugeot and Mercedes have the best-made gears obtainable, but the scream of the pinions when the motors are running fast can be heard for half a mile away quite easily.

With a silent chain it is possible to put a plain pulley against the back of the slack side, but it has been done only quite rarely, just why this is so not being obvious, but for quantity production the roller is a much more attractive proposition than the silent pattern. It is cheaper, it is probably stronger for its weight—especially when worn a bit; it is easier to assemble and it is easier to provide with adjustment of a simple character. Against these advantages there can only be put the still greater quietness of the silent kind. In fairness, it should be added that some chain makers claim that the silent chain is the more durable—weight for weight—and there is little evidence to show whether this is, or is not, the case.

---

*The 1915 models in Europe would not have been announced till last November following practice over there, which is regular.

Designing Advantages of Adjustment

The engineer gains from the provision of adjustment, whether automatic or not, the advantage that he is not bound to minutely exact centers for the camshaft and crankshaft; these can be arranged a convenient round number dimension apart and the adjustment left to care for the slack. The manufacturer gains the ability to use all the chains without rejects, as he can adjust either short or long chains to give equally good service. When one remembers the immense number of joints in a chain—and every joint is a bearing—it is obvious that it is fairly close work when guarantees are demanded that the variation of each foot of chain shall not exceed a few thousandths of an inch.

Yet engineers in Europe have fought against the adjustable feature, because it taxes their ingenuity to accommodate a simple, inexpensive and yet thoroughly effective device. Still it can be done, as there are plenty of examples to show; the chain makers are a mine of ready reference on this branch of the subject, and one cannot avoid the feeling that the automatic adjustment will win out.

Possibility of Special Gearing

There have been several attempts to find an application of worm or spiral gearing which would be as quiet as the chain and more durable. Experiments along this line in Europe have not been very persistent nor have they been very encouraging, but a few are now being made here. Anyone who would venture to forecast the result would be distinctly bold, but there seems no doubt but that the helical spur gear is bound to vanish, with the common use of higher motor speeds, upon which most engineers seem agreed. It is to be hoped that the special kinds of spiral gearing will gain adherents, because that is the only way in which the matter can be settled, but meanwhile there is no need to be afraid of the chain as long as it is good chain. It will cost more than cast iron helical gears, but then so does the self-starter automobile cost more than the cranked one. Like all other things that really do make for the comfort and pleasure of the motorist, quiet motor distribution gearing is bound to come.

Details of Design

Chain makers agree that the best form of chain layout for the average motor is a triangular arrangement, the chain passing round the crankshaft and camshaft sprockets and also round a third sprocket which drives the magneto, pump or generator. The latter fitting can usually be so arranged that adjustment of the chain is possible. Yet when one actually gets busy on the drafting board to put such a chain into an average motor it exhibits surprising difficulties. It is not advisable to use a layout that causes the chain to embrace only a small arc of any sprocket—on the contrary, it ought to wrap round as much of the sprocket's periphery as possible. It is particularly inadvisable that the crankshaft sprocket which does all the driving, should only touch three or four teeth of the chain. In the usual motor it will be found that the camshaft and crankshaft centers lie in such positions that the third pinion for a triangular drive has to be situated in a position where it is useless for driving anything else. It would not be possible to use a single chain to drive two camshafts in a T head motor, for example.

None the less, it is the business of the chain concerns and the automobile engineers to find some easy way in which one chain, with adjustment, can be made to serve for driving the camshaft and the generator or other auxiliary. The use of more than one chain cannot be *necessary* and it must inevitably lead to increased cost. Again, to use chain for one part of the distribution gearing, and spur gears for another part, is to throw away the advantage of the chain altogether.

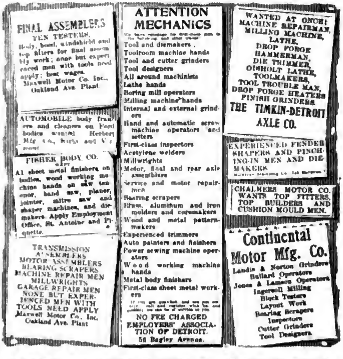
Any engineer who enjoys a mechanical problem will find the question of chain layout a most fascinating exercise for his faculties, but those who decide to try it should remember that there are two kinds of chain, and that the roller pattern has not yet been given many opportunities to show its qualities in motor work, although it is peculiarly attractive by reason of its ability to drive on both sides at once.

Skilled Mechanics in Demand for Detroit Car Factories

DETROIT, MICH., April 17—There is hardly an automobile or motor car parts manufacturing concern in the city today which is not trying to add to its working force. Small concerns with less than 100 men on their pay-rolls and big plants with thousands of men, with even day and night shifts, are either advertising directly, or indirectly through the medium of employment agencies, for more men.

Although a similar condition exists practically every year at this time, this year the demand for skilled workingmen is much greater than ever before. By skilled men the manufacturers mean specialists for special machines and expert mechanics.

At the plant of the Maxwell Motor Co., where 2,000 to 3,000 men are now employed, it was said that there is room for an unlimited number of skilled mechanics. The Cadillac Motor Car Co., although having now more than 8,200 men on its pay-roll, is lacking from 100 to 150 specialists not assemblers or body painters or trimmers, but men who can handle the special machines. Ford, with over 16,000 men working, is also looking for the skilled worker. So it is with Packard, Regal, Paige, Chalmers, King and many others.



FINAL ASSEMBLERS
YEN TESTERS.
Body, hood, windshield and top fitters for final assembly work; none but experienced men with tools need apply; best wages.
Maxwell Motor Co. Inc.,
Oakland Ave. Plant

AUTOMOBILE body framers and cleaners on Ford bodies wanted. Herbert Mfg. Co., [illegible] and [illegible]

FISHER BODY CO.
A1 sheet metal finishers on bodies, wood working machine hands on saw tenoner, band saw, planer, jointer, mitre saw and shaper machines, and die makers. Apply Employment Office, St. Antoine and Piquette.

TRANSMISSION
ASSEMBLERS
MOTOR ASSEMBLERS
BEARING SCRAPERS
MACHINE REPAIR MEN
MILLWRIGHTS
GARAGE REPAIR MEN
NONE BUT EXPERIENCED MEN WITH
TOOLS NEED APPLY
Maxwell Motor Co., Inc.
Oakland Ave. Plant

ATTENTION
MECHANICS

[illegible]

Tool and diemakers.
Toolroom machine hands
Tool and cutter grinders
Tool designers
All around machinists
Lathe hands
Boring mill operators
Milling machine hands
Internal and external grinders
Hand and automatic screw machine operators and setters
First-class inspectors
Acetylene welders
Millwrights
Motor, final and rear axle assemblers
Service and motor repairmen
Bearing scrapers
Brass, aluminum and iron molders and coremakers
Wood and metal pattern-makers
Experienced trimmers
Auto painters and finishers
Power sewing machine operators
Wood working machine hands
Metal body finishers
First-class sheet metal workers

[illegible]

NO FEE CHARGED
EMPLOYERS' ASSOCIATION OF DETROIT.
58 Bagley Avenue.

WANTED AT ONCE!
MACHINE REPAIRMAN,
MILLING MACHINE,
LATHE,
DROP FORGE
HAMMERMAN,
DIE TRIMMER,
GISHOLT LATHE,
TOOLMAKERS,
TOOL TROUBLE MAN,
DROP FORGE HEATERS
FINISH GRINDERS
THE TIMKIN-DETROIT
AXLE CO.

EXPERIENCED FENDER SHAPERS AND PINCHING-IN MEN AND DIE MAKERS
[illegible]

CHALMERS MOTOR CO.
WANTS TOP FITTERS,
TOP BUILDERS AND
CUSHION MOULD MEN.

Continental
Motor Mfg. Co.
Landis & Norton Grinders
Ballard Operators
Jones & Lamson Operators
Ingersoll Milling
Block Testers
Layout Work
Bearing Scrapers
Inspectors
Cutter Grinders
Tool Designers

Newspaper advertisements of Detroit car and parts factories for more men

· The Engineers' Forum ·

Defense of Front Position for Radiator—Front Radiator Lighter—Less Interference with Other Parts—Overhead Valve Motor Need Not Be Costly

By Russell Huff,

Consulting Engineer, Packard Motor Car Co.

DETROIT, MICH., Editor THE AUTOMOBILE:—The advantages of the conventional way of placing the radiator out in front of the motor on passenger cars and trucks, instead of behind the motor, are so numerous and obvious that there can be little argument of real merit left for any other construction.

In almost every problem of engineering there are several ways of accomplishing the desired result, but the best compromise construction is usually adopted. It is seldom the ideal is realized in any engineering problem. The radiator in front of the motor may not be the "ideal" construction, but a study of the problem by automobile engineers in this country and abroad for 20 years has led them to adopt this construction as the best compromise, and it has become the standard conventional construction of the world.

Front Radiator Is Lighter

The chief criticism of this construction is that the radiator in this position is more exposed to danger from traffic accidents than is the case with the radiator placed behind the motor. To offset this one criticism there are a number of pertinent reasons favoring this construction.

The radiator located in front has by far the greatest cooling efficiency, when size and weight are taken into consideration. It can be made lighter than would be possible when located in any other position. This means less volume of water carried in the radiator and an additional saving in water weight. It is much more accessible, and being more compact, is less troublesome to mount in a flexible manner and has less trouble from leaks caused by frame twisting and vibration. This position also permits of a better fan mounting, which not only increases the air circulation through the radiator but also forces a draught of air back over the motor and over the exhaust header and helps to keep the engine cool. This position for the radiator also enables the artist to obtain better streamline effects in body designing.

To further offset the slight advantage of greater safety in traffic collisions which is claimed for the radiator placed behind the motor, we have the following serious objections to contend with in this construction:

Dashboard Radiator in Way of Other Parts

There is a great increase in the weight added to the car, because the radiator must be larger and heavier. This construction places the dash back farther and makes a longer wheelbase necessary. The increase of concentrated dead weight directly over the flywheel requires a heavier and stiffer frame construction to meet the new loaded conditions. The longer wheelbase also calls for a stronger and heavier frame. There is also the increased structural difficulty of mounting the radiator in this position to avoid the flywheel casing, the steering gear, the control rods to the magneto, carbureter and throttle valve, and electrical wiring and piping which must connect the motor with the driver's compartment. There is great difficulty in obtaining a suitable flexible mounting for a radiator in this position, and great expense involved in removing such a radiator from the car for repairs. Inaccessibility of the radiator filling cap, increased heat in the driver's compartment in the summer time, and the difficult problem of providing satisfactory fan construction for the forced draught which is necessary to obtain efficient cooling, are additional objections to this location.

Protection a Minor Consideration

While there are a number of other serious difficulties to be overcome in securing satisfactory results from the radiator behind the motor, I believe the above-mentioned advantages of the conventional construction where the radiator is placed out in front of the motor, and the disadvantages of locating the radiator behind the motor, more than offset the one single advantage of greater protection from traffic accidents which is claimed for the latter construction.

Even in the danger zone in war times, the radiator in front is a safer type to use, because it presents a smaller target for the enemy than the large, bulky radiator placed behind the motor.

The radiator in front has the still further advantage of being farther removed from the driver, so that there is less danger of bullets intended for the driver striking and puncturing the radiator than would be the case with the radiator back of the motor and close to the driver.—Russell Huff, consulting engineer, Packard Motor Car Co.

Front of the Car Is Best Position for the Radiator

By John Younger

BUFFALO, N. Y.—Editor THE AUTOMOBILE:—On reading Mr. Morrison's letter in the Forum for April 15, I have looked up records on the reports of radiators and find that it is about 4 months since we have had one returned for trouble due to an accident wherein the radiator was punctured. These records cover the worst seasons of the year when the streets are icy and trucks are more inclined to skid than at other times.

The only thing that may be said in respect to Mr. Morrison's letter is that *something* must be placed in front of the truck, and whatever it is must bear the brunt of the collision affecting this part. If it is only a thin sheet steel hood over the engine, it is as likely to be punctured, and the obstacle will be driven in on the motor.

Our company mounts the radiators somewhat back of the very front of the truck, with a large, stout bumper in front, which protects the vital parts from the majority of collisions.

We have found that when you have arranged for your exhaust pipe and flywheel, and other parts of the motor, to go through the radiator, then the advantage of accessibility is sacrificed very materially, so, taking everything into consideration, we prefer the radiator in its present position.

In so much as radiators have been placed on cars behind the motor for many years, yet the majority of cars and trucks are still fitted with radiators placed in the front, it is obvious that there is no advantage in making any change in position.—JOHN YOUNGER, chief engineer, truck department, Pierce-Arrow Motor Car Co.

Overhead Valve Cheaper to Manufacture than Pocket Type

NEW YORK CITY—Editor THE AUTOMOBILE:—Having recently read the interesting article on overhead valve motors by A. Ludlow Clayden in THE AUTOMOBILE, for April 8, I would like to state that the idea that expense is involved by using overhead valves is not always true. In elaborate motors like the racing Peugeot the cost of the valve gear may be very high, but in commercial manufacturing much simpler designs give good service. Motors like the ones not so popular for small cars have detachable heads with the valve seats machined directly in the heads. After facing off the head it is a cheap job to cut the seatings and bore the valve guides—cheaper than it is on a block casting without a detachable head. The cost of the rockers and the long push rods is very small and is offset by the simpler cylinder castings and the fact that no valve cover plate is needed. In a good many overhead valve motors the valves are shorter and the springs lighter than are needed for the pocket type and this saves money as well.

Suitable for Eights

I agree with Mr. Clayden as to the suitability of the overhead type for eights. We already have one example of the neatness that can be gotten this way in the Ferro, which is the neatest of all the eights to look at. It is very surprising that there have not been some more attempts along this line, and I shall expect to see a lot of overhead valve eights next year.

A theoretical point in favor of the valve-in-head that seems to me to have been missed is that it is much easier to make the gas passages inside the casting for this type. There is no need to have the intake and the exhaust so much mixed up with each other when the valve ports are not all in a row, side by side.

I think it is easier to make a cheap motor to give good power with overhead valves than with ordinary valve location, or else why do so many manufacturers adopt the system for their small motors? R. P. M.

Recent Court Decisions—Some Insurance Cases

By George F. Kaiser

AS almost without exception, every automobile owner, whether an owner of a passenger car, or a commercial vehicle, is insured under policies covering him against loss by fire, theft, liability or collision, the question of insurance is an important one. Several court decisions have been lately handed down on the question of insurance.

In New York it has been decided that, when a policy provides that it shall be void if the person insured conceals or misrepresents any material facts concerning the subject of the insurance, that the person's statement embodied in the policy that his automobile is a 40-horsepower four-cylinder touring car, built in 1910, when, in fact, it is a 24-horsepower car developing only 29-horsepower and built in 1906, is a misrepresentation of a material fact as mentioned above and therefore voids the policy.—*Read vs. St. Paul Fire & Marine Insurance Co.*, 151 *N. Y. S.* 274.

In this case an action was brought to recover $500 on a policy upon an automobile, which was destroyed by fire. The court held that if a company is informed that a car is a 1910 model, when it is a 1906 model, they are relieved from payment of loss under the policy, as a 1910 car is naturally of a greater value than a 1906 car.

A Theft Insurance Case

In another New York case where a policy had been issued insuring an automobile against loss by theft, the court held that the person insured must show that the car was stolen and taken with a felonious intent, and that he could not recover under his policy if he had been wrongfully deprived of it by one acting under an honest belief that he was entitled to its possession.

Suit was brought to recover $1,000 on a policy against loss, theft, robbery or pilferage. The owner of the car sailed for Europe, leaving the car in his country place in Connecticut. A short time thereafter a man went to the place where the car was kept and told his caretaker that he was the owner's partner and he was taking the car down to have it painted and would return it in ten days. The caretaker turned the car over and a receipt was given for it. The party taking the car was under the belief that he was entitled to it, because it was the property of a company of which he was a member.

The court held that the car owner could not recover from the insurance company on this state of facts, as the automobile had been taken by mistake and not with an intent to steal it.—*Rush vs. Boston Insurance Co.*, 150 *N. Y. S.* (*New York*) 457.

When the Car Is Rented

In still another case the court held that in a policy which insured the owner of an automobile truck against loss arising by reason of its ownership, maintenance or use, a warranty that "none of the automobiles herein described are rented to others" spoke of as of the date of the policy, and hence was not violated because thereafter and at the time of the accident on which the assured brought suit it was rented to others.

Suit was brought against the automobile truck owner for damages resulting from injuries received by being struck by the truck.

The court held that, although there was a warranty in the policy that none of the automobiles were rented to others, that warranty only applied to the date of the issuance of the policy, April 14, 1912, and not to the date of the accident, May 24, 1914, and therefore the truck owner was entitled to judgment against the insurance company.—*Mayor Lane & Co. vs. Commercial Casualty Insurance Co., 150 N. Y. S. 624.*

The Rostrum

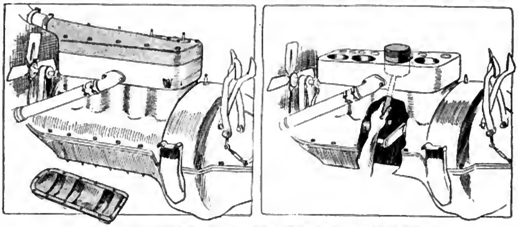


Fig. 1—Illustrating steps in reaching the pistons on a Ford motor

Side Play Caused Knock

Editor The Automobile:—I have a six-cylinder car of a well-known make and have used it 2 years. The last year I noticed a slight click in the engine and thought perhaps one of the push rods needed adjustment. I went all over them and adjusted them all so that there was no more than 1-32-inch play between any of them, but there was still the same click. Good repairmen tell me, when listening to it, that one of the push rods needs adjusting, but they cannot find the one that needs the adjustment. I was puzzled and when I overhauled the engine I discovered that one of the bushings, where the push rods run in, had side play which caused a knock or click similar to that when the push rods have too much play.

Johnstown, Pa. H. C.

Unused Storage Battery Should Have Care

Editor The Automobile.—The other day I started to operate my car after having had it set away in the garage for 4 months; during which time the battery ran down. I drove it 10 miles to a well-known storage battery service station. The man in charge of this station told me to just disconnect the wiring from the charging dynamo and that it would do no harm to the electrical end to go ahead and run the car without having a battery in it to take care of the current, saying that if I had no battery to receive the current it could not generate any. Later on I met another man who said that I should not run my car a mile without a battery in it, because by so doing, I would burn the wiring out of the dynamo, because I was generating current and that without the battery there to receive it, would put my electrical apparatus all out of commission. I may say that my car is equipped with the Disco starting and lighting system.

Please advise me through the Rostrum which of the above opinions is correct.

Pleasantville, O. H. F. Y.

—In the first place you were entirely wrong in leaving the battery in the car for a period of 4 months, during which time the battery was allowed to run down. The battery should have been given an extra charging at occasional intervals in order to keep the specific gravity up to the standard, which is between 1.275 and 1.300. In laying up the storage battery for the winter, it must be remembered that the storage battery as used for electric starting and lighting or for electric lighting only, is strictly an electro-chemical apparatus, and requires a certain amount of attention or care, whether idle or in actual service. Therefore, if the car owner will bear this in mind, and follow the directions given herein, he should have little difficulty in keeping the battery in healthy condition during the winter months. If the battery is always filled to the proper height, and kept fully charged within the limits of the standard 1.280 to 1.295, it may be safely considered as being in a healthy condition. Every car owner should have a hydrometer syringe, to use in determining when the battery is fully charged, and it will also be found convenient to use in filling the battery with water.

Inspect the battery once every 2 weeks, and take a gravity reading of the electrolyte with the hydrometer syringe, to determine the strength or capacity of all cells, after which fill each cell to the level of the inside cover with pure distilled or clean rain water. If convenient for the car owner to operate the motor of his car, he should run the engine for a period of 2 or 3 hours, as necessary, until the gravity has reached 1.280 in all cells. The engine should be operated at a speed equivalent to a car speed of 15 to 18 miles per hour.

The car owner may find it impossible to charge the battery on the car on account of the necessity of placing the car in storage. In this event, if alternating current is available, a small vibrating rectifier can be purchased. This apparatus costs little, and can be attached to the wall, and connected to any standard lamp socket. Charging the battery overnight, or about 12 hours every 2 weeks, would be sufficient to keep the battery in healthy condition. This, however, must be proven by hydrometer test. If the car owner does not wish to incur the expense of a rectifier, he may remove the battery from the car, and take it to a battery service station, or garage, that has charging facilities and have it recharged every 2 weeks. The battery should be kept in a dry place.

The car owner must also bear in mind that a battery starts to wear out commencing with the day it is made. If he does not wish to be bothered with the care of the battery while his car is out of commission, he may send the battery to the nearest battery service station where it can be treated for dry storage, providing it is in healthy condition when it is sent. Under these circumstances, there would be practically no deterioration of the battery while in storage. When the car owner desires the battery placed in commission again, he should notify the service station 2 weeks in advance of the time it is wanted, in order to give sufficient time to rebuild the battery. The expense to the car owner in this instance would be transportation both ways, and the cost for tearing down and rebuilding the battery.

The car owner will, by following these suggestions, be assured that his battery will be in a condition to give satisfactory service, when placing his car in commission, after the winter months. He may also be sure that the battery cannot possibly freeze. The accompanying table shows at what temperature the electrolyte in a storage battery will freeze.

The car owner who keeps his car in commission during the winter months will continue to give it the same care that it demands at all times of the year, but will have to give special attention to keeping it fully charged, as the work the battery is called upon to give in cold weather is unusually heavy, for the reason that a cold motor is very hard to start, therefore using more current in the effort.

2—The Disco system should always have one generator brush pulled out of the brush holder when the battery is not connected. When the brushes make contact on the commutator there is a field current generated which will rise to approximately 30 or 40 volts. This will have a tendency to heat the field coils if run in this condition for any length of time. Also if the battery is not connected and you use the generator the life will be burned out, as all the current generated by the generator will be forced through the lamps.

Freezing Point

Specific gravity 1.120 battery empty, 20° above zero.
Specific gravity 1.160 battery ¾ discharged, at zero.
Specific gravity 1.210 battery ½ discharged, at 20° below zero.
Specific gravity 1.260 battery ¼ discharged, at 60° below zero.
Specific gravity 1.280 battery full, 70° below zero.

Battery Should Float on Line

Editor THE AUTOMOBILE:—I recently attached a generator to the flywheel of a model G, 1910 Franklin, for the purpose of electrically lighting my headlights and tail light. The wiring is in series. The generator is a 3-magnet type, 6 volts and made by the Manhattan Electric Supply Co.

Owing to the unequal illumination at different speeds of the motor, I am contemplating the addition of a Witherbee 6-60 to 70 storage battery.

1—Will you kindly show by diagram the new wiring arrangement to connect the batteries?

2—Please state the voltage and candlepower of the bulbs, meaning head and tail lights. Which will be conducive to maximum efficiency?

I am using at present 6 volts and 6 candlepower for headlights and 6 volts and 10 candlepower for tail light with the result that the headlight which is on the same side as the tail light, the left, is much dimmer than its fellow at all motor speeds.

3—Please mention a good brief text book on the care of a storage battery.

Pearl River, N. Y. S. H. M. D.

—The best way to connect the battery would be simply to have it what is popularly known as floating on the line. This method of wiring is shown in Fig. 2.

2—The headlights should be 16-candlepower, side lights, 4-candlepower, and tail and speedometer lights, 2-candlepower, all rated at 6 volts.

3—The best books on the care of storage batteries are those which are published by the storage battery companies themselves. These are instruction books which give practical information on their care which is probably what you desire rather than books on the construction.

Loose Ring Causes Carbon

Editor THE AUTOMOBILE:—Cylinder number one on my Ford carbonizes very badly. The spark plug in that cylinder is shortened with carbon every time the car is run about 20 miles. I took the cylinder-head off and found that the exhaust valve had a notch burned out across the seat of the stem. I then thought that, if possible, I would put a new valve stem in and grind it well and that everything would be all right, but after I had done so an excessive amount of carbon still collected in that cylinder. I cannot understand why this is, unless it is caused by a lack of compression. That cylinder seems to miss until the engine warms up but after it is warmed up it seems to have very nearly as much power as the others. I am now of the opinion that it is losing compression past the piston rings. It may be that one of the rings is broken or sprung. The other cylinders do not carbonize like this. I know this cylinder is not losing compression through the valves because they are ground and in good condition.

Will you please advise me what you think is the trouble? What is the best way to get to the piston in order to put new rings on same? Is it best to unscrew nuts at the bottom of connecting-rod and then take the cap off, take off the piston head and then push the piston out through the top of the cylinder, or would it be best to unscrew the nuts and take off the cylinder block? If this should be done, how would I disassemble it? What nuts, etc., would I have to loosen? What should the clearance in the opening of the piston rings be after being placed into cylinder?

Plantersville, Miss. WM. I. SHUMPERT.

—The method of getting at the piston on a Ford car is to take off the cylinder head, remove the plate from the bottom of the crankcase and, by reaching through this, remove the bolts holding the connecting-rod bearings in place. After the connecting-rod bearing caps are removed, the pistons can be pushed up through the top of the cylinder. You need not bother about the clearance between the opening of the piston rings, as this will take care of itself with new rings. The method of removing the piston is clearly illustrated in the sketches, Fig. 1. The loose rings are probably the cause of your trouble.

Many Special Starting and Lighting Systems

Editor THE AUTOMOBILE:—Who makes the Auto-Lite system?

2—How many of the builders of cars own their own starting and lighting systems?

Nevada, Ia. C. W. H.

—The Auto-Lite system is made by the Electric Auto Light Co., Toledo, O.

2—None of the car builders except the Kissel company are using their own cranking system, although many have special designs which have been made by the starting and lighting company to meet the needs of the individual car to which they are fitted.

Wants Parts for 1912 Model Ohio

Editor THE AUTOMOBILE:—Please let me know where parts can be secured for the 1912 Ohio car formerly manufactured by the Ohio Motor Car Co.

St. Bernard, O. E. L. K.

—Parts for the Ohio car can be obtained from the Crescent Motor Co., Cincinnati, O.

Relation of Magneto and Plug Points

Editor THE AUTOMOBILE:—I have a four-cylinder motor equipped with a single magneto system. I have had quite a little trouble with the motor missing, both at high and low

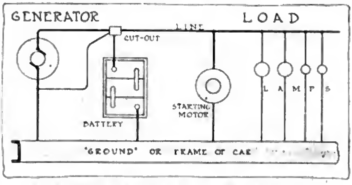


Fig. 2—Wiring diagram for a battery floating on the line

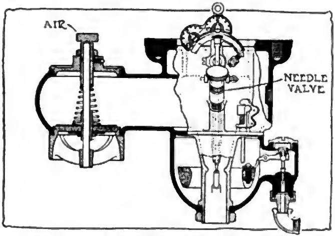


Fig. 3—Section through a Schebler model L carbureter

speeds. In going over the ignition system carefully I found that the magneto breaker box platinum points break about .015-inch on one side of breaker box and about .018-inch on the other side. I also found that by adjusting the points of my spark plugs in numbers one and four cylinders to about .020-inch apart and adjusting numbers two and three to .030-inch that the motor would run perfectly, both at high and low speed. But I was surprised to find that by exchanging the plugs from numbers one and four to numbers two and three cylinders that the motor would not run at any speed without missing. I have tried different adjustments of the magneto points, but always find that better results can be obtained by adjusting the spark plug points accordingly. I am an automobile mechanic with 14 years' experience, but this is something new to me.

I would like to be informed if there is a relationship existing between the adjustment of the magneto points and the adjustment of the spark plug points. In other words, if the magneto has a slightly different break on cylinders one and four than the break on two and three, can this trouble be overcome by adjusting the spark plug points to suit?

St. Petersburg, Fla. C. E. McNabb.

—There is no doubt a definite relationship between the two distances because of the ability of the current to jump a gap of just a certain distance. These air gaps are resistances in a circuit and hence in overcoming the resistance, the current does a definite amount of work. Naturally if a large proportion of this work is done at one point, a smaller portion will be done at the next. This would seem to bear directly on your problem, and establish the relationship which you have discovered in adjusting the spark plug points. It would seem better to adjust all the spark plug points to the minimum size opening at which they will fire in all cylinders, for in this way the uncertainty and trouble which is apt to occur should the plugs be mixed in cleaning, for instance, will be overcome.

Suggests Cause of Trouble in Starting

Editor The Automobile:—In The Automobile for March 18 M. P. B. of Lakeport, N. H., has trouble with starting his Ford when hot. My diagnosis would be that it is caused by a rich mixture as this is quite common in new cars especially in summer.

I am assuming that the car when cranked immediately after being stopped while warm will start without spinning, but upon being left standing a few moments part of the gasoline in the carbureter vaporizes and fills the intake pipe with a mixture that is too rich to be exploded and consequently must be cranked through the engine. It is seldom necessary, but in extreme cases a small petcock screwed into the intake near the place it forks and this opened while cranking the car while warm, will remedy the trouble. Would be glad to know the result.

Natoma, Kan. R. A. McEwen.

Motorcycle Engine Light for Stationary Work

Editor The Automobile:—Our company is manufacturing a labor-saving machine in which we had intended installing a 1-4-horsepower electric motor. In order to get away from the troublesome feed coil which would be constantly under foot, I want your valued suggestions on the following points.

1—Could a small gasoline motorcycle engine be used? Relatively, how much noisier would it be than an electrically-driven motor of 1-4 horsepower?

2—What would a motorcycle equipment weigh, omitting gasoline, and what space would such equipment occupy, not including gasoline tank?

3—Have you any data as to the makers of such small gas engines producing not over 1 horsepower and the probable cost of equipments in lots of 100 to 1,000.

New York City. M. A. Morris.

—A small gasoline engine can be used but it would not be advisable to use a motorcycle engine for this purpose where the motor will probably be driven under load continuously. The ideal type of motor for your purpose will be a small two-cycle marine or stationary type of gasoline engine. This is fitted with a heavy flywheel and is so arranged that it can be bolted to a firm base and thus render very simple the installation, which would not be the case with a motorcycle motor which is designed for lightness and not for heavy-duty work.

2—The motorcycle equipment would weigh much less than the marine equipment, but if you are intending this for stationary work, the mere fact of a slight additional weight would not seem to be of material difference. The motorcycle equipment would probably weigh 60 or 75 pounds, whereas the marine motor would probably weigh about 100 pounds.

3—We have no such data on hand but very probably some of our subscribers have and will communicate with us, whereupon we will be very glad to send you the information.

Remedy for Hot Starting Trouble

Editor The Automobile:—I would suggest that M. P. B. of Lakeport, N. H., who complains of trouble in starting a warm Ford engine, try shutting off the gasoline at the needle valve, then turning the engine over. When it fires quickly turn up the needle valve to normal position.

I have found this to be the cure for the trouble mentioned in numerous instances; the warmth seems to choke up the carbureter and manifold with an over-rich, non-explosive mixture.

Tarrytown, N. Y. J. J. H.

Needle Adjustment Is Too Fine

Editor The Automobile:—I have a Flanders 20, 1911 model. Last fall I put on a Schebler carbureter model L. I do not know just how to set it. If you shut the adjustment on the needle valve clear up it will hardly run. I have the air about half off.

2—What is the cause for about 1-2 pint of gasoline leaking from the carbureter out through the air pipe when the engine stops? Is the float set too high?

3—The magneto is a Splitdorf and I have trouble in short circuiting. I have put on an all new magneto cable but it goes through anywhere it happens to touch any metal. Can it be that the magneto is too strong? It runs well at other times.

4—Can you take up wear in the clutch on these cars? The flywheel has about 1-20-inch play between it and the housing. Does this harm anything?

5—Where can I get a light two-cylinder engine of a design similar to a motorcycle engine having 4 or 6 horsepower with a magneto?

Marathon, Ia. **Ora Smith.**

—Evidently you have cut the needle adjustment down too fine and you should give it a turn and one-half on the needle and also adjust the air valve to seat lightly. Schebler model L is shown in section in Fig. 3.

2—The leaking is probably due to the condensation of the heavy gas in the manifold. When the engine stops it runs out in the manifold and back through the carbureter. The use of an exhaust sleeve or drum around the exhaust manifold and a flexible tube running to the air bend in the carbureter, will probably overcome this trouble. The height of the float should be 1 1-16 inches from the top of the bowl to the top of the cork float when the valve is seated.

3—The probable reason for the current leaking is that the insulation is not heavy enough or it has become worn in places where it has rubbed against the metallic surfaces. Probably leaking occurs on the wires at the point at which they pass through the fiber block over the exhaust manifold. It would be well to note if this block is properly in place.

4—The clutch can be taken up by increasing the tension on the clutch spring by an adjustment nut.

5—It would probably be most economical for you to purchase a used motorcycle or cyclecar with a similar type engine, as these will have the magneto attached. If a new engine is desired it can be secured from any of the motorcycle or motorcycle engine companies.

First Year for Dodge Bros.' Car

Editor The Automobile:—Have the Dodge Bros. ever had a car on the market before this year?

2—If so, what year and what was the name of it?

3—Have they ever manufactured the engines for Ford?

South Pittsburg, Tenn. W. F. A.

—This is the first finished car that the Dodge Bros. have had on the market.

2—The Dodge Bros. plant was erected especially for the present car and no others were manufactured before it.

3—Yes, they made the first engine for the Ford company but have had nothing to do with the model T engine.

Dodge Made First Ford Motor

Editor The Automobile:—I am under the impression that Dodge Brothers were the first to manufacture the Ford engine, being the holders of the patent, but their control ran out with the Ford on January 1, 1915. Am I right in this?

St. Johnsbury, Vt. **G. F. Chamberlain.**

—The Dodge Bros. did make the first Ford engine but were never concerned with the manufacture of the present model T motor. There is no patent control involved one way or the other and the Ford officials say there never was so far as the engine was concerned.

Magneto Probably Is Mis-Timed

Editor The Automobile:—I would like to know what makes the engine kick back when starting on the magneto.

2—How much oil is required in the crankcase of a six-cylinder motor?

3—Please show me by sketch the mechanism coupling between the clutch and gearbox of a 1911 Thomas model M.

4—How can I stop the oil leaking from this coupling?

5—How long will a magneto run without remagnetizing it and overhauling it in general?

6—How long is the average life of a spark plug?

7—What treatment is necessary to make a brake lining stick better?

Saugus, Mass. **Robert E. Reason.**

—The fault is that you have not retarded the spark sufficiently on the quadrant or if you have done this, the magneto is mis-timed.

2—It is impossible to give you exact data as to how much oil is required in the crankcase of a six-cylinder motor, as with different sizes of oil pan and different systems of ignition the quantity of oil will vary. The average six-cylinder motor, such as for example, the Hudson 6-40, will have 16 pints of oil but others will have less or more in accordance with their individual design.

3—The coupling between the clutch and gearbox of the 1911 Thomas model M is a cross-universal which is illustrated in Fig. 4.

4—The oil can be prevented from leaking from this coupling by removing the packing nut and replacing the felt washer with a new one. This can be secured from the Thomas company in Buffalo, at a very slight cost.

5—Magnetos will run for 5 years and upward without remagnetizing if a good job has been done in the first place and if the magnets employed have the proper degree of retentivity. The exact time cannot be stated but the service which you can secure from a magneto before it needs recharging will extend over an indefinite period of years.

6—The average life of a spark plug is two seasons. Some makes of plugs which are more costly and which have a better composition of non-burning material in their electrodes will last much longer than the cheaper plug. The average of two seasons may be taken as a mean for average priced plugs.

7—No treatment should be given a brake lining to make it fit better except keeping it clean and maintaining the proper adjustment on the brakes. When worn down the brake lining should be replaced. One of the frequent occurrences is the wearing of the asbestos compound below the surface of the copper rivets which hold it in place. This brings the copper rivets in contact with the metal brake band, greatly reducing the retarding effort of the brake.

To Install Atwater Kent System

Editor The Automobile:—I have a 1906 Mitchell. It never had a magneto on it, using dry cells only, but it does not give satisfaction. I have been thinking about installing an Atwater Kent system, but the timer shaft does not stand straight up and is close to the hood. Can you tell me how it can be arranged? Can it be driven by bevel gear from timer or can it be driven by gear or chain from crankshaft?

Bradley, N. J. **G. A. Morgan.**

—The Atwater Kent system could be installed on this car by arranging a bevel gear drive from the timer shaft. This would be a better method than by arranging a chain or chain drive direct from the crankshaft.

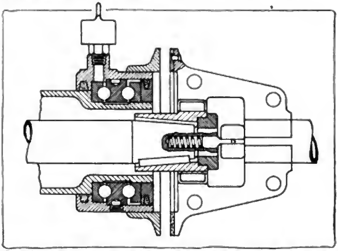


Fig. 4—Sectional view of coupling between clutch and gearset of Thomas model M

The Engineering Digest

Electric Bus, American in Details, for York, England

POSSIBILITIES for export of American-made omnibuses and also the chances for the electric storage battery type in cities of medium size are illustrated in the trial bus which has recently been supplied the city of York, England, by the Edison Accumulators, Ltd., the British concern representing the interests of the iron-nickel storage batteries. The bus holds only 22 passengers, all seated, and the driver collects the fares, and the vehicle is therefore frankly intended for leisurely traffic conditions and not for the crush of the metropolitan centers; but the market in this direction, here as well as in Europe, may be large in the aggregate as soon as it shall have been reasonably well established what type of vehicle is most suitable all the year round in the matter of service and low upkeep cost.

In the following are mentioned the design features which characterize the vehicle and some of the details which indicate the American origin.

The whole chassis without the batteries weighs 4,026 pounds and with body and batteries somewhat above 4 tons; the overall length is 17 feet 10 inches. The wheelbase is 11 feet 6 inches and the wheel gauge 5 feet 7 1/4 inches. The door where the passengers enter is on the near side close to the driver's seat, so that the reception of fares shall not retard the operation. All the battery cells used for propulsion are housed in compartments under the seats, as shown in dotted lines in the plan view of Fig. 1, and the load distribution effected by this arrangement should render it possible to lighten the construction. The battery comprises 64 Edison cells with 300 ampere-hours capacity, at 72 volts, for a five-hour discharge. One charge will drive the vehicle 40 to 45 miles at a speed from 10 to 12 miles per hour. The normal charging rate is 60 amperes for 7 hours, but short boosting charges between times will increase the mileage. The lighting is taken care of by an auxiliary battery kept under the driver's seat; it consists of 6 small cells connected to a switch which permits cutting out these cells when the main battery is boosted while keeping them in series parallel with the main battery for ordinary charging.

The frame of the chassis, shown in Fig. 2, is of rolled channel section reinforced along its central portion by an inner channel section liner filled with hard wood, making a strong and flexible box girder construction. The axles are low-carbon steel forgings. The front springs are under the frame, to give a large steering angle.

Rear springs are assisted by coil springs bolted to the frame over the rear axle, the coils making contact with a plate on the axle when the vehicle is half loaded, this permitting the vehicle to run with little bouncing when underloaded. The wheels are of hickory wood with solid rubber tires and run on one double and one single row of ball bearings totally enclosed in oiltight hubs. The transmission brake and the wheel brakes are both operated by pedals, leaving the driver's hands as free as possible. Power is transmitted from the motor, which is supported entirely in the frame, as shown in the illustration, to the differential countershaft by a tempered flat steel blade, which cushions the starts of the vehicle by its torsion, and also the stops if these are effected by the transmission brake. At the motor end this transmission shaft enters by means of a large square slip joint. Universal joints are dispensed with by this construction. The differential is mounted in Hyatt bearings with balls for the end thrust, while the drive shaft is carried in double rows of balls. The wheels are driven by sprocket chains from the countershaft.

The motor is of course designed for the peculiarities of the Edison battery, taking a normal current of 40/72 ampere-volts at a speed of 900 revolutions per minute. It has a large slotted commutator similar to the commutator on a railway motor and works with fixed brushes. A continuous torque drum controller, giving five forward and two reverse speeds, is placed under the small hood in front of the dash and is operated by a handle above and concentric with the steering wheel. Ampere-hour meter, safety switch and lighting switches are also under the hood, with the dial of the meter inset in the dash in constant view of the driver. It registers actual ampere-hours when the battery is on charge. —From *The Engineer*, March 19.

Valveless Pump with Tubular Piston for Liquid or Air

AMONG the considerable number of high speed pumps for various purposes which have been developed in recent years with a view to avoiding the power waste and upkeep trouble due to the close piston fits in reciprocating pumps, the May-Nelson construction, which is of American origin,

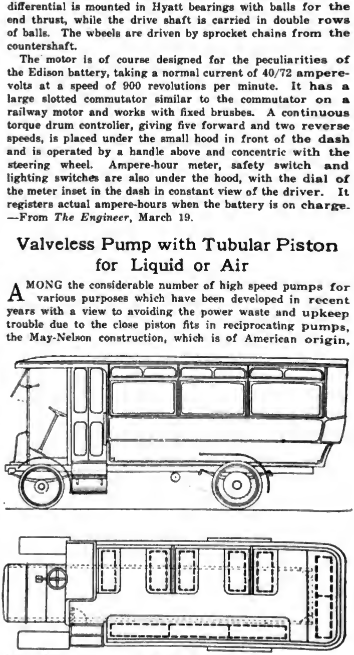


Fig. 1—Side view and plan of electric storage battery omnibus for medium size cities

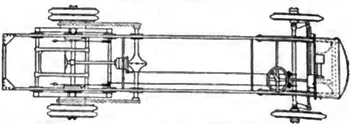


Fig. 2—Chassis of iron-nickel storage battery omnibus

presents some features which may bring it under consideration for automobile purposes, as either a water, oil or air storage pump. It differs from the true rotary pumps, which are also valveless, in that its piston does not participate in the rotary movement of the shaft of the eccentric by which it is actuated but is merely made to oscillate freely in all directions around its own axis. It is composed in the main of a tubular cylindrical body E, Fig. 3, in two pieces connected by a radial partition F, and of a hollow tubular piston G which is oscillated by two eccentric disks, not shown.

The bottom of cylinder E has two ports O and P, one on each side of the radial partition, which serve, according to the direction of rotation, as intake and delivery ports for the displaced fluid. The illustration shows four successive positions of the piston, 90 degrees of rotation apart, from which it is seen that the two spaces separating the exterior and interior piston walls from the exterior and interior tubes of the double cylinder are moved around in such manner as to create suction in the space to the left of the partition and pressure in that to the right.

It is stated that with a single cylinder a pressure of 45 pounds per square inch can be obtained, and when three cylinders are arranged in series and used as a condenser pump for air, either dry or humid, the atmospheric pressure can be reduced to one fiftieth of an inch.—From *Génie Civil*, March 13.

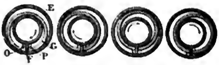


Fig. 3—New type of pump with oscillating tubular piston.

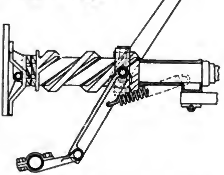


Fig. 4 — Motor-starting device for light cars, operated by reciprocating pedal, nut with roller thread and sleeve on driving-shaft.

Foot Pressure Motor Starter Device for Very Light Car

In a lengthy description of the Horstmann light car the starting device shown in Fig. 4 is mentioned as effective and convenient. Its practicability depends however on having the change-speed gear mounted upon the rear axle, and the cone clutch shaft and spring are also abbreviated to make room for it. It acts upon the flexible joint at the front end of the driving shaft by means of a ratchet tooth clutch of the same kind that is used with ordinary starting cranks. One part of this clutch is formed upon the front end of a quick-threaded sleeve which is free to revolve upon the driving shaft. The first movement of the pedal, by the reciprocation of which the starting is effected, engages the catch, and further pressure rotates the sleeve by means of a box with rollers arranged to take the place of a threaded nut of the same pitch as the sleeve thread. When pressure is taken off the pedal a coil spring returns it to the rear end of the sleeve and disengages the ratchet tooth grip. A rapid to-and-fro movement of the pedal will thus keep the motor shaft revolving as long as required for making the start.—From *Automobile Engineer*, March.

How War Affected Automobilism in Switzerland

All Private Traffic Stopped—Factories Rushed with Work

For six months after the beginning of the European clash the use of automobiles for private purposes was entirely prohibited in Switzerland. The country suddenly roused to take active steps to protect its armed neutrality depended for mobilization entirely upon the Swiss Volunteer Automobile Corps and the vehicles owned by citizens. These were all duly registered and it was a matter of only a few days to pick from the lists those suited for the military work, to requisition them and to have them delivered up to the authorities. The cars unsuited for the work might have been left in the possession of the owners if it had not been for a shortage of gasoline and tires in the country. It had been neglected to lay in supplies of these articles, and the government found it necessary to make sure of them for the army by forbidding everybody else to make use of them. Even in the army only the superior officers were allowed to use fuel for personal transportation, so long as the difficulties had not been met.

Very large orders for motor vehicles reached the Swiss factories, on the other hand, from Germany as well as from France, after home orders had entirely ceased. Night shifts were put to work, and one factory in the eastern end of the little country, close to Austria, is putting up new factory buildings to increase the production. On November 27 the government prohibited the export of automobile motors and of construction parts, but the export of complete vehicles was allowed under permits in each case, and many private owners shipped the vehicles abroad which had become useless to themselves. A peculiar effect was a boom in bicycles. All stocks in this article were soon sold to physicians and business persons who could no longer drive cars. Especially in Geneva, which was known as the Eureopean city having the largest number of automobiles per capita, the disappearance of the cars and the reappearance of the bicycle became noticeable in the street life.

Gasoline which was found on private hands was bought up for the army, but the prices paid were so low that no private initiative for getting the supplies renewed from abroad was encouraged, and only a total of 811 tons of gasoline reached the country in August, September and October, as compared with a normal importation of 5,000 tons during these months. In November larger quantities arrived and the trade in fuel was released, but the use of cars remained under severe restrictions for lack of tires. A Geneva importing firm offered to supply all the tires needed by the government, and meetings of protest against the continued prohibition were held in different parts of the country, but even these actions were without effect for a time, as the government had entered into a previous contract with a different tire-making concern whose large shipments were held up in Italy. Lubricating oil during all this time rose to very high figures, as new oil stores were detained in the port of Genoa for several months by the Italians.

Finally the difficulties were gradually overcome to such an extent that on February 1 the government allowed motor traffic again in all of Switzerland and also released the trade in tires subject to new restrictions that might be adopted at any time if found necessary for the defense of the country. Since then normal conditions have been re-established, with the number of motor vehicles in circulation greatly reduced, however.—From *Allgemeine Automobil-Zeitung*, March 20.

Distribution of Forces Between Cushioned and Uncushioned Components of Sharp Shocks

Discussion of
"The Improvement
of
Spring Systems"

By M. C. K.

WHETHER it is worth the while to take special constructive measures for protecting motor vehicles against the horizontal component in severe road shocks was the fundamental question which was raised and answered by the writer without any attempt at impossible precision but with a view to getting all the essentials in the subject before the reader's intuition so strongly and vividly as to rouse opinions. Fellowcraft and W. C. M. took up the constructive end of the subject, in approval of the general idea but somewhat in opposition to the writer's suggestions on the advisability of providing SEPARATE means for cushioning the horizontal element of shocks in the case of motor vehicles which are operated with tires giving little relief for this element. Finally Fellowcraft presented in the April 8 issue a demonstration to the effect that the ratio of the horizontal and vertical shock forces cannot be higher than 1 : 1.61 in the case under discussion, the inference being that both are best cushioned by the same spring.

M. C. K. must try to show that the ratio of forces, as figured by Fellowcraft, is not demonstrated in accordance with the complete set of conditions of the road shock, and that it would be less interesting for practical purposes, even if it were fully demonstrated, than approximate figures for the shock in terms of work. And with regard to the work figures F. has come to agree substantially with the estimates of M. C. K., though by following different (and on the whole better) methods.

First it should be kept in mind that the whole inquiry from the beginning was intended to result in conclusions of interest for the improvement of spring systems. The assumption of a perfectly rigid vehicle and equally rigid road obstacle was introduced to simplify reasoning and not to trap the reasoner into deductions which may be defended theoretically but become faulty in the degree as practical elements are admitted.

F.'s reasoning is most conveniently followed by turning to the issue of April 8, pages 630 to 632.

His diagram omits the curve BC, around A as a center, described by the wheel axle B, under the influence of the vehicle movement and the shock, and the diagram therefore represents only the geometrical relations existing at the instant when the shock begins.

He says: "Therefore the maximum possible mean value of A'H' = 122,000 pounds." He has previously figured the force by dividing the kinetic energy by the space. But the question is not of "a mean value." This term may be useful for an estimate, but it is misleading for a demonstration of exact figures, as the shocks depend upon the maximum forces. The omitted curve BC, re-inserted in Fig. 1 herewith, shows *per se* that the force of the shock is concentrated at and near B and dwindles rapidly toward C. If it is practically all concentrated upon 1-5 of the shock space, the maximum force value becomes 5 × 122,000 pounds. But it is really of no interest to determine, in this manner, the resistance which would exhaust the kinetic energy of the vehicle in a space of 10.53 inches or 1-5 of this space, as we know it will not be exhausted by the little shock in question. And F. recognizes this by having no other use for this irrelevant figure than for making it appear "evident," by comparison, that the figures of interest should "be determined by the component H'B—"; that is, that the figures for the horizontal shock should be determined from the figures for the vertical shock alone. And, as this is what he set out to prove, the so-called vicious circle is to that extent a factor in his argument, despite its apparent stringency.

This flaw does not happen to be vital, though, as his conclusion may be correct for other reasons, not given. But F. arrives at a value for R "the mean vertical force" by again assuming that there is question of mean forces. Again without regard to the movement represented by the curve BC, he figures a "mean vertical acceleration" from a space of 3 inches, getting a "mean vertical force," R = 12,676 pounds. Now, if the vertical force is practically spent during the first inch of the 3-inch rise, F.'s figures for a and R should be multiplied (by more than 3). Whatever the factor of multiplication, this would increase the figure for the horizontal force in the same ratio, according to F.'s geometrical contention, and his ratio would still hold, IF AND PROVIDED it could be assumed that the distribution of the horizontal force over the space of 10.53 inches followed the same time schedule as the distribution of the vertical force follows over the space of 3 inches. But there is no reason for this assumption. The shape of curve BC in fact excludes it, and curve BC represents the nature of the obstacle, which is of the kind that gives the sharp shocks and the most pronounced horizontal component of a shock. Fig. 2 shows, for example, graphically that 1-3 of the rise is finished before the vehicle axle has advanced more than about 1-8 of the distance from B to C and that 2-3 of the rise corresponds to about 1-3 of the horizontal space.

It is plain that the horizontal shock is much more nearly instantaneous than the vertical one, that it is condensed on a smaller proportion of its space, and that its maximum therefore is more severe than the geometrical relations in F.'s diagram would indicate. Perhaps the horizontal component decreases during the period of 0.01755 second as the lengths of the half-chords in Fig. 2 and the vertical component inversely as the ordinates of curve BC. At all events, F.'s demonstration is not a cogent demonstration for the relations arising during the progress of the shock. And the fundamental trouble with its pertinency is that the whole idea of a "mean vertical acceleration" is incongruous with the circum-

(*Continued on page* 729)

FIG. 1

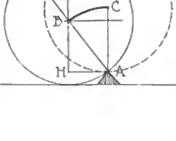


FIG. 2

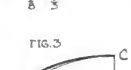
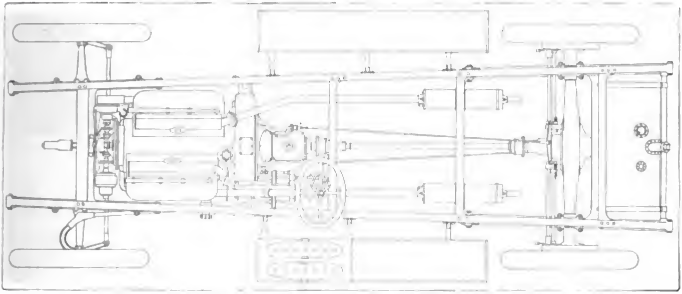


FIG. 3

Careful Detail on Standard Steel Cars

Big Railroad Suppliers' Cars Use Well-Known Units—Individuality Observed in Smaller Fittings—Good Bodywork a Feature



Plan view of chassis used in the eight-cylinder model of the Standard Steel Car Co.

STANDARD STEEL CAR automobiles, the existence of which was announced a few weeks ago, are to be made only in small quantities, for this year at least. Cars have been assembled and partially made at the company's works in Butler, Pa., for some time past, but it is only lately that they have been got into line for introduction on the market. Most noticeable at first glance, is the good bodywork with high finish and harmonious lines. Careful examination discloses no radical features but an excellence of detail that is unusual and there is a well-defined practicality about everything. The design is the work of men who have a great experience of the road and the repair shop, so it contains no fads whatever but plenty of those little inconspicuous things that make for satisfactory service.

Six and Eight Similar

There is not much difference between the six and the eight, beyond that in the motors which are both Herschell-Spillman types, the six being 4 by 5 1-2 inches and the eight 3 by 5 inches bore and stroke. These dimensions give capacities of 415 cubic inches and 282 cubic inches for the six and eight, respectively.

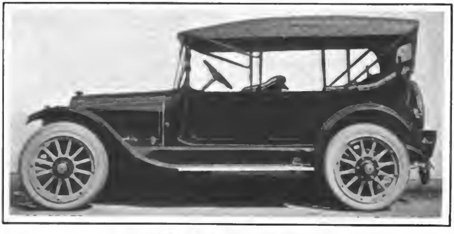
Thumb Nut Brake Adjustment

On the six the rear axle is a Weston-Mott with thumb nut adjustment for the service brake, but the eight has a Timken axle. Both clutch and gearset are products of the Warner Gear Co., the clutch being multiple-disk with Raybestos facing, the transmission being identical for either chassis. Behind the gearset, however, there is a difference, as the six has a torque tube with a wide armed fork anchored to swivels on the frame, while the eight has a simpler construction as shown in the drawings.

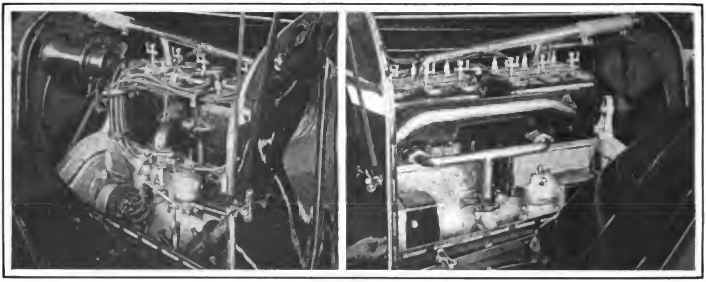
The plan view of the chassis shows the tapered form of frame used, and it is interesting to observe that the springs are mounted directly beneath the frame sills, so they also taper towards each other. The makers originally designed the frame to taper, but mounted the springs so that they lay parallel, but experiment showed that there was no disadvantage in allowing the front ends of the springs to be closer together—if anything it might add a little to the lateral stability of the car.

Starter Detail Simple

The electrical equipment is Westinghouse two unit, the combined generator and igniter being employed. The generator is located on the right side of the motor in the six, and the water pump is driven in tandem with it, the coupling attaching to the free end of the armature shaft. In the



Six-cylinder Standard Steel touring car

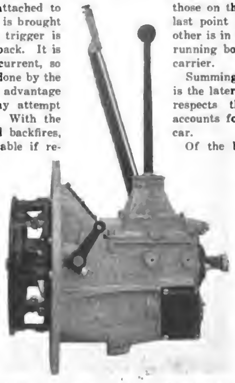


Views of Herschell-Spillman motor in Standard Steel six-cylinder, showing disposition of starter, generator and magneto

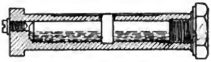
eight, the same sort of generator is situated in front of the motor.

The starting motor in both six and eight lies on the right side and meshes with the flywheel through the medium of a Bendix drive and there is an especially ingenious control for the starting operation. At the end of the ignition lever quadrant on the steering wheel there is a sort of trigger which prevents the spark lever from being brought right back to the limit of its possible travel. This trigger is bent over the end of the quadrant, and pressure with the thumb will lift it so that the spark lever arm can slip underneath and come to the extreme end of the quadrant.

At the foot of the steering column, attached to the lower spark lever, is a contact which is brought against another fixed contact, when the trigger is lifted and the spark lever brought right back. It is these contacts that control the starter current, so the switching in of the starting motor is done by the spark lever. This construction has the advantage that it renders absolutely impossible any attempt to start without retarding the ignition. With the Bendix drive, although it will withstand backfires, they impose a stress which is not desirable if repeated constantly as it might easily be by a poor driver. The idea of combining the starter switch with the spark lever is thus peculiarly happy since it gives a safeguard while adding to convenience.



Gearset and clutch. Note multiplying levers



Hollow spring shackle bolt

All Wiring Part of Chassis

The cowl board though it appears as part of the body, in the customary way, is really nothing of the sort, since it is mounted on brackets attached to the frame. The body merely drops over the cowl board and the two parts are joined together by a few screws which prevent any chance of rattle. This enables all the wiring to be done under the best possible conditions, out in the open where the whole length of each wire can be seen at once. There is no feeding through holes or screwing to terminals that themselves are out of sight. All wires are contained in copper pipes which are said to be better than flexible tubing, as they are absolutely and permanently waterproof. Since it also carries all other instruments, the cowl board completes the chassis and makes it a vehicle with everything save seats for the passengers. Any kind of body can be put on, and a body can be taken off, without interfering with ability to drive the car.

Points of Difference

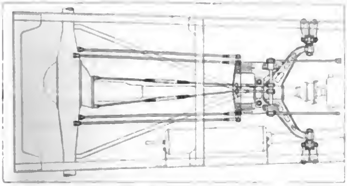
For gasoline feed the six has an air pump on the motor, and the eight uses the Stewart vacuum tank, but this completes the list of differences so far as the motors are concerned. Another difference is found in the spring suspension, since the eight has half-elliptic rear springs while those on the six are three-quarter pattern, and the last point in which one car does not resemble the other is in the spare tire mounting, the eight having running board location and the six a rear end tire carrier.

Summing up, it will be seen that the eight, which is the later model, is slightly more simple in several respects than the six chassis which doubtless accounts for the fact that the eight is the cheaper car.

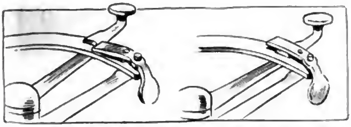
Of the bodies the keynote is comfort combined with smooth exterior; a streamline design without extremes, and the hoods merge nicely into the bodies. All the fittings are of good quality, good upholstery is used and the tops are double thickness Fabricoid that can be washed inside or out with soap and water.

A petty detail which shows how well the car is cared for in design is the spring bolt used in all the shackles. This is hollow and arranged to contain a fair quantity of oil, so that it is only necessary to fill it up every few weeks. The outstanding advantage of supplying oil to spring bushings from inside the bolt is that it is likely to distribute more evenly than is grease forced into the bushing in the ordinary way. Of course it is more expensive, but in this sort of way no expense has been spared in the Standard Steel cars.

Of the two cars, the six has the longer wheelbase, being 126 inches to the eight's 121, also the tires are 36 by 4 1-2 on the six and 35 by 4 1-2



Torque tube arrangement used for six-cylinder Standard Steel car



Details of trigger on spark quadrant which controls starting motor

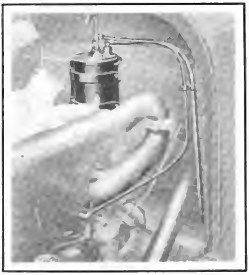
Cowl board with instruments is part of chassis. Note accelerator sector set in toeboard

on the eight. The makers intend the six to take larger and heavier bodies than will be supplied with the eight, though both have the same capacity—seven passengers—in the standard touring types. In the Pittsburgh showrooms there are some fine examples of costly inclosed bodywork on the six-cylinder chassis but so far none of these have been catalogued. The prices for open bodies, and with complete equipment as outlined above and including tire pump on motor, are $2,100 for the six and $1,735 for the eight.

Special Mounting for Vacuum Tank on Premier

INDIANAPOLIS, IND., April 17—In designing the new 6-50 model, the engineers of the Premier Motor Mfg. Co., have given close attention even to such details as the mounting of the dash tank of the Stewart vacuum gasoline system. A special niche is provided for this in the cowl board of the body as shown in the accompanying illustration and into this the tank is securely fastened by collar band of steel 3-32 by 7-8-inch which extend around half the service of the tank, the remainder being embedded in the groove in the cowl. The bands are fastened to the underside of the cowl by four machine screws.

The location of the tank behind the motor protects it from air currents while the heating of the gasoline in the tank due to its proximity to the cylinders insures easy vaporization, economy and thorough combustion of the fuel. The tank is mounted sufficiently high to insure ample gravity for the gasoline feed pipe.

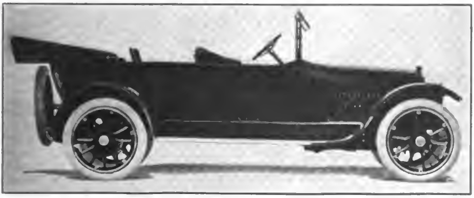


Mounting of Stewart vacuum fuel feed tank on Premier 6-50

New Seven-Passenger Chandler

CLEVELAND, O., April 17—The accompanying illustration shows the new seven-passenger touring car brought out by the Chandler Motor Car Co., to replace the former five-passenger type as announced in THE AUTOMOBILE for April 1. The new model, with a roadster built on the same chassis forms the company's line. With either body it sells for $1,295.

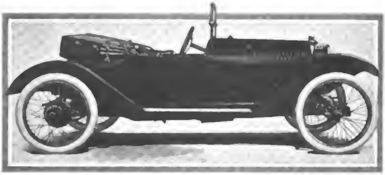
Apart from lengthening the wheelbase of the chassis from 120 to 122 inches, there is no chassis change from the former model. In the new body are two folding seats which when not in use fit snugly into recesses in the back of the front seat and are covered by flaps; when opened they are self-supporting and require no screws or other hand adjustments. There are no supports under them which gives maximum leg-room for the rear seat passengers.



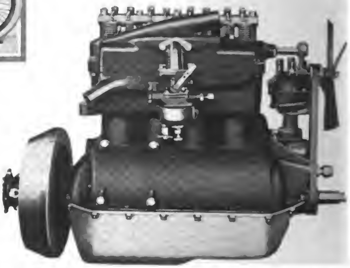
Left — New seven-passenger Chandler touring car at $1,295

Body Acts as Frame in New Cornelian

Two-Speed Gearbox with Only Three Gears and No Countershaft—Unusual Springing



New Model Cornelian roadster which with wire wheels sells for $410



Intake side of four-cylinder block motor used in new Cornelian, showing mounting of carbureter and Atwater Kent timer-distributer

MORE than passing interest attaches to the new model Cornelian car, which is in roadster form only, and of the lighter type. It is made by the Blood Brothers Machine Co., Allegan, Mich. This concern, which for a number of years has been identified with the automobile industry as a parts specialist, began the making of its distinctive roadster type some three years ago, and was located in Kalamazoo, Mich., until last year when the move to a well-equipped new plant at Allegan was made.

It will be remembered that the Cornelian car was first brought to the notice of the general public at the time when the cyclecar was at the height of its popularity. But while most of the cyclecars were of narrow tread type, the Bloods stuck tenaciously to the standard 56-inch tread width, which they retain in this latest model.

The Sterling four-cylinder motor of 2 7-8 by 4 inches delivers 13.4 horsepower by the S. A. E. formula. The clutch is a leather-faced cone; Atwater Kent ignition is used; a Holley carbureter furnishes the mixture. Other specifications take in a transverse spring system, floating rear axle, left drive, center control, wire wheels, 28 by 3 tires, shaft drive, and wheelbase of 100 inches.

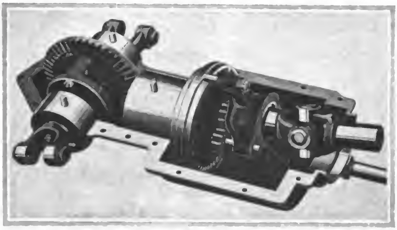
Peculiar Two-Speed Transmission

The most unusual features of the car are the transmission system, which affords two forward speeds and reverse with only three gears and without the use of a countershaft; the absence of a frame, with the body acting in that capacity as well as performing its carrying function; the suspension of the seat on half-elliptic springs independent of the body proper; and the transverse springs which take the place of the regulation form of axles, combining lightness and strength.

Referring to the illustrations, the unusual transmission system with its unique design will be made clear. While this principle has been used by the Bloods since the inception of the car, nevertheless, it is undoubtedly new to a great majority of the automobile public. The entire transmission system is in unit with the rear axle, and consists of a sliding and rocking member which is so mounted as to allow it to be swung from side to side and thus mesh the desired set of gears.

In the views shown, the sliding and rocking member is at A, and it will be seen that it is fitted with two gears, B and C. The control or shifting rod is at D, and driving connection is made through the annular gear E for low speed and reverse. For high speed, or direct drive, the gear B meshes with the small female clutch member F which is rigidly attached to the carrier of the large annular gear E, and thus drives directly the pinion connecting to the regular form of bevel differential ring gear. When driving direct, then, the gear B acts as the male member of what might be regarded as a dental clutch, and does not revolve free of the driving shaft G, but forms a solid drive from this shaft to the bevel pinion.

It will be noticed that the rocking arm A is rigidly attached to the shifter rod D, which is operated from a control lever at the driver's hand. To obtain first speed, the control lever is thrown so as to turn shaft D to the left, considering the observer to be facing forward. This swings arm A to the left also, after which it slides arm A back so that gear B meshes with the annular gear E, making a driving connection through the two gears to the rear axle. In the top of the arm there is an index

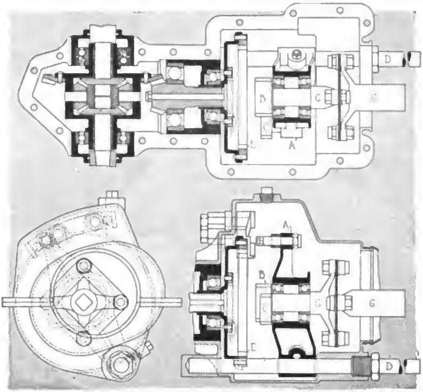


Two-speed gearset and differential. Gearbox has three gears for two forward speeds and reverse pin H which registers with guide holes in the top of the housing to make the sliding positive. That is, this pin properly positions the arm so that the meshing will be correct. When connected thus, gear C is idle.

Now suppose that high speed, or direct, is desired. The control lever first brings the arm A forward, thus unmeshing the gears. Then it is swung so that gear B is in line with the shaft. Pushed back now, the index pin positions it correctly that the dental clutch action may be obtained, gear B being wider than gear C so that B can slip into the female portion F without interference from gear C, which causes the whole mechanism to revolve together at the same speed.

To get reverse, the arm A is swung to the right, and when slid back gear C meshes with gear E, and the latter is thus turned in the opposite direction from shaft G, through this intermediary gear, the drive being through gear B, which is now clear of the annular gear, to gear C, and thence to gear E.

This change-speed system therefore really employs only three gears, whereas the conventional gearset for two forward speeds and reverse would require at least six gears. This is exclusive of the differential and bevel driving gears, which are the same in either the Cornelian or the conventional drive. There would also have to be a countershaft in the conventional set, the sliding and rocking arm feature of this unusual construction doing away with that also in the Cornelian. The shafts all run on New Departure bearings.



Upper—Horizontal section through the two-speed transmission used in the new model Cornelian. Lower left—End view through the system. Right—Vertical section

Axles Are Leaf Springs

The rear axle itself is of peculiar construction, making for extreme lightness. It is a floating form, and of a type used by De Dion. Just outside the differential housing, each axle shaft is fitted with a universal joint K, as shown in the illustration of the transmission system. Instead of being inclosed within an axle tube or housing, these axle shafts run open to the wheels. Long transverse springs form the axle proper, two below the axle shafts and one above. These form a platform which suspends the body. Thus the universal joints take care of any slight alteration of the relative position of wheels and differential due to action of the springs. The ends of the springs attach to the wheel hubs, and hold up body and driving system at their center.

Seat suspension in the new Cornelian is independent of the body, the seat being carried on long semi-elliptic springs

The front spring suspension is similar to the rear, the transverse springs taking the place of an axle and performing their spring function as well. However, only two springs, one above the other, are used in front instead of three, they attaching to the vertical wheel spindles at their ends.

While on the question of the springing, the novel seat suspension free of the main body should be mentioned. One of the illustrations brings this out. The seat at both bottom and back is suspended on two long half-elliptic springs, which act independently of the car springs to make an exceedingly comfortable riding proposition.

No Chassis Frame Used

Lightness is further promoted by the entire absence of a frame, the body itself performing that function and making the bridge between the two axles. It is constructed entirely of steel, ribbed and reinforced, and thus has strength enough to take the place of the conventional frame. This feature, together with the axle construction makes a low center of gravity, it is pointed out, and therefore reduces the unsprung weight to a minimum.

The motor is a standard Sterling type with overhead valves, and 18 horsepower is claimed for it. It is thermosyphon cooled, and cylinders are cast in a block. The upper half of the crankcase and the cylinders are in one piece, but the cylinder head, carrying the valves, rocker mechanism and spark plugs, is detachable. The constant level, circulating splash system of oiling is employed, whereby the oil is drawn up by a pump from the reservoir in the bottom of the crankcase and distributed to the individual splash troughs. The connecting-rod ends dip into these troughs and throw the lubricant to all the bearing surfaces.

The crankshaft is carried on two bearings, both of die cast babbitt, 3 inches long and 1 9-16-inch in diameter. Valves, of regular poppet design, have a total diameter of 1 1-4 inch, with a clear opening of 1 1-8 inch. The connecting-rods, 8 inches long, work with pistons having three rings each and the timing gears are helically cut.

At the price of $410, the Cornelian has two gas headlights, tail light, generator, tools, and so on. Electric lights and cranking are extra. The top and windshield are $25 extra.

Walker Motor Uses Cored Rotary Sleeve

Single Balanced Valve Worm Driven from Crankshaft

A ROTARY valve motor in which the valve mechanism has but four moving parts has been produced by W. N. Walker, Rome, N. Y. As will be noted from the accompanying drawing, the valve action is exceedingly simple, consisting of a tubular valve on one side of this motor, serving the purposes of both an exhaust and intake. The valve is driven by worm gearing from the crankshaft and is made in two parts to allow for expansion throughout its length. Each of the two parts is driven independently off opposite ends of the crankshaft.

Gas Distribution by Ports

Distribution of the gases is accomplished by ports in the rotary valve. The intake gases pass through a series of radial ports surrounding the middle section of the valve, admitting the mixture from the carbureter into the interior of the tubular valve, whence it is distributed to the various cylinders in the customary manner by means of radial slits opposite ports.

The valve is shown in detail in the accompanying illustration. As will be seen, it is a balanced construction, small ports leading directly through the valve disposed in suitable angular relation to one another to permit the cylinder pressure to be equalized on both sides of the valve, whenever the port is closed. This balances the pressure on the wall of the valve and prevents excessive friction due to an unequalized load.

The gases enter through the intake manifold at and pass directly into the central portion of the valve. The interior of the valve only takes care of the intake gases. The exterior portions, as shown in the accompanying illustration, are recessed at B to provide a passage for the exhaust gases. The timing of the motor is of course determined by the peripheral spacing of the intake and exhaust ports in the valve. The recesses for the exhaust conduct the exhaust gases to one or the other of two circular depressions placed midway between the first and the third and fourth and sixth cylinders respectively. These are shown at C and D.

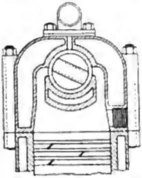
The passage of the gases is thus readily explained; entering from the intake manifold at A they are free to pass into the central portion of the valve and are then subject to the suction of the cylinders on the intake stroke. The valve slots are so arranged that they are open in accordance with the following timing. Intake opens at 10 degrees past upper center and closes 30 degrees past lower center. The exhaust opens 50 degrees before lower center and closes 5 degrees past upper center. The area of the port is 7-16 by 3 1-4 inches. On the experimental motor to which these dimensions and timing apply the cylinder dimensions were 3.5 by 4 and the number of cylinders, six. The valve rotates at one-quarter crankshaft speed.

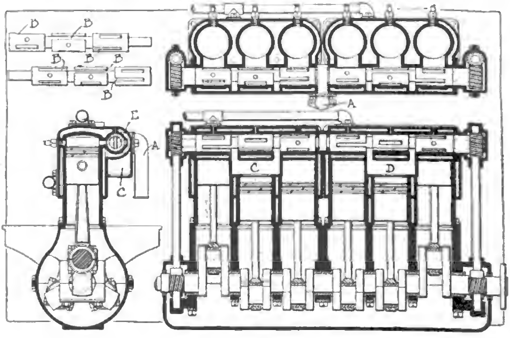
The valve timing is set from the end of the valve and when arranged for one cylinder is correct for all three, the valve being split at the center. The cooling of the valve is taken care of by waterjackets which completely surround the valve housing except at the port opening. This is shown in the accompanying cross-section at E. In addition, cooling is also effected by exposing the walls of the valve chamber to the cool incoming mixture, which, as it undergoes a certain amount of vaporization, absorbs heat, thereby reducing the surface temperature.

Valve Clearance .001 Inch

The clearance between the valve and its chamber is .001-inch and it is claimed that with this clearance and because the valve is balanced there is no difficulty in shearing the film of lubricating oil. It is additionally claimed that the very low temperature attained by the valve is evenly distributed through the entire valve section and therefore distortion will not result from unequal expansion.

The motor, as illustrated herewith, is only one of the forms in which it is possible to arrange the valve. If desired, it can be placed directly in the center of the combustion space as shown at L.





Left—One adaptation of the Walker valve with the sleeve in center of combustion space

Right — Walker balanced rotary valve on side of motor showing details of construction of the valve and the coring necessary in the cylinders for the water jacketing and manifolds. Note double-end drive for the valve from both ends of crankshaft

Distribution of Force Between the Components of Sharp Shocks

(*Continued from page 722*)

stances. We know that such an acceleration of 405.5 feet per second (per second) could not be reduced to nothing at C without any other force than gravitation to reduce it. There is therefore in reality question of a different and more irregular force. Perhaps it may help the intuitive comprehension to say that the collected shock force splits into its horizontal and vertical components according to a ratio that varies during the progress of the shock.

The best light on the points of practical interest is obtained, however, by letting down the theoretical bars a little and imagine that the wheel is not perfectly rigid but can yield and spring a little, as all wheels in practice do.

AT THE MOMENT OF IMPACT THE VEHICLE IS GOING FULL SPEED FORWARD AND CONTINUES TO DO SO, WHILE THE RISE OVER THE OBSTACLE MUST BE PRODUCED FROM REST. The rise cannot be instantaneous, as all the forces are finite. Its speed cannot at first be at all comparable to the forward speed of B. But this relative retardation immediately after the impact, as compared with the subsequent portions of the rise, is in conflict with the nature of curve BC, according to which the rise is relatively strongest at the beginning. And such a conflict can only mean that the force of the horizontal shock is made relatively stronger at that moment. If there is any yield in the wheel at all, the curve BC is buckled into the shape of B'C, Fig. 3, and the subsequent reaction throws the wheel slightly upward from the obstacle. Both the horizontal and the vertical shocks are then terminated in spaces of movement which are of about like extent, and the horizontal is determined by a mass and a velocity which are both higher than those determining the vertical shock.

"Is it fair," asks F., "to draw conclusions . . . in terms of work . . .?" M. C. K. thinks it is perfectly fair when there is question of work of considerable magnitude done in a small fraction of a second, and conditions are so complicated that the forces cannot be determined with accuracy because they depend upon exact knowledge of certain irregularities of movements, which perhaps could be eliminated in theory but in practice must alwayst be present.

M. C. K. does not pretend to have stated here, or to have stated before, exactly what MUST take place during a shock of the kind described, as this would require a strict demonstration, like that of Fellowcraft's but more elaborate and difficult and after all not conclusive for more than one condition. He did not feel that this was possible or profitable. And F.'s argument has settled this opinion, at first more vaguely entertained. An estimate in terms of work, on the other hand, supplies a frame within which the forces that determine the destructive effects may play differently according to the practical circumstances. In this sense the work values show what may take place. The forces may rise in pounds to the numerical magnitude of the foot-pounds in the work values, if the conditions cause the work to become condensed in an instant. And it is against these possibilities that springs are provided.

The majority of road shocks have but a small horizontal component—which, moreover, interferes little with comfort, being absorbed in the vehicle movement—and it must seem a doubtful expedient to interfere with the best action of the springs for the vertical component by combining them with springs which normally have little to do, if the combination is so intimate that they must always work together. Such a combination in practically a single spring—set for an average angle of import which must be too small for shocks with a large horizontal exponent and too large for the majority of shocks—must always be too hard for its normal work and too weak for the exceptional work for which it is mostly intended. M. C. K. therefore sticks to the belief that independently operating springs for the two shock components represent the construction problem to be solved for all motor vehicles operated with hard tires, while LARGE air tires may take care of the problem acceptably enough for the present, so far as the ordinary pleasure car is concerned.

European High-Efficiency Motors—Part II

(*Continued from page 711*)

of maximum lift and t the time during which the velocity increases from o to v_c, according to the known formula,

$$t \times j = v_c, \text{ or } j = v_c/t$$

The time t corresponds to the distance of A to B, or the angle $\beta = 22$ degrees of rotation of the cam, or

$$t = \frac{\beta}{\omega} = \frac{22}{12{,}000} = 0.00183 \text{ (see below).}$$

The maximum velocity of the lift is traced by the line C — C.

When the shaft revolves $\alpha = 38$ degrees, the cam lifts the valve e = 9.3 mm. The angular velocity per second of the cam is ω, or

$$\omega = 360 \times \frac{n}{60} = 360 \times \frac{2{,}000}{60} = 12{,}000 \text{ degrees per second.}$$

The velocity V_c becomes

$$V_c = \frac{\omega \times e}{\alpha} = \frac{12{,}000 \times 0.0093}{38} = 2.93 \text{ meters per second.}$$

We can also establish this value with the formula:

$$V_c = \sqrt{2 \times j \times S}$$

if we consider j constant; in reality this value is variable for the different points of the cam. If we take the values of the first of these formulæ, we obtain

$$j = \frac{C_e}{t} = \frac{2.93}{0.00183} = 1{,}600 \text{ m.p.s.}$$

The mass M_s and the acceleration j being determined, we can obtain according to the formula of the valve inertia

$$P_{is} = M_s \times j = 0.0119 \times 1{,}600 = 19 \text{ kilos (39 1-2 pounds).}$$

The effort of inertia P_{ip} of the pushrod becomes

$$P_{ip} = M_p \times j = \frac{Q_p}{g} \times j = \frac{0.55}{9.81} \times 1{,}600 = 8.95 \text{ kilos (19 1-2 pounds).}$$

The load P_s of the valve spring becomes

$$P_s = 1.4 \times P_{is} = 1.4 \times 19 = 27 \text{ kilos (59 1-2 pounds)}$$

and the load P_p of the pushrod spring

$$P_p = 1.4 \times P_{ip} = 1.4 \times 9 = 13 \text{ kilos (28 1-2 pounds).}$$

In order to facilitate the calculations we have used round figures in the preceding formulæ. The effort P on the cam at the moment of valve opening becomes:

$$P = P_s + P_p + P_{is} + P_{ip} = 27 + 13 + 19 + 9 = 68 \text{ kilos (150 pounds).}$$

An effort of 150 pounds is therefore necessary in order to open the valve. If the motor is one which need not necessarily be silent, we can dispense with the valve tappet spring; in this case all that is necessary is to increase the valve spring by the amount of the tappet spring. If we are dealing with an exhaust valve which opens against pressure in the cylinder, it is not necessary to take this pressure into account, for it is only 20 kilos, while the acceleration at this particular moment is a low value.

(*Continued on page 740*)

STEEL—Its Pathology—Part III

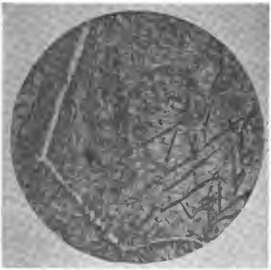
(*Continued from page* 708)

have the properties that it possessed at the time it was at the definite temperature at which it was quenched. In other words, it can be kept nearer the Austenite.

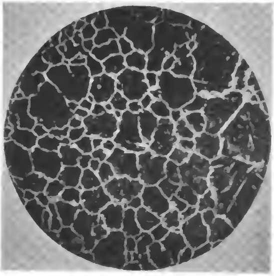
There are two prime factors by which the heat treating of steel can be controlled. First, by the temperature to which the material is raised; and second, by the rate of cooling. After these primary considerations there are four secondary ones: The original chemical and physical properties of the metal which should have been correctly chosen; second, the composition of the substances with which the metal comes in contact during its period of heating and cooling; third, the length of time consumed in raising the material to its temperature; and fourth, the length of time the material is soaked, or, in other words, allowed to remain at its highest temperature.

With the large number of materials that the metallurgist has at his disposal to start with, the wide range of temperatures to which he may raise the steel, and the wide range of possibility throughout all the other variables mentioned in the preceding paragraph, there is little wonder that the hundreds of thousands of permutations and combinations produce fields of research which annually bring forth new and improved results.

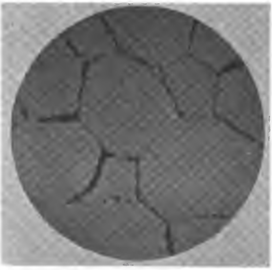
Forging can be taken for a good example. The bar of stock from which the forging was made may have had a fairly good structure, but if the shock of the falling die struck this bar of stock when at a temperature lower than the critical its structure would become distorted, some of the crystals broken down and others reformed. If the temperature of the bar, however, was above the critical point, and the steel in an Austenitic condition when the die struck it, the resulting steel will be a fairly uniform formation of Austenite crystals. Although the original structure will have been changed, the forged piece will still have the characteristic Austenite. Thus it is seen that not only in heat treating is temperature of the greatest importance, but also the steel must be worked at the proper temperature.



Typical specimen showing Cementite and Martensite magnified 250 diameters. Here the needle-like characteristics of the glass hard Martensite are visible. The Cementite is the solid background.—W. Campbell



Cementite and Pearlite magnified to 60 diameters. The Cementite is visible in its characteristic thin line and the Pearlite is shown in the black areas throughout the section.—W. Campbell



Austenite and Troostite magnified 50 diameters. This steel is in the transitory stage from the Austenite towards the Ferrite and Cementite.—W. Campbell

Steel Worked in Austenitic Stage

As a general rule steel should be worked when it is in the Austenitic stage. It is then sure to keep a uniform structure because the carbon is in solid solution with the iron and is therefore distributed uniformly throughout the metal. If it is worked below the critical point, the carbon has begun to stratify and form different combinations and carbides with the result that uniformity is not apt to result. Just as soon as the temperature begins to fall below the critical point the Austenite begins to break up into Ferrite and Cementite. If the carbon content of the steel is high, Cementite will result, and if it is low the greater part will be composed of Ferrite.

By working the steel well above the critical temperature the size of the Austenite crystals is kept small and although on cooling the Austenite crystals will not remain in that form if they are finely divided, the size of the grains of the final result will be much smaller and hence a more uniform structure will result. A final steel will be composed of Pearlite; Ferrite and Pearlite; or Cementite and Pearlite, according to the carbon content. The higher the carbon content the greater percentage of Cementite, and therefore the harder the steel. It can always be remembered that the cause of the great effect of carbon on steel is due to the fact that it only takes 1 per cent. of carbon to form 15 per cent. of Cementite—the hard, brittle constituent of the high carbon steel.

The ultimate object is to secure a fine, uniform grain and this can be secured by not re-heating the metal to too high a temperature and by thoroughly rolling it or working it at a temperature well above its critical point. If this is correctly done the micro-photograph will show a fine, evenly-distributed grain which, in the case of carbon steel, will be composed of Ferrite and Pearlite. The Ferrite is light gray and the Pearlite has a black, stratified appearance on the micro-photograph; the percentage of carbon will determine the relative quantities of Ferrite and Pearlite, i.e., the lower the carbon, the more Ferrite.

Steel Can Be Worked Cold

Steel can be worked cold, as in the case of cold-rolled steel, but afterwards it must be annealed in order to remove the internal strains which have resulted from the cold working. The annealing must be done above the critical point, i.e., at which the steel has been again raised to the Austenitic condition where the iron carbide is in solution, and on cooling a complete re-crystallization results. In annealing steel care must be taken that the exterior surface does not become oxidized, owing to the tendency of the metal to absorb oxygen while hot. When the surface becomes oxidized scale forms which peels off under slight stresses.

In annealing, if the temperature is too high the crystals of Austenite become large and on cooling a coarse-grain material will result. On the other hand, if the temperature is too low a complete reformation of the crystals and an elimination of internal strains will not be effected. On ordinary carbon steels the temperature of annealing is generally somewhere between 700 and 850 degrees Centigrade. The prescription that the doctor of steels has selected will effect the proper treatment and the annealing temperature will be less for one composition than for another.

Two results are desired from heat-treating: first, to bring the steel to its proper degree of hardness, and second, to bring the grain to a fine, even structure. As a general rule, the larger the percentage of Austenite that can be retained the harder will be the resulting metal and this is where the work of the alloys is important, because with ordinary carbon steel it is very difficult to retain very much of the Austenite after the steel has cooled to its ordinary temperatures. Martensite is an undesirable form often found in the carbon steel, being the next step below Austenite, and under the microscope it has a characteristic needle-like appearance. With the alloys such as nickel the Austenite is retained in the form of the grain which generally shows under the microscope as a polygonal structure which is of more or less fineness, depending on the result of the heat-treating. Martensite, while very hard, is very brittle, and when a steel consists entirely of Martensite, which would be the case with high-carbon, highly-hardened steel, it is practically useless. When such a steel is produced it must be re-heated at low temperatures and cooled quickly, but not suddenly, this process being known as tempering, and results in the furthering of the change from Austenite into Ferrite and Cementite. The final result will be either Troostite or Sorbite, and the lower along the scale the process is carried, the lower the hardness and brittleness and the higher the ductility.

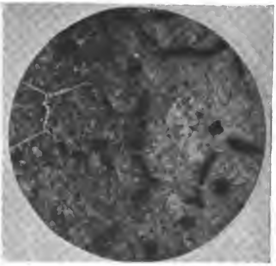
Alloy Steels Retain Hardness

The heat-treating of the alloy steels brings out the value of these alloys in allowing the metals to retain their hardness, and yet, when cooled, to have the normal fine-grained Pearlite and Austenite structures. These alloys such as nickel, manganese, chromium, vanadium and tungsten either form solid solutions with iron or form carbides which are valuable in producing the desired structural composition. Each of the alloys has a definite action which can be brought out under the influences of the heat-treatment.

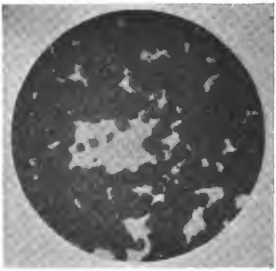
Nickel, probably the most useful of alloys for automobile work, is soluble in iron and has marked influences on the properties of a high-carbon steel. The higher the carbon the greater the effect of nickel. The 3.5 per cent. nickel steel most commonly used in automobile practice shows under the microscope a marked Pearlitic structure. This, as has been pointed out, is the result of the inter-stratifying of Ferrite and Cementite in the ratio of six parts of Ferrite to one of Cementite. The presence of the Cementite renders the steel hard, the presence of the Ferrite renders it ductile, and the combination is what generally results from the use of nickel in steel;—a hard metal with high elastic limit and great tensile strength. Higher percentages of nickel up to 15 per cent. produce Austenitic steels. Just between the Pearlitic and the Austenitic steels are the hard, brittle steels which are made up of Martensite. These are useless and care must be taken in the use of nickel not to strike the intermediate period between the Pearlite and the Austenite. The intermediate period is at about 7 per cent. nickel with a carbon content of .5 per cent. Here the Martensite exerts its properties and the result is a steel which probably would break if bent slightly and would have no elasticity whatever.

Manganese is the material which eliminates the ill-effects of sulphur to a large extent, resulting in the formation of a sulphide which does little harm to the structure. When manganese steel is slowly cooled the micro-photograph will show considerable carbide surrounding the typical grains of Martensite. If the steel is quenched suddenly at a temperature

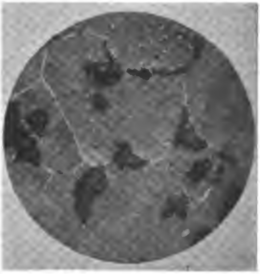
(*Continued on page* 740)



Troostite and Austenite magnified 50 diameters. The Austenite shows in the polygonal grains whereas the Troostite is in the lake-like formations throughout the section.—W. Campbell



Graphite and Cementite magnified 60 diameters. The black masses of graphite are readily perceived interwoven through the background of gray Cementite.—W. Campbell



An example where the temperature in treatment was carried too high. Here is shown a piece of steel which has been burned, thereby creating the weak areas which are visible in the micro-photograph.—W. Campbell

The AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, April 22, 1915 No. 16

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - - - - - - One Year, $3.00
Other Countries in Postal Union, including Canada - - - - One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Bad Brakes Spell Death

WHEN the first few automobile builders came along they had their hands full with the task of producing a motor that would keep running and a transmission which would hold together. When they had expended the whole of their energies upon these essentials almost anything sufficed for the remainder. Hence, no doubt, the crude, comfortless and weird-looking bodies of the early days. Amongst the things which were left to the last were brakes; the manufacturer had too much trouble in making his car go to evince any great anxiety about stopping it, and there was as little to go on in brake designing as in motor making. In a horse vehicle you have motor and brake in one, so that the crudest of contrivances, which can aid the retarding effort of the animal, for centuries sufficed to fill the bill. For very many years the brakes on railroad trains were crude and inefficient—it was easy to stop a train slowly but impossible to bring it to rest quickly in emergency, and this cost the lives of thousands of people. Even after the air brake had been invented it was all too long before it came into general use; railroad men in all parts of the world were accustomed to the inefficient brake systems they had and resented change.

Today, the average automobile is in the same state as the poorly equipped railroad train existing *after* the discovery of the air brake. Not that there has been any special form of brake invented which makes all the difference to the automobile as did the Westinghouse brake to the train, but rather because while a select few have improved their brakes to keep pace with improved motors, the majority have brakes no better than ten years ago.

Let it not be forgotten that bad brakes are death to somebody sooner or later. If the automobiles of today had brakes as good as their motors there would be many living who have ceased to do so even since the dawning of 1915.

City Accidents

STATISTICS are useful as forming bases for deductions that point to possible improvements in practice, and viewed in this light the recent figures on fatal accidents in the streets in New York City prove that control of the pedestrians is practically as important as control of the vehicles in the prevention of accidents. Of the sixty-two persons killed by vehicular traffic on the streets of the city during the first 3 months of the present year twelve were not killed at street intersections but midway of intersections; in other words, crossing the streets at points where they are not supposed to do so.

Accidents are going to continue on the streets of our large cities, but they can be reduced by careful regulation of vehicular traffic and equally careful regulation of pedestrian traffic. You cannot secure the minimum of accidents by legislating for the regulation of either one; you must legislate sanely for both, at the same time, and with the regulations equally enforced. Our sidewalks carry signs telling where automobiles can be parked, in other cities are signs stating where street cars and buses stop, yet in none of these cities can you find signs which tell the pedestrians where they must cross the streets as well as where they must not cross them. A few conspicuous sidewalk signs defining the duties of pedestrians would accomplish a great deal and do much to reduce accidents.

When we enter street cars we face signs of Safety First; when we go to railroad depots we see safety signs; in short, we meet them in many places, yet strange that we never meet them at dangerous street intersections. Safety largely depends on instilling the safety habit in our pedestrians as well as in those driving vehicles. A few signs will aid vastly in impressing on the pedestrians what their duties are when crossing streets. Better still, if our traffic officers require that pedestrians be required to obey traffic laws to the same extent that vehicles are required to do so.

OUR roads are dotted on every fine day with cars held up with tire troubles, the old story of tires neglected during winter and then spoiling the spring trips. Take the tires off, take the tubes out, clean tubes off, clean out the casings, add new chalk, graphite the rims, and you will find that many of the early spring troubles will disappear. If your car has stood on the tires all winter you will have more trouble, a trouble that cannot be remedied by these directions.

Ford Production May Reach 325,000

Company Produces 2,096 Cars in 1 Day—A Record—1,300 of These Made in Detroit Plant

DETROIT, MICH., April 19—*Special Telegram*—In 1 day, on March 17, the Ford Motor Co. made 2,096 cars. It is a production record never before attained by any automobile manufacturer in the whole world. It is the average annual production of a great many car makers.

This record output represents the total of the cars built in the main plant in Highland Park and in the twenty-two assembling plants now in operation throughout the country. Probably 1,300 to 1,400 of the cars were made in Detroit.

To make this achievement possible the Ford officials say that no special arrangements were made but that it resulted from the gradual increase of the number of working men and the continual perfecting of the general working system throughout the plants. There were from 16,000 to 17,000 men on the payroll in Highland Park on that day and about 7,000 in the assembling plant. In the latter they are working 8 hours a day but in the big plant they are working 24 hours a day, in three shifts, each shift working 8 hours.

This immense output of automobiles for 1 day does not seem so extraordinary to the Ford company, whose officials said that the very next day after that record was made the output was 2,026, and on April 11 it was 2,011. From now on it will be steadily increased and within a few weeks an output of 3,000 or more a day will be recorded.

If all of the 2,096 cars made March 17 had been runabouts the total value for the day's output would have been $922,240. It required seven trains of fifty freight cars each to carry away the record breaking production, or a trainload an hour. All of the cars were shipped in 1 day.

Only about 2 years ago, May 28, 1913, the Ford company achieved the then considered extraordinary feat of building 1,000 cars in 1 day. June 17, 1909, for the first time 100 cars were made in one day at the Highland Park plant.

The production of the Ford company for the 365 days of 1905 was 401 cars less than what was made on that single day, March 17.

Instead of a total production of 300,000 cars for its fiscal year ending August 1, the Ford company will make at least 325,000 cars.

3,000 Shipped from Canadian Plant

FORD, ONT., April 15—Three thousand cars were shipped during March from the Canadian plant. Three thousand six hundred is the goal for the factory to reach during April, while every possible means of increasing the output is being employed. A rate of 150 cars per day has been reached by the factory and even this may be beaten. The March 29 week marked the largest output in the history of the company, and on Saturday, eighty-one cars were made by noon.

Canadian Ford Raises Pay—Cuts Hours

FORD, ONT., April 21—*Special*—All employees who have been in the service of the Ford Motor Co., Ltd., 6 months or longer are to receive a minimum wage of 50 cents an hour, or $4 a day, working hours being reduced to 8 hours a day, or 48 hours a week, according to an announcement made here today by G. M. McGregor, general manager.

This means an increase of 15 to 60 per cent. in the wage scale of the 2,400 employees of the company in Canada and it is estimated that about $600,000 a year will be distributed among them in addition to present wages.

NEW YORK CITY, April 21—The Safety First Society of this city, as a result of the records of the board of coroners, has issued a report showing that during the first 3 months of the present year sixty persons were killed on the streets of the city by vehicular traffic, and that of this number forty-nine were killed at street intersections and twelve midway of the blocks or points of street intersection. There were twenty-one fatalities in January, seventeen in February and twenty-four in March.

An analysis shows forty-five killed by motor vehicles, including fire engines, motor buses, taxicabs, motor trucks and passenger cars. Six were killed by trolley, nine by horse vehicles, one by train and one by motorcycle. Further analysis shows that several deaths were due directly to the pedestrians who were not struck by the vehicles but walked into the rear wheels. There has been suggested the necessity of compelling guard rails along the side of vehicles to prevent people walking into the sides of vehicles, but general opinion is that pedestrians must be educated to look to the right or left when crossing a street. Several of the accidents were due to storms when umbrellas obscured the approaching vehicles.

BOSTON, MASS., April 17—Medical Examiner J. B. Magrath, whose district embraces a large part of Suffolk County, which includes more than half of Boston, gave a few statistics on accidents at an automobile meeting this week, and ended by advising a campaign of education for children and parents. He said that in 1914 of the accidents reported to him that ended fatally in which vehicles were concerned there were sixty-three, due to steam, electric and horse-drawn vehicles, and twenty-two due to motor cars and cycles, a percentage of about 75 per cent. for the former and 25 per cent. for the motor-driven. The figures were thirty-four steam, fourteen electric and fifteen horse-drawn. He said that laws and ordinances would not be effective against children because they could not be enforced, and so it would mean educating them through the schools. He said the people had not realized the great change in the use of thoroughfares in the past 10 years, and it was time that there was an awakening.

S. A. E. Chain and Miscellaneous Standards Divisions Meet in Detroit

DETROIT, MICH., April 20—*Special Telegram*—Preliminary to the meeting of the standards committee of the Society of Automobile Engineers, which opens here on April 22, two sub-committees or divisions were in session today. These were the chain division and the miscellaneous division. Of the ten members of the miscellaneous division all but three were on hand, the absentees being C. W. Spicer, Berne Nadall and E. R. Whitney. The entire six members of the newly-formed chain division were present.

Today's deliberations of the miscellaneous division dealt principally with the standardization of speedometer drive-shaft ends and of cotter pin sizes. This cotter pin standardization seeks to cut down the number of needed sizes from some 200 to about forty-five. A table has been prepared giving a list of the recommended cotter pin sizes and also showing their applications to S. A. E. rod ends and bolts and U. S. bolts. As to speedometer drive ends the object is to arrive at some standard fitting which any manufacturer can order and be assured that any type of speedometer will fit it. This will enable any maker of flexible tubing to have a standard to go by. The division is getting out measurements for submission to manufacturers for criticism. In both of these matters the reports to the standards committee will be of progress.

The chain division is new and it is really just getting under way, sounding out the opinions and views of chain makers of this and foreign countries. Its report will be essentially one of progress.

No standard was up for final adoption today, all those considered being merely tentative for later submission to not only the standards committee but to the society as a whole, and to the manufacturers.

Tomorrow, April 21, the international standards, research and springs divisions will meet.

Busby, Duplex Governor Engineer, Dies

NEW YORK CITY, April 15—Lloyd G. Busby, chief sales engineer for the Duplex Engine Governor Co., New York City, died in Lima, O., April 17, while traveling. Funeral services will be held at 163 East Sixty-first street, New York City, Monday afternoon, April 26. Busby, who was 26 years old, was taken ill with pneumonia while in pursuit of his duties.

Overland Daily Output to Be 600

Expect 100% Increase in 1916—Before June 1 Additions to the Factory Will Be Finished

TOLEDO, O., April 19—Six hundred Overland cars a day will be the output of the Toledo factory during its next fiscal year. This statement was made by John N. Willys, president of the Willys-Overland Co., while in the West, where he has been spending the winter.

"By June 1 we will have finished additions to the Overland factory which will make it possible for us to turn out 600 cars a day," says Mr. Willys. "This will be our daily output next year.

"At the present time we are building 300 cars a day. The increase in this year's business is 30 per cent. over that of last year, when we built 48,468 Overlands. I fully expect that 1916 will see a 100 per cent. increase.

"The Toledo plant of the company covers 99 acres of ground. Its capacity has been doubled in the last 2 years. The new additions now in the course of construction will contain 17 acres of floor space, making a total floor area of 79 acres. The company employs 12,000 men."

Dunham Leaves Chalmers—Hinckley Promoted

DETROIT, MICH., April 16—George W. Dunham, second vice-president and consulting engineer of the Chalmers Motor Co., has relinquished his active duties with that company to become a consulting engineer at large with offices in Detroit, wherein he will have an opportunity to act in an advising capacity for any automobile manufacturer. C. C. Hinckley, who has been a Chalmers designing engineer, becomes consulting engineer of the Chalmers company to succeed Mr. Dunham.

Mr. Dunham has had a varied automobile experience, starting with the American Carriage Co. In 1904 he became engineer for the Oldsmobile company which position he held until 1909 when he became associated with the Hudson Motor Car Co. In 1910 he formed the Chalmers connection which he has just given up. Mr. Dunham will make a specialty of high speed motor work, having studied this type of design for several years.

Mr. Hinckley was first connected with the Covert Motor Vehicle Co., Lockport, N. Y., in an engineering capacity, later going with the Olds Motor Works as assistant to Mr. Dunham. He later became chief engineer of the Oldsmobile concern when Mr. Dunham left it to go with the Hudson company. Mr. Hinckley came to the Chalmers company in 1912.

MADISON, WIS., April 15—Up to April 10, applications for automobile licenses in this state numbered 42,000, averaging about 1,000 a day. The record for a day is 1,700. Last year 53,161 licenses were issued. The annual increase has been about 55 per cent.

SAUK CITY, WIS., April 15—A. L. Aldrich, second vice-president of the Shaw Motor Co., this city, has been promoted to the first vice-presidency. The concern recently established permanent works at Sauk City, removing to that place from Chicago.

Madison Motors Co. Is Incorporated

INDIANAPOLIS, IND., April 17—The Madison Motors Co., with plants at Anderson, was incorporated on Thursday for $500,000, as announced in THE AUTOMOBILE for April 1. The principal stockholder is C. E. Gibson, former treasurer of the Gibson Automobile Co., this city, and part owner of the Empire Automobile Co. Associated with Gibson and named as directors are W. E. Moore and O. R. Ewing.

At present the company will concentrate its efforts on a six-cylinder car equipped with a Rutenber motor. The body of the new car is of the streamline type. The car has a 118-inch wheelbase and is equipped with Remy starting, lighting and ignition device.

A light four-cylinder car of substantial build and low-priced is now being finished and within a short time will be ready for the market. The six-cylinder will be produced first, however.

Pampell Heads Lyons-Atlas Co.

INDIANAPOLIS, IND., April 16—E. H. Pampell is the new president of the Lyons-Atlas Co., succeeding J. W. Lyons. Mr. Pampell represents interests of great importance in the Lyons-Atlas concern.

$500,000 Goodrich Factory Addition

AKRON, O., April 15—The B. F. Goodrich Co. will build an addition costing around $500,000, work on which will be started this summer. This will probably mean the employment of several hundred more men by the company which is now running at full capacity. Recently the company bought at public sale a strip of land adjoining the canal in the rear of the present factories. The factory will be built on this land.

New Head for Pullman Company

YORK, PA., April 20—Edward K. Fox, this city, was made the president of the Pullman Motor Car Co., at a reorganization meeting held in this city yesterday. Mr. Fox fills the vacancy caused through the resignation of Thomas C. O'Connor, New York, which occurred last fall. The new president, it is said, has purchased the controlling stock of Mr. O'Connor and R. N. Cook, also of New York City.

At a reorganization of the company last June, R. N. Cook was made vice-president and since that time he has acted in the capacity of president.

To Confer on S. A. Business Conditions

WASHINGTON, D. C., April 17—American manufacturers desirous of extending their trade in the Central and South American republics will be interested in the proceedings of the conference of ministers of finance and bankers of all the American countries, which opens here May 21. The purpose of the conference will be consideration of relationships, especially in the realm of business and finance, among the countries of the western hemisphere.

It is now assured, by reason of the high character of the personnel that will make up the gathering that the conference

Market Reports for the Week

NEW YORK CITY, April 21—The metal markets this week were more or less prominent as a result of the numerous price changes. Tin this week was lower, due to the arrival at Boston of three steamships with 1,650 tons, which will later come to this city. This metal went down to $46.00 per 100 pounds at a loss of $10.00. Copper was strong throughout the week and reached a new high mark in prices. Electrolytic copper closed at $0.17 1-4 and Lake at $0.18. Antimony this week was firm and at the closing on Tuesday went up 1 cent a pound. Beams and channels on Thursday rose 5 cents and remained at that rise throughout the week, closing at $1.31. No changes occurred in the oils and lubricants markets, which have been very steady during the past 3 weeks. Fine Up-River Para went up 1 cent on Tuesday. Trading continued light, manufacturers restricting their purchases as a rule to small parcels for prompt use.

Material	Wed.	Thurs.	Fri.	Sat.	Mon.	Tues.	Week's Changes
Antimony	.21½	.21½	.21½	.21½	.21½	.22½	+.01
Beams & Channels, 100 lbs.	1.26	1.31	1.31	1.31	1.31	1.31	+.05
Bessemer Steel, ton	18.00	19.00	19.00	19.00	19.00	19.00	+1.00
Copper, Elec., lb.	.16⅜	.16⅜	.16⅜	.16⅜	.17¼	.17¼	+.00⅞
Copper, Lake, lb.	.16½	.16¾	.17	.17	.18	.18	+.01½
Cottonseed Oil, bbl	6.54	6.40	6.40	6.48	6.60	6.65	+.11
Cyanide Potash, lb.	.21	.21	.21	.21	.19	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	41	41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	92	.92	.92	.92	.92	.92	......
Lead, 100 lbs.	4.17½	4.17½	4.17½	4.17½	4.17½	4.17½	......
Linseed Oil	.62	.62	.62	.62	62	.62	......
Open-Hearth Steel, ton	18.50	19.00	19.00	19.00	19.00	19.00	+.50
Petroleum, bbl., Kans., crude	.40	40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, refined	..	..	..	..	..	..	......
Rubber, Fine Up-River, Para	.60	60	60	.60	.60	.61	+.01
Silk, raw, Ital.	..	3.90		..	3.90	3.90	......
Silk, raw, Japan	..	3.52½		.	3.52½	3.50	—.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	56.00	54.00	52.00	50.00	50.00	46.00	—10.00
Tire Scrap	04¼	.04¼	.04¼	.04¼	.04¼	.04¼	......

will be one of the most practical and important ever held in which the agents of governments have come together. It is rumored that a highly ambitious plan contemplating the establishment of a great bank of the Americas would be presented to the conference, but if such a plan is in contemplation, government officials here are not prepared to admit it.

Thus far sixteen of the American nations have accepted the invitation of this government and it is understood that the balance will name embassies within a few days.

Norwalk Plant Sale on April 24

MARTINSBURG, W. VA., April 15—A public sale of the property of the Norwalk Motor Car Co., this city, will be made on April 24, according to an order issued by trustee in bankruptcy C. E. Martin. The property consists of a two-story brick building, the main factory, 40 by 100 feet in size; office furniture, machinery and tools; two Model E Norwalk cars and one model F, light six.

NEW YORK CITY, April 20—The Bankers' Trust Co., as trustees for the 10-year sinking fund gold bonds of the Locomobile Co. of America, is inviting proposals for the sale to it of bonds bearing coupons maturing subsequent to June 1 next at prices not to exceed 105 per cent. of the value of the bonds. Bids will be received up to May 26 at noon.

Dividends Declared

The following dividends have been declared:

Paige-Detroit Motor Car Co., Detroit, Mich., monthly increased from 4 to 7 per cent.

Lozier Motor Co., Detroit, Mich., 10 per cent. to creditors of old company. Sent out by Detroit Trust Co.

American Voiturette Co., Detroit, Mich., 10 per cent. to creditors.

U. S. Should Protect American Trademarks

WASHINGTON, D. C., April 17—More than ordinary interest attaches to an interview given out by Assistant Commissioner of Patents James T. Newton, in which he expressed the opinion that strong efforts should be made to bring about a change in the present situation which permits American trademarks to be registered in South American countries for the purpose of preventing American merchants from importing their goods into those countries. Involving the foreign relations of the United States, as the matter does, Commissioner of Patents Ewing said that whatever actual steps were taken would have to be taken through the State Department or through the Pan-American Union.

Unscrupulous Persons Profit

"There is no doubt that in a number of cases American merchants have been held up by unscrupulous persons in some of the South American countries, and also in some of the countries of Europe, who have registered the American trademarks in their own countries," said Assistant Commissioner Newton. "Under the American law the man who first uses a trademark is entitled to it and to registration of that trademark. In the South American countries and in Germany and some other countries of Europe the first person who registers a trademark with the officials of those countries is entitled to the trademark.

"You can readily see what an opportunity such a system offers to the unscrupulous. A person in a South American country, having registered the trademark of a well-known American brand, can absolutely prevent the importation of those goods into the South American country unless the American merchant is willing to come to terms with him, first paying him a round sum."

Automobile Securities Quotations

NEW YORK CITY, April 19—Automobile security prices received their first reversal today after an advance, more or less steady, which began in the last week of March. And furthermore, the decline came after a record-breaking trading day, when over 1,500,000 shares in all stocks were dealt in, thereby making a record for activity since September, 1911.

Gains were few and small while the drops were in some cases extraordinary; for instance, General Motors preferred with a decline of 20 points and the common with an 8 3-4-point loss, and the drops in the preferred stocks of a few of the tire issues which, heretofore, have shown unusual strength and activity.

There were a few gains made on stocks, however, which have up to this date been inactive, notably, the 6-point rise of Packard common and the 3-point gain of International Motors. The latter stock during the last few weeks has shown exceptional activity on account of large war orders, and the issue has correspondingly risen. Stewart-Warner rose this week to 68 at a gain of 10 points. Texas Oil rose 4 points. J. I. Case preferred was a little more active this week, closing at 78 with a gain of 3 points.

Security prices in the Detroit exchange experienced a sympathetic reversal. Though some of the stocks rose, the gains were smaller than usual while the declines, which heretofore have been few and small, were much larger, ranging from 1 to 6 points. No changes occurred in the inactive stocks.

	1914		1915		Week's
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	200	..	285	..	..
Ajax-Grieb Rubber Co. pfd	99	102	100	..	..
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	..	..	78	87	+3
Chalmers Motor Company com	80	82½	93	98	—1
Chalmers Motor Company pfd	89	91	92	94	..
Electric Storage Battery Co	49½	50	51¾	52½	+1¼
Firestone Tire & Rubber Co. com	284	290	455	460	..
Firestone Tire & Rubber Co. pfd	107½	109	110	112	..
General Motors Company com	81½	82	136	138	—8¾
General Motors Company pfd	92	92½	99	101	—20
B. F. Goodrich Company com	27	28	46	47	—5¼
B. F. Goodrich Company pfd	88	89½	101½	102½	—1
Goodyear Tire & Rubber Co. com	165	170	238	244	—2
Goodyear Tire & Rubber Co. pfd	95	96	104½	105½	+ ½
Gray & Davis Inc. pfd	90	97	..	..	..
International Motor Co. com	..	5	17½	19½	+3
International Motor Co. pfd	..	15	32	35	..
Kelly-Springfield Tire Co. com	..	..	134	135	—4
Kelly-Springfield Tire Co. 1st pfd	..	..	84	85	..
Kelly-Springfield Tire Co. 2d pfd	..	..	134	140	—3
Maxwell Motor Company com	8	8½	47	49	+1
Maxwell Motor Company 1st pfd	32	33	81	83	—3
Maxwell Motor Company 2nd pfd	12	12½	36½	38	—2½
Miller Rubber Company com	..	..	185	190	
Miller Rubber Company pfd		.	101	103	.
New Departure Mfg. Co. com	.	..	..	..	..
New Departure Mfg. Co. pfd	.	..		..	.
Packard Motor Car Co. com	103	..	86	..	+6
Packard Motor Car Co. pfd	94	98	93	.	—1
Peerless Motor Car Co. com	15	..	20	21	.
Peerless Motor Car Co. pfd	..	75	..	55	
Portage Rubber Co. com	..	25	34	36	.
Portage Rubber Co. pfd	..	75	85	95	
*Reo Motor Truck Company	7¾	8¼	14¼	15¼	+1⅛
*Reo Motor Car Company	19¾	20¼	33½	34½	+1
Splitdorf Electric Co. pfd	40	50	..	..	.
Stewart-Warner Speed. Corp. com	55	59	68	70	+10
Stewart-Warner Speed. Corp. pfd	99	101	103	105	+1
Studebaker Corporation com	32	33	63	65	—3½
Studebaker Corporation pfd	85	86½	99	101	— ½
Swinehart Tire & Rubber Co	60	65	90	95	
Texas Company	139	140	142	144	+4
U. S. Rubber Co. com	58	60	69	71	—3½
U. S. Rubber Co. pfd	101½	102	107	109	—1
Vacuum Oil Co	212	216	208	210	..
White Co. pfd	97	100	103	108	
Willys-Overland Co. com	64	66	125	128	—4½
Willys-Overland Co. pfd	89	94	100	101	— ½

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

Chalmers Motor Co. com	..	82	93½	94¼	+ ¾
Chalmers Motor Co. pfd	..	91	93	96	+1
Continental Motor Co. com	150	..	175	187½	+8½
Continental Motor Co. pfd	..	80	80	85½	+1½
General Motors Co. com	78½	80½	143	145	—1
General Motors Co. pfd	91	93	101	103	—4
Maxwell Motor Co. com	8⅛	8¾	51	52½	+5
Maxwell Motor Co. 1st pfd	32	34	82	84	—2
Maxwell Motor Co. 2d pfd	12	12¾	39	40½	— ½
Packard Motor Car Co. com	103	..	80	..	—6
Packard Motor Car Co. pfd	94	98	93½	..	— ½
*Reo Motor Car Co	20¼	21¼	32½	33¼	+ ½
*Reo Motor Truck Co	8½	9½	14¼	15¼	+1⅛
Studebaker Corporation com	..	..	65	67	—1½
Studebaker Corporation pfd	..	.	99	101	—2

INACTIVE STOCKS

*Atlas Drop Forge Co	..	21	..	26	..
Ford Motor Co. of Canada	..	560	600	..	.
Kelsey Wheel Co	195	..	190	200	
*W. K. Pruden Co	..	21	19¼	21	
Regal Motor Car Co. pfd	..	40	12	20	..

BONDS

General Motors, notes, 6s, 1915	101	102	..		.
Packard Motor Co. 5s, 1916	95	98½	..		..

---

*Par value $10: all others $100 par value.

Great Britain Again Our Largest Buyer

Purchases 4,913 Cars During Last 8 Months—During February Last 1,183 Cars Shipped There—Total Amounts to $5,372,788

WASHINGTON, D. C., April 16—Detailed figures showing the exports of automobiles and parts during various periods were made public today by the bureau of statistics. According to the official returns the United Kingdom still remains the best customer for American cars. During February last 1,183 cars of all kinds, valued at $1,688,313, were shipped there, as against 1,269 cars, valued at $1,017,594, exported in February a year ago. During the 8 months' period ended February, 4,913 cars, valued at $3,904,239, were exported in 1914, as against 4,631 cars, valued at $6,447,015, shipped to the United Kingdom in 1915. The big increase in the value of the exports is due to the large shipments of motor trucks made in the last few months.

France's imports of American cars during February last amounted to 412 cars, valued at $1,389,599, while in February a year ago the number was seventy-two and the value $49,011. During the 8 months' period the shipments of cars to that country rose from 536, valued at $410,814, in 1914, to 2,436, valued at $6,407,087, in 1915.

There were no shipments of cars to Germany in February last, while in February, 1914, the number was 108 and the value $79,600. The exports during the 8 months' period dropped from 590, valued at $413,144, in 1914, to sixteen, valued at $17,364, in 1915.

Italy's imports of American cars numbered sixteen, both in February last and the corresponding month of 1914, but the value decreased from $12,434 in February, 1914, to $11,390 in February last. During the 8 months' period the shipments decreased from 211, valued at $150,144, in 1914, to 42, valued at $35,112, in 1915.

Under the heading "Other European Countries" the exports amounted to 262 cars, valued at $193,736, in February,

Exports and Imports of Automobiles, Trucks, Parts and Tires for February and Preceding 8 Months

	February				8 months ending February			
	1914		1915		1914		1915	
EXPORTS	Number	Value	Number	Value	Number	Value	Number	Value
Automobiles:								
Commercial	57	$83,461	1,002	$3,022,482	493	$797,722	4,974	$14,011,924
Passenger	2,837	2,378,494	2,230	1,785,330	16,390	14,919,087	9,134	7,593,429
Total	2,894	$2,461,955	3,232	$4,807,812	16,883	$15,716,809	14,108	$21,605,353
Parts of (not including engines and tires)	.....	612,813	......	564,976	......	4,222,301	......	3,354,222
Total automobiles, and parts of	.....	$3,074,768	......	$5,372,788	......	$19,939,110	......	$24,959,575
BY COUNTRIES								
Cars, carriages, etc.: Automobiles:								
France	72	$49,011	412	$1,389,599	536	$410,814	2,436	$6,407,087
Germany	108	79,600	......	....	590	413,144	16	17,364
Italy	16	12,434	16	11,390	211	150,144	42	35,112
United Kingdom	1,269	1,017,594	1,183	1,688,313	4,913	3,904,239	4,631	6,447,015
Other Europe	262	193,736	131	406,368	1,151	906,827	832	2,100,646
Canada	292	361,895	349	345,733	2,055	2,940,057	1,727	2,236,426
Mexico	9	10,071	10	6,347	138	217,528	49	54,774
West Indies and Bermuda	38	35,854	183	98,630	372	348,599	651	439,642
South America	115	88,244	132	66,767	1,463	1,500,584	603	337,452
British Oceania	374	320,195	526	451,706	2,516	2,166,771	1,880	1,536,591
Asia and other Oceania	199	180,509	131	197,433	1,468	1,432,323	814	1,443,677
Other countries	149	112,812	159	145,526	1,475	1,325,779	427	349,567
Total	2,894	$2,461,955	3,232	$4,807,812	16,883	$15,716,809	14,108	$21,605,353
Tires for automobiles:								
Belgium	.....	....	......	....	......	$15,429	......	....
France	.....	....	......	....	......	....	......	$6,090
Germany	.....	$11,240	......	....	......	70,534	......	....
England	.....	55,355	......	$189,481	......	859,990	......	1,081,141
Canada	.....	48,767	......	56,326	......	508,485	......	414,392
Mexico	.....	5,691	......	4,161	......	93,953	......	65,017
Philippine Islands	.....	6,358	......	32,086	......	100,520	......	157,247
Other countries	.....	41,763	......	69,492	......	402,944	......	536,216
Total	.....	$169,174	......	$351,546	......	$2,051,855	......	$2,260,103
IMPORTS								
Automobiles	9	$20,575	8	$9,061	230	$529,359	227	$376,916
Parts of (except tires)	.. ..	42,018	......	29,958	......	397,802	......	566,913
Total automobiles, and parts of	... .	$62,593	......	$39,019	......	$927,161	......	$943,829
BY COUNTRIES								
Automobiles:								
France	4	$8,829	2	$4,158	103	$257,592	38	$91,011
Germany	.....	....	......	....	15	37,307	6	13,606
Italy	.....	....	......	....	39	58,666	90	94,920
United Kingdom	2	4,546	4	3,903	36	110,222	57	137,356
Other countries	3	7,200	2	1,000	37	65,572	36	40,023
Total	9	$20,575	8	$9,061	230	$529,359	227	$376,916
India rubber, crude:	Lbs.		Lbs.		Lbs.		Lbs.	
Belgium	1,097,669	$629,244	....	....	5,973,501	$3,556,693	1,902,370	$950,872
France	313,615	189,149	33,675	$17,067	1,677,818	680,131	612,889	257,033
Germany	853,934	427,900	....	....	4,332,184	2,199,235	732,118	358,098
Portugal	4,514	1,724	....	....	31,594	10,310	1,798,119	538,996
United Kingdom	4,098,605	2,413,875	10,581,465	5,345,432	28,280,917	19,038,286	35,849,563	18,329,034
Central American States and British Honduras	29,958	20,045	67,782	35,051	388,281	214,916	380,607	168,540
Mexico	21,114	14,139	43,455	19,225	449,514	235,737	1,284,872	487,407
Brazil	2,129,616	841,273	3,483,244	1,411,623	23,048,882	9,355,071	30,175,669	12,406,174
Other South America	20,132	5,985	343,127	173,039	894,498	470,064	2,465,507	1,095,371
East Indies	1,279,270	697,326	26,420	11,816	8,008,173	5,616,326	12,746,417	6,147,260
Other countries	195,471	111,145	898,485	580,484	1,255,089	713,407	2,524,529	1,546,102
Total	10,243,898	$5,349,805	15,477,653	$7,393,737	74,336,451	$41,490,176	90,481,060	$42,285,467

1914, and to 131 cars, valued at $406,368, in February last, while during the 8 months' period the figures were 1,151 cars, valued at $906,827, in 1914, and 832 cars, valued at $2,300,646, in 1915.

Three hundred and forty-nine cars were exported to Canada in February last, the value being $345,733, while in February a year ago the number was 292 and the value $361,895. During the 8 months' period the exports decreased from 2,055 cars, valued at $2,940,057, in 1914, to 1,727, valued at $2,236,426, in 1915.

War-ridden Mexico imported nine American cars in February, 1914, the value being $10,071, and ten cars in February last, the value of which was $6,347. During the 8 months' period the imports decreased from 133, valued at $217,528, in 1914, to forty-nine, valued at $54,774, in 1915.

Exports of cars to British Oceania showed a healthy increase during the month's period, the number increasing from 374, valued at $320,195, in February, 1914, to 526, valued at $451,706, in February last. However, during the 8 months' period the shipments declined from 2,516, valued at $2,166,771, in 1914, to 1,880, valued at $1,536,591, in 1915.

Buffalo, N. Y., April 17—It is expected that the United States Light & Heating Co. will emerge from receivership about the middle of May. Bankers who are interested in the affairs of the company are strongly recommending that holders of the old securities pay their assessment of $15 on the preferred stock and $2.50 on the common and take securities of the new company in accordance with the provisions of the plan for reorganization.

The bankers report that the earnings of the company at present are in excess of interest obligations on securities of the new company, and the outlook is said to be more favorable than for some time.

New York City, April 19—At a meeting of the Mayor's Central Committee on Street Traffic held at Police Headquarters, this city, today, action was taken which will bring about a conference between the committee and opposed interests on Wednesday, April 28. The meeting was in the nature of a public hearing and several speakers expressed opposition to an ordinance which they believed to be in contemplation limiting the length of vehicles using the streets to 24 feet 6 inches, the height to 12 feet 2 inches and the width to 7 feet 6 inches and the weight to 28,000 pounds.

Arguments were heard from representatives of the Motor Truck Club, Society of Automobile Engineers, the Traffic Committee of the Bronx Board of Trade, Automobile Trade Assn., Electric Vehicle Assn. of America, the Traffic Board of the Merchants Assn., a coal merchant, the Knox Motors Co., and the New York Van Owners' Assn.

The new Abbott-Detroit eight-cylinder model now being built by the Consolidated Car Co., Detroit, Mich., which took over the assets of the Abbott Motor Car Co. some time ago. As stated in a previous issue, the Abbott eight uses a Herschell-Spillman eight-cylinder, 3 by 5 V-type engine in which the two blocks of cylinders are offset from one another, allowing the connecting-rods to be placed side by side on the crankshaft. The chassis is practically the same as that formerly carrying the Model F name, which was a four-cylinder design. It has 121-inch wheelbase, floating rear axle, dry-disk clutch, left drive and center control, three-speed Warner gearset, Remy ignition, Zenith carbureter and Stewart vacuum fuel feed. A clean-cut streamline type of body is fitted, which does credit to the car. First shipments of this model are said to have been made last week.

Austin Injunction Modified

Cadillac Co. May Use, Repair and Resell Its Cars Having Two-Speed Axle—May Furnish Parts

CINCINNATI, O., April 16—Upon motion of the Cadillac Motor Car Co., Detroit, Mich., the United States Circuit court of appeals has modified the injunction which Walter S. Austin, of the Austin Automobile Co., Grand Rapids, Mich., obtained last year against the Detroit manufacturer in his suit for patent infringement covering the construction of two-speed axles.

The modified injunction permits the Cadillac company to use, repair and resell its cars having the two-speed axle, and to furnish parts or repairs for such cars, but does not allow the company to make or sell new cars with that type of axle.

It was also decided that the appeal of the Cadillac company against the decision rendered against it in this case by Judge C. W. Sessions, in Grand Rapids, Mich., in January, will be heard before the circuit court at the second week of the June session.

Cannot Fix Re-sale Prices

Detroit, Mich., April 15—Re-sale prices cannot be fixed, according to a decision filed here in favor of the Government in its suit against the Kellogg Toasted Corn Flakes Co.

The Government attacked the selling plan of the defendant company, stating that it fixed the price at which its product should be sold from the manufacturer to the jobber, from the jobber to the wholesaler, from the wholesaler to the retailer, and from the retailer to the consumer.

On the ground that it held a patent on the carton in which its product was packed and that this patent gave it the right to fix the price of its goods, the Kellogg company filed a motion to dismiss the Government's petition. This motion was denied in the United States circuit court of appeals.

Can Re-open Patent Cases

Washington, D. C., April 19—By dismissal last week for want of jurisdiction of the case of E. L. Chott against Thomas Ewing, commissioner of patents, the United States Supreme Court left in force a ruling of the Court of Appeals of the District which in effect recognizes the right of the commissioner to re-open a case and reverse it after decision by the board of examiners of the patent office.

The case arose out of the application of Chott for letters patent on alleged improved dental broach holders. After the board of examiners had reversed the decision of the preliminary examiner that the alleged improvement was old, Commissioner Ewing re-opened the case, made a personal examination, and upheld the primary examiner.

Nebraska Has New Automobile Law

Lincoln, Neb., April 17—Sweeping changes in the automobile license and registration laws are made in a bill passed recently by the senate and signed by the governor this week.

Automobile registration is placed under the state board of irrigation and public highways. The registration fees are to be paid to the county treasurer of the county in which the car owner or dealer resides.

Motorcycles are assessed $2 annually, automobiles operated for private purposes, $3 annually, and machines in commercial use, or offered for public hire, are charged $5 per annum. Every dealer in motor vehicles is required to pay a tax of $5 for each class of machine in which he deals.

Of the amounts paid, $1.50 of each $2 license, $2 of each $3 license, and $4 of each $5 fee is retained by the county treasurer and applied to the road fund, to be used for road dragging, etc. The balance is to be turned over to the state highway board for the state road fund.

Albany, N. Y., April 20—The Senate last night passed the Spring bill, abolishing the Labor Department and the Workmen's Compensation Commission and substituting an Industrial Board of five members to take over the functions of both. It is said the measure will save the state $227,000 annually. The bill now goes to the Assembly for concurrence.

Working on Sheepshead Bay Track

200 Men Clearing Ground—Wood Track Foundation Will Be Started May 1—Width 70 Ft.

NEW YORK CITY, April 21—Work started on April 17 on the new Sheepshead Bay 2-mile motor speedway in this city, and already over 200 men are taking down the various buildings and getting the ground cleared away. It is expected that the foundation of the track will be started by May 1 and the contract with the builder of the tracks and grandstands specifies August 20 as the date when these must be completed. As yet no date has been selected for the opening race. The track is to be of wood construction, and will be 70 feet wide on the straightaways and approximately 76 feet on the curves. The wood used is long leaf, yellow pine in 2 by 4-inch pieces laid on edge and running circumferentially or in the same direction as the line of travel of the cars when racing. These planks vary in length, namely 12, 14, 16, 18 and 20 feet, so as to give lap-jointing everywhere. The planks are soaked in creosote and the track will have a dark brown appearance. The banking is such that at the curves the outer edge is 25 feet 6 inches above the ground, the claim being made that the banking will permit of a higher speed than Brooklands track. A cross section of the track on the curves follows a parabolic curve, this being the same scheme as employed on Brooklands.

On the straightaways of either side, which are practically 1-2-mile long each, the track is supported on transverse concrete walls 6 feet apart and on the curves it is supported by steel frame work.

Safety precautions are being looked after in every respect. There will be a 30-inch wall of 8-inch concrete around the entire outside of the track and a similar wall at the inside. Between these cement walls and the spectators wide safety zones are arranged for. The grandstand will have accommodations for 30,000 and will be of steel with a double deck, and located directly opposite the repair pits. Diametrically across on the back stretch will be the bleacher grandstand with a capacity of 25,000. Special facilities are arranged so that there will be no delay in motorists entering or leaving the track.

22 Entries to Date for Indianapolis

INDIANAPOLIS, IND., April 17—The recent entries of three Peugeots to be driven by Resta, Burman and probably Duray, has brought the list for the Indianapolis 500-mile race on May 29, up to twenty-two.

The Peugeots this year will represent two entirely different classes of motor construction. Resta's car is one of the trio that competed in the last French Grand Prix. Measuring 274 cubic inches, of the long-stroke type, it is said to be very speedy. The other two are smaller cars, like the one Duray drove last year. The list of entries to date follows:

CAR	DRIVER	ENTRANT
Stutz	Wilcox	Stutz Co.
Stutz	Anderson	Stutz Co.
Stutz	Cooper	Stutz Co.
Bugatti	Oldfield	George Fuller
Delage	De Palma	W. E. Wilson
Porter-Knight	Hughes	F. R. Porter
Porter-Knight	Whalen	F. R. Porter
Porter-Knight	Keene	F. R. Porter
Cornelian	Chevrolet	Blood Bros. Machine Co
Sunbeam	Chassagne	Sunbeam Co.
Sunbeam	Porporato	Sunbeam Co.
Duesenberg	O'Donnell	Duesenberg Co.
Duesenberg	Alley	Duesenberg Co.
Maxwell	Rickenbacher	Maxwell Co.
Maxwell	Carlson	Maxwell Co.
Mercedes	De Palma	E. C. Patterson
Not named	Bergdoll	Erwin Bergdoll
Not named	Not named	Erwin Bergdoll
Not named	Not named	Erwin Bergdoll
Peugeot	Resta	Peugeot Co.
Peugeot	Burman	Peugeot Co.
Peugeot	Duray	Peugeot Co.

Overland Wins Oklahoma City Race

OKLAHOMA CITY, OKLA., April 20—*Special Telegram*—The curtain raiser of the 3-days' road race meet being held here this week by the Southwest Auto Racing Assn. on the 2.409-mile course was won by an Overland which negotiated the 99 miles in 2 hours 2 minutes and 3 1-2 seconds, a speed of a little over 49 1-2 miles an hour. This was over a bad course with soft dirt and deep holes. The curves were particularly rough with the asphalt straightaways fairly smooth. Today's attendance was about 10,000.

On Saturday a 200-mile road race for a purse of $5,000 with a $1,000 bonus for the world's record car, will be run over the same course. The entries include Oldfield, Carlson, Disbrow, Hearne, Burman and Cooper.

The summary:

99-MILE OKLAHOMA ROAD RACE—$1,000 PURSE

Car	Driver	Time
Overland	Claude Foster	2-2-3 1-2
Hupmobile	R. W. Thomas	2-2-34
Studebaker	C. S. Shaffstall	2-5-5
Buick	C. B. Chandler	Time not taken

Wheeler to Head Twin City Speedway Co.

ST. PAUL, MINN., April 17—F. W. Wheeler of Indianapolis, is scheduled to be elected president of the Twin City Motor Speedway Co. He will take a 25 per cent. interest in the company, which will soon begin work on a site comprising 360 acres located on the city limit line, 1-2-mile south of Minnehaha Falls, adjacent to the soldiers' home, at a cost of $1,000,000.

Makers Show Little Interest in Exposition

SAN FRANCISCO, CAL., April 13—Not a few automobilists are expressing disappointment at the exhibit of automobiles in the Panama-Pacific International Exposition here. Although there is a goodly representation of leading makers with plenty of space for exhibits, the exhibit is not by any means completely representative of the industry, and while some makers have too much space others have not enough. There is no effort at uniformity in the general scheme of decoration and apparently some makers are trying to dominate the exhibit by the expenditure of a few extra hundreds of dollars. The impression is that at least twice as many exhibits could have been arranged in the same amount of space with better results.

Ford has a complete display, including an assembly plant which shows a few of the major operations in the assembly of this car, such as mounting the motor, body, adding the radiator and hood, and starting the motor by the same method as used in the factory. There are some thirty men at work in his exhibit and often fifty to seventy-five spectators quite interested in the operation.

The present exhibit cannot be looked upon as an active sales exhibit, such as an annual automobile show. Some of the factory exhibits have men in attendance and in several cases two or more makes are grouped together under the name of the local agent. Little or no trade literature is being distributed and there does not seem to be much demand for it. After wandering through the different buildings the visitor is almost forced to conclude that the automobile exhibit is not getting its share of the people, but this may be due to the season being somewhat early so far as the show is concerned.

At one of the exhibits it was stated that two cars had been sold, but at many others no sales were made and little effort was being made to make sales or get the name of prospects. From what you could judge from a casual observation, it would seem that many of the local dealers simply view the exposition as a dead exhibit.

Among those exhibiting are Ford, Overland, Buick, Studebaker, Maxwell, Hupmobile, Cadillac, Jeffery, White, Mitchell, Hudson, Packard, Interstate, Westcott, Kissel, Oakland, Briscoe, Saxon, Moline, Oldsmobile, Pierce truck, Federal truck Sterling truck, Menominee truck and one or two motorcycle manufacturers. The exhibit of automobiles seems practically complete with the exception of Buick, whose space is still empty.

Milwaukee's Progressive Show a Success

MILWAUKEE, WIS., April 19—Something new in the way of automobile shows was introduced here on Saturday and Sunday, April 17 and 18, under the name of "Progressive Automobile Show" by the Milwaukee Automobile Dealers, Inc., the new trade organization supplanting the Milwaukee Automobile Dealers' Assn., existing since 1910. The show was a decided success.

The progressive show idea consists of private exhibits of cars and chassis in the individual showrooms, as distinguished from the annual show held in the Auditorium in January of each year. Each of the thirty-two members of the association had an exhibition of the latest models and stripped and cut-out chassis such as usually are furnished for winter show purposes.

Nearly 100 demonstrating cars, bedecked with signs reading: "Progressive Auto Show—Get In" were used to transport show visitors from one place to another. After an individual or a group had inspected the models in one showroom, he or they were asked if they wanted to look at other displays and then invited to take a free ride to whichever salesroom they desired to go. The next dealer repeated the process.

All field men and salesmen were called in by the respective houses to wait on the trade during the 2 days. Scores of sub-agents and independent dealers from all parts of the state attended.

Fifty different factories were represented in the show by the thirty-one Milwaukee dealers comprising the association. Many lesser agents not members of the association made special displays, but did not have the benefit and advantage of the transportation system supplied by the organization and had to be content with as many prospects as free will afforded them.

Developments in the Jitney Bus Field

Tennessee Defines Jitneys as Common Carriers

MEMPHIS, TENN., April 15—The Legislature has passed a bill for the regulation of jitneys. The measure defines them as common carriers and prohibits their operation in any city or incorporated town without permit or license from the municipal authorities. It requires the furnishing of a bond, in a sum to be fixed by the municipality but in no case to be less than $5,000 for each car operated, to insure the payment of any damage that may occur. It empowers the municipalities to fix the terms of operation, prescribe the routes and impose a tax for the exercise of the privilege granted.

R. I. Jitney Liability Plan Is Adopted

PROVIDENCE, R. I., April 17—The Rhode Island Jitney Bus Owners' Assn. held a meeting last week and adopted by-laws which touched directly on the liability of the jitney in case of negligence on the part of the driver.

The substance of the by-laws is that any settlement or judgment levied upon any member of the association is to be borne by the entire association by a pro rata assessment.

LOS ANGELES, CAL., April 14—Representatives of the Los Angeles Auto Bus Owners and Operators Assn. filed with the City Clerk their initiative ordinance petition yesterday. Officers of the association claim that there are 13,333 names on the petition and that they are sure of the 5 per cent. qualified names necessary to place the ordinance before the people at the next general municipal election.

The Jitney Bus Assn.'s ordinance provides for no indemnity bond or insurance and it reduces the license tax from $60 to $12 per year.

All jitney buses must be equipped with non-skid tires on the rear wheels and when such tires are worn smooth and when the surface of the street is wet, the rear wheels must be equipped with tire chains. These provisions, however, are not to become effective until 90 days after the ordinance is passed.

Houston Jitney Ordinance Declared Void

HOUSTON, TEX., April 15—The jitney ordinance recently passed by the city of Houston was held to be unconstitutional and void by Judge William Masterson. The provision requiring a bond of $10,000 formed an important element in the case. It was understood that the city would be willing to withdraw this feature and amend the ordinance accordingly.

PAWTUCKET, R. I., April 16—As a result of the introduction of the jitney service in Pawtucket, the trolley company has cut its service. Lack of patronage is the reason given by the officials.

Quaker Jitneys Make $10 a Day

PHILADELPHIA, PA., April 17—In the short space of a few weeks the jitney bus has grown from nothing to an established trade in which hundreds of persons are engaged earning from $5 to $10 daily, has cut into the earnings of the Philadelphia Rapid Transit Co. to an alarming extent and has had the effect of making the general public more or less indifferent regarding the outcome of the Broad street subway project, a rapid transit program that was uppermost in the public mind until the advent of the jitney. Every day sees additional cars put on the streets, until now all count has been lost and their numbers can only be estimated. These estimates vary from 400 to 650 and the little buses are multiplying with remarkable rapidity.

Figures gleaned from inquiry among half a dozen operators of jitneys ranging from the smallest car to the largest as to operating cost cover a wide range and are mostly based upon estimates, few of the drivers having the time or the inclination to keep accurate accounts.

One operator of a 5-passenger bus claimed daily average receipts of $8, with operating expenses of $2.50, allowing for gasoline and oil consumption and depreciation. This does not, however, take into account any outlay for new tires.

Another operator of a larger car computes his expenses as only averaging $2.25 a day, whereas his receipts are as high as $15 some days.

A third averages $10 in receipts and $4 in expenses, while a fourth, having a shorter route to cover claims receipts as high as $13.35 and expenses about $3.80.

N. Y. to Curb Jitney Buses

ALBANY, N. Y., April 21—By a vote of 81 to 42 the Assembly today passed the Thompson bill, placing jitney buses under the supervision of the Public Service Commission. In its original form the Thompson bill excluded New York City. The bill was later amended to cover New York City, too. Under its provisions jitney bus companies, before beginning operation, must secure not only the consent of the Board of Estimate, but also a certificate of convenience and necessity from the Public Service Commission. The bill passed the Senate last week by a vote of 27 to 18. The bill now goes to the Governor.

Jitney Service Suspended in Spokane

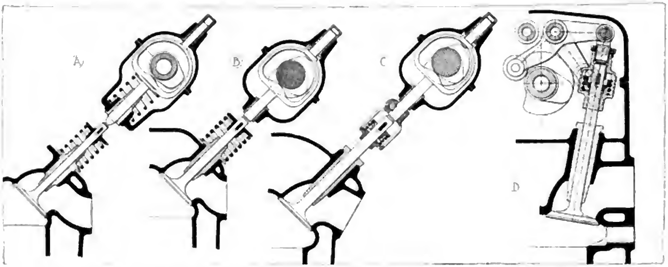
SPOKANE, WASH., April 15—Cheap automobile service was suspended yesterday by order of the police department. All 5-cent fare automobile drivers and a number of other owners of rented machines were forced by the police to suspend operation until they complied with the state law calling for a $2,500 bond and a state license. Until the drivers of the machine have secured permits under the new city ordinance they will not be permitted to operate in Spokane.

As the taxicab drivers have obtained a temporary injunction to prevent the enforcement of the bonding clauses of the law against them the taxicab companies have not been molested as yet. The legislation seems to be directed against the jitney operators.

3-Cent Jitney in Atlantic City

ATLANTIC CITY, April 15—Several Jitney buses appeared on the streets of this city displaying 3-cent signs. This is taken as a criterion that already a rate war is on among the rivals in this field. Another addition is a cyclecar, capable of carrying two passengers with the driver. A pay-as-you-enter line is scheduled to make its appearance on May 1.

RICHMOND, VA., April 19—Judge Crump, of the Law and Equity Court, ruled today that the courts have no right to interfere with the operation of jitney buses. This was a defeat for the traction company, which had sought an injunction against the jitneys.



Figs. 14A, B, C and D—Various methods of valve operation, showing means for positively lifting the valve and returning it to its seat

European High-Efficiency Motors—Part II

(Continued from page 729)

The valves of high speed motors must be made of special steels. These organs have not only to withstand excessive vibration but also the high temperature of the exhaust gases. It is therefore necessary to have steels capable of resisting very high temperatures, which may be as high as 572 degrees F., and of withstanding a pressure of 114,000 pounds per square inch. Steel makers have given this problem their close attention and have produced high nickel steels capable of fulfilling all requirements. Although, as the result of modern progress, it has been possible to reduce the weight of valves very considerably, perfection has been sought in another direction. However, carefully valve springs are made, they never have a very long life, as can be readily perceived when it is remembered that the set of valve springs absorb and give about 4 horsepower on a 130-horsepower Grand Prix motor. With the finest possible steel valve springs which have to withstand 2,000 vibrations a minute cannot possibly have a long, useful life. Sooner or later, the metal shows signs of fatigue, and in consequence the timing is modified and the valve no longer closes correctly.

On this account it has been sought to abolish the valve springs in motors capable of 4,000 r.p.m., and by means of a light spring having but three-tenth millimeters stroke, ensure the closing of the valve and its gas-tightness. Fig. 14A shows a valve operation for a motor having either two or four valves placed in the head of the combustion chamber. The valves and the pushrods are each operated by a separate spring; it will be noted that the valve is relatively light in order that the spring may be capable of assuring its return. In Fig. 14B the valve is returned by a spring and the pushrod by a second cam placed by the side of the main cam. The pushrod spring has of course become useless and has been abolished.

Fig. 14C shows the positive valve control which constitutes the greatest perfection of the present time. The valve and the pushrod are mechanically operated. A stirrup-shaped member is keyed to the pushrod and with an intermediary spring it assures the return of the valve. The spring only serves to maintain the valve in contact with the valve seat; it is therefore possible, in the case of twin valves, to operate them by means of a double cam and a single stirrup.

Fig. 14D shows a design with a single camshaft and two series of valves, one on each side of the motor. Twin intake or exhaust valves can have the same double cam, and the connecting organ between the operating lever and the cam can be made in any appropriate manner. It is to be noted that in the designs Fig. 14C and Fig. 14D the valves are relatively heavy and are in consequence free from the possibility of breakage.

It may be asked why detachable valve seatings are not employed, as is the case in other motors. The reason is that it is absolutely necessary to cool the valve seats—the intake as well as the exhaust. The pocket and the ribs of a separate valve cage offer such a resistance to the passage of the gases as seriously to interfere with the correct working of the motor.

(To be continued)

Steel—Its Pathology—Part III

(Continued from page 731)

of 1,050 degrees Centigrade, plain Austenite with its characteristic polygonal grains will be produced.

Vanadium Forms a Double Carbide

Vanadium forms a double carbide with carbon and iron and this forms one of the independent portions of the mixture when the amount of vanadium in the steel is in excess of 7 per cent. When the vanadium present is less than this the Pearlitic structure is secured and a much stronger resulting mixture is obtained. The separation of the brittle double carbide in forming an independent mixture tends to increase the brittleness of the resulting alloy. Hence it is found that in pure vanadium steels more than .5 per cent. is rare. It is kept below the double carbide danger.

Tungsten is another alloy which forms a double carbide and hence must be used below the percentage at which the brittle double carbide separates itself from the other materials in the mixture. The structure of the tungsten steel is Pearlitic until the percentage of tungsten reaches a higher percentage than 10, at which time the double carbide separates. There is no intermediate or Martensitic stage with this alloy. The effect of the tungsten is to increase the tensile strength and hardness without increasing the brittleness until the double carbide separates itself.

Some of the alloy steels are self-hardening; Mushet steel, which is a tungsten alloy having a percentage of 8.3 tungsten and 1.73 manganese, is an example of this. Other steels, however, have to be quenched in certain cooling agents in order that they reach their proper characteristics. Some of the cooling agents commonly used are mercury, diluted sulphuric acid, salammoniac, salt, carbonate of lime, various kinds of oils, tallow, wax and even sweet milk. Some alloys require a double quenching, being heated to one temperature and plunged into one cooling agency and then heated to another and plunged into a different cooling agency.

Steels should be brought back to their proper structure after every operation which is apt to disturb them, by annealing. In order to prevent oxidization of the surface of the steel the piece to be annealed is usually packed in a cast-iron box with some charcoal, charred bone, fire clay or some other ingredient which precludes the possibility of oxygen reaching the surface. Slow cooling after annealing generally gives the best results. The Society of Automobile Engineers specifies a number of heat treatments, some of which are herewith appended.

Examples of S. A. E. Heat Treatments

Heat Treatment A

After forging or machining:
1. Carbonize at a temperature between 1600° F. and 1750° F. (1650°-1700° F. desired.)
2. Cool slowly or quench.
3. Reheat to 1450°-1500° F. and quench.

Heat Treatment B

After forging or machining.
1. Carbonize at a temperature between 1600° F. and 1750° F. (1650°-1700° F. desired.)
2. Cool slowly in the carbonizing mixture
3. Reheat to 1500°-1550° F.
4. Quench.
5. Reheat to 1400°-1450° F.
6. Quench.
7. Draw in hot oil at a temperature which may vary from 300° to 450° F., depending upon the degree of hardness desired.

Heat Treatment H

After forging or machining:
1. Heat to 1500°-1550° F.
2. Quench.
3. Reheat to 600°-1200° F. and cool slowly.

Heat Treatment K

After forging or machining
1. Heat to 1500°-1550° F.
2. Quench.
3. Reheat to 1300°-1400° F.
4. Quench.
5. Reheat to 600°-1200° F. and cool slowly.

Heat Treatment L

After forging or machining
1. Carbonize at a temperature between 1600° F. and 1750° F. (1650°-1700° F. desired.)
2. Cool slowly in the carbonizing mixture.
3. Reheat to 1400°-1500° F.
4. Quench.
5. Reheat to 1300°-1400° F.
6. Quench.
7. Reheat to 250°-500° F. and cool slowly.

Heat Treatment M

After forging or machining:
1. Heat to 1450°-1500° F.
2. Quench.
3. Reheat to a temperature between 500° F and 1250° F. and cool slowly.

Heat Treatment P

After forging or machining
1. Heat to 1450°-1500° F.
2. Quench.
3. Reheat to 1375°-1425° F.
4. Quench.
5. Reheat to a temperature between 500° F. and 1250° F. and cool slowly.

Heat Treatment Q

After forging.
1. Heat to 1475°-1525° F. (Hold at this temperature one-half hour, to insure thorough heating.)
2. Cool slowly.
3. Reheat to 1450°-1500° F.
4. Quench.
5. Reheat to 250°-550° F. and cool slowly.

Heat Treatment S

After forging or machining:
1. Carbonize at a temperature between 1600° F. and 1750° F. (1650°-1700° F. desired.)
2. Cool slowly in the carbonizing mixture.
3. Reheat to 1600°-1700° F.
4. Quench.
5. Reheat to 1475°-1550° F.
6. Quench.
7. Reheat to 250°-550° F. and cool slowly.

New Inter-State roadster which sells for $1,000, completely equipped

Inter-State Adds Roadster

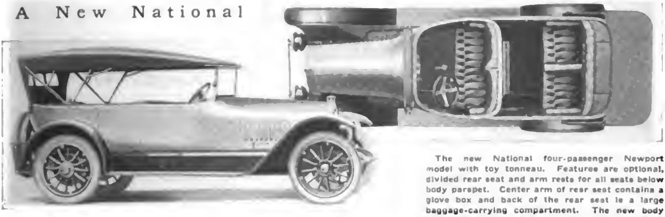
MUNCIE, IND., April 16—The Inter-State Motor Co., Muncie, Ind., announces it has added a roadster model which, like the touring car, will sell for $1,000, completely equipped. This new model is built on the same standard chassis as the touring car, the block motor being of the overhead valve type and having 3 1-2 by 5-inch cylinders with a removable head. Among the special features are exceptional leg room and a commodious compartment at the rear which provides storage for two tires mounted on rims. Access to this compartment is through a door which lets down and forms parts of the body when locked. Another unusual feature is a baggage compartment behind the seat and large enough for the contents of a small steamer trunk. Access to this compartment is through a door on top of the back of the seat which may be opened with the top either up or down. The body itself is of the streamline type mounted on a wheelbase of 110 inches.

1½-Ton Garford Is Worm Driven

LIMA, O., April 15—First details of the second size Garford truck which is being produced by the Garford Motor Truck Co. have been made public. The vehicle is of conventional appearance, is rated at 1 1-2 tons capacity and is worm driven; the chassis lists at $1,800. Right drive is standard, though left drive with center control is optional. The motor has four L-head block cylinders 3 3-4 by 5 1-2 and drives through a multiple-disk clutch, three-speed gearset and full-floating axle. Ignition is by high-tension magneto and a Rayfield carbureter is used. Solid tires, either demountable or pressed on, are used, 36 by 3 1-2 front and 36 by 5 rear. The equipment includes odometer, curved steel dash, two oil lamps set flush in dash, oil tail lamp, driver's seat with cushions and separate folding back, and the usual set of tools. Electric lighting and starting are extra.

RACINE, WIS., April 15—The J. I. Case T. M. Co., Racine, Wis., has perfected a new type of three-wheeled farm tractor designed especially for use on marshy and swampy land. Fifty of the new machines are now coming through and a large production is planned during the remainder of the year. The design is somewhat unusual in that one wheel is set off to one side while the other two follow each other in tandem form.

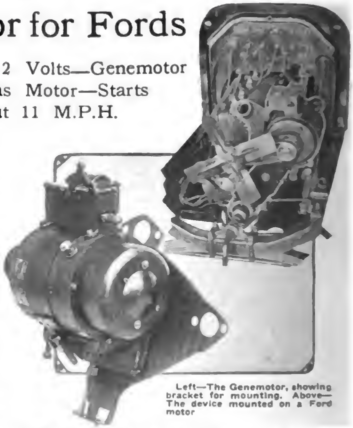
A New National



The new National four-passenger Newport model with toy tonneau. Features are optional, divided rear seat and arm rests for all seats below body parapet. Center arm of rear seat contains a glove box and back of the rear seat is a large baggage-carrying compartment. The new body is mounted on the six chassis and sells for $2,375

G. E. Motor-Generator for Fords

Single Electrical Unit Wound for 12 Volts—Genemotor Develops 45-Foot-Pounds Torque as Motor—Starts Charging as Generator at About 11 M.P.H.



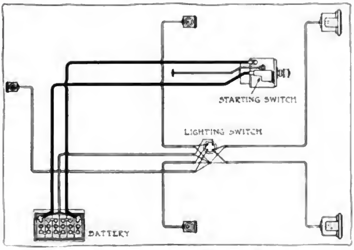
Left—The Genemotor, showing bracket for mounting. Above—The device mounted on a Ford motor

THE starting and lighting system outfit placed on the market by the General Electric Co. for Ford cars, and known as the Genemotor, shows a very successful use of the motor-generator system. The principal mechanism consists of the single electrical unit wound for 12 volts which operates as a generator or motor as the case may be and the necessary accessories for attaching this to the Ford car and operating it. The battery used in connection with the outfit is a six-cell 42-ampere hour unit manufactured by the United States Light & Heating Co., especially for use with this system.

Is Readily Attached

The Genemotor is cylindrical and fully inclosed, about 10 inches long overall, 7 inches in diameter and weighs about 52 pounds. It is supported rigidly on the right-hand side of a Ford engine, viewed from the front, by a pressed steel bracket secured at three points. This bracket can be attached without drilling or tapping any holes. The base of the bracket rests on the lower flange of the engine frame and is fastened to it by the bolts holding the crankcase up to the body of the engine. The front upper support is formed by a portion of the bracket that is clamped between the cylinder head casting and the nozzle through which the water circulating around the engine cylinders passes to the radiator. The third point of support is effected by clamping a portion of the bracket between the main cylinder casting and the nozzle through which the cooling water passes from the radiator around the cylinders. The Genemotor itself, being circular, is carried on a malleable iron support riveted to the bracket. The position of the Genemotor on this support is determined by suitable adjusting screws, and it is rigidly clamped in position by means of a steel band provided with a suitable tension screw. This method of mounting permits adjustment of the Genemotor both for alignment of the sprocket gears and tension of the driving chain. The installation is fully covered and protected by the engine hood when the latter is closed.

As a motor, the Genemotor will develop a torque of about 45-foot pounds, and the torque developed at the engine shaft by means of the selected gear ratio has been found amply adequate to start a Ford motor under very severe conditions of tight adjustment and cold water. The storage battery is carried on the right running board of the car, and is employed to accumulate current while the car is in motion for supplying the starting and lighting system when the car is at rest



Wiring diagram of Genemotor installation on Ford motor

Acting as a Generator

When the car has attained a speed of about 11 miles per hour, the Genemotor, acting as a generator, develops an electromotive force sufficiently high to overcome the normal voltage of the battery and permit charging to take place. At this point, the reverse current relay operates, closing the circuit between the generator and battery, and charging begins at a low rate, the current gradually increasing as the speed of the car increases to a maximum of slightly over 10 amperes.

A suitable, twenty-six-tooth, steel sprocket is mounted on the engine shaft at the point where the crank is ordinarily applied. A thirteen-tooth steel pinion, mounted on the motor shaft, drives this sprocket and thus the engine through a silent chain of special design. The Genemotor is running either idle, as a motor, or as a generator, at all times while the engine is in motion, and thus all clutches can be eliminated. The fan is driven by a belt from the Genemotor shaft pulley, mounted outside of the sprocket, to a split pulley provided for clamping onto the standard fan pulley.

The main switch and reverse current relay are mounted in an inclosed metallic case on top of the Genemotor and are readily accessible. The switch, which controls the motor, is closed through a cam actuated by a pushrod extending through the dashboard of the car and terminating in a knob conveniently located near the steering wheel column. The contacts are of the multiple leaf pattern and the switch is provided with a mechanism that assures a quick break on opening. The reverse current relay prevents current feeding back to the generator when the latter is operating at low speed or when the engine is not running. The wiring system is metallic throughout, no ground return being used.

With complete equipment, exclusive of lamps, the Genemotor retails to the user at $75 and the system can be readily installed by anyone with a fair degree of mechanical knowledge, or at any garage at reasonable cost. It is distributed by A. J. Picard & Co., New York City.

Factory Miscellany

WASHINGTON Assembling Plant for Ford—An assembling plant is to be built by the Ford Motor Co., in Washington, D. C., this summer. It will probably be a four-story structure, 100 by 400 feet, and similar in general design to the several assembling plants recently completed in other large cities for the Ford company. With the plant in Washington, the Ford company will have twenty-five distributed in eighteen different states. It is also reported that assembling plants are to be started this year in the states of Kansas and Iowa. In fact, it is said to be the plan of the company to have eventually one or several assembling plants in every state of the Union and also in those foreign countries where the growth of the Ford business will warrant it. Construction work will be started within a few days upon the plant to be located in Buffalo, N. Y. This will be a four-story structure somewhat irregular in shape, with a maximum length and width of 100 and 400 feet.

To Mfr. Automobiles—P. A. Seeker, Marine City, Mich., has purchased land at London, Ont., for an automobile factory to cost $65,000.

Carr Rubber to Add—The F. S. Carr Rubber Co., Superior street, Tilbury, Ont., will build an addition to its factory. Plans are being prepared.

Locomobile to Add—The Locomobile Co. of America, Bridgeport, Conn., has plans for erecting a four-story manufacturing addition on its Seaside park property.

Siro Carburetor Plant Damaged—Fire April 4 damaged the plant of the Siro Carburetor Mfg. Co., Pleasant street, Northampton, Mass. The loss was $5000.

To Mfr. Tire Pressure Gauge—J. F. McDonald, Nevada, Ia., contemplates constructing a factory for the manufacture of a device for gauging the pressure on automobile tires.

Elyria Tire to Build—The Elyria Tire & Rubber Co., Elyria, O., will shortly begin the erection of a brick, steel and concrete plant, 80 by 106 ft., for the manufacture of hard rubber tires for automobile trucks.

Preparing for Cuyahoga Addition—A large force of men has been placed at work clearing up the recently acquired land at Main and Broad streets, Cuyahoga Falls, O., preparatory to erecting a factory building by the Falls Rubber Co.

Fisk to Add—The Fisk Rubber Co., Chicopee Falls, Mass., will build an addition of brick and steel construction, 50 by 30 feet, and six stories high, to connect the buildings of the plant. It will be completed in about 6 weeks. The company will probably make further additions.

Fire at Premier Plant—The trainer shed of the Premier Motor Mfg. Co., Indianapolis, Ind., was destroyed on April 9. The origin of the fire is unknown. The loss, estimated at $6,300, is fully covered by insurance. The building containing valuable patterns of the company was threatened for a time, but was saved through the efforts of the fire department.

Parts Co. Makes Improvements—The Werra Aluminum Co., Waukesha, Wis., aluminum castings, is making changes and improvements in its foundry and machine shop to gain additional room made necessary by the tremendous rush of business. The plant has been on a day and night schedule for some time. Its trade for the most part is for automobile and engine parts.

Touraine Co. Adds Two Plants—The Touraine Co., southwest corner of Broad and Huntingdon streets, Philadelphia, Pa., manufacturer of the Vim light delivery car, has added two factories to their equipment, one at Twentieth street and Montgomery avenue, that city, which will be used as production headquarters, and the other at North Wales, Pa., where in the future all bodies for the Vim will be built.

Falls Machine Busy—The Falls Machine Co., Sheboygan Falls, Wis., is working two 10-hour shifts, the greatest capacity ever reached by the plant, on large orders for motor car engines. The direct cause of the unusually heavy operations is an order for 6,000 6-cylinder engines for the Grant Motor Co., Findlay, O. More than 200 skilled operatives are now at work, compared with about eighty-five at the beginning of the year.

Racine Co. Mfg. Bolster Springs—The Harvey Spring & Forging Co., Racine, Wis., a large manufacturer of springs and forgings for motor and automobile manufacturers in the middle west, has started a large production of a new type of bolster spring for heavy duty vehicles which is the outgrowth of experimentation in its automobile spring business. The spring is being made in a simple form for application to vehicle already in use without reconstruction.

Packard Establishes Shipping Record—On April 12 the Packard Motor Car Co., Detroit, Mich., established a new record by shipping the largest number of motor vehicles turned out in any one day since the company started in business. The day's output, when loaded aboard freight cars, represented a value of $212,795.

Present reports indicate the April business for the Packard will exceed any previous April in the number of vehicles shipped and, with good weather, it will beat the largest month's record in the company's existence.

The Automobile Calendar

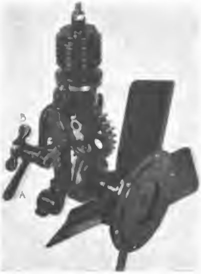
April 22	Detroit, Mich., S. A E. Standards Divisions to Report.
April 30, May 1-2	Portland, Ore., Track Races; Northwest Automobile Assn.
May 1	Irvington, N. J., track meet; O. V. Matthews.
May 1	Philadelphia, Pa., Quaker City Motor Club, Eighth Annual Sociability Run to Atlantic City.
May 5-6	Detroit, Mich., Motor Truck Convention of the N. A. C. C., Hotel Statler.
May 8	Salem, Ore., Track Races; Northwest Automobile Assn.
May 15-16	Vancouver, Wash., Track Races; Northwest Automobile Assn.
May 16-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17	Spokane, Wash., Show, Davenport Hotel.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 18-19	Boston, Mass., annual meeting of the American Automobile Assn.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolie Motor Speedway.
May 29	Philadelphia, Pa., Stone Harbor Memorial Day Run from Philadelphia.
May 29-30	Seattle, Wash., Track Races; Northwest Automobile Assn.
June 3	New York City, 11th Annual Automobile Outing for Orphans; Orphans' Auto. Day Assn. of N. Y.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-6	Tacoma, Wash., Road Race
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept. 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 13	Oakland, Cal., Pan American Road Congress.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 1-2	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show; Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.

ACCESSORIES

Beartone Pump, Horn and Fan

THE Beartone combination horn, fan and tire pump has been put on the market. This accessory is designed primarily for Ford cars but will be supplied for all makes. The pump, which follows the latest practice in motor design, is a single-cylinder 1 1-2 by 1 1-4 inches bore and stroke respectively and is driven from the fan by a worm gear. The pump cylinder is of gray iron and the pistons are fitted with ground rings and bronze connecting-rod.

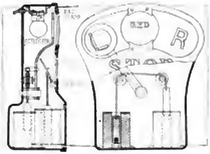
Lubrication is provided by a wick oiler which, while insuring constant lubrication prevents a spray of oil being pumped into the tires. The hub of the fan is cored to carry sufficient grease for lubricating the bearings for a year, a grease cup mounted on the bracket making it possible to oil the fan while in motion. The pump is furnished complete with air hose and automatic gauge. If this gauge is set for a certain tire pressure, when this has been reached the gauge pops off, preventing the tire from being over inflated. The range of the gauge is from 40 to 120 pounds. Of course, the pump is thrown into engagement only when it is desired to inflate a tire. To engage the pump, the lever A is pressed, engaging the gear on the pump with that on the fan. If desired the pump may be carried in the toolbox and attached by merely tightening the hand nut B.



Oakes combination pump, horn and fan

The fan-horn-pump unit is interchangeable with the fan on the Ford, requiring less than 10 minutes for mounting, according to the maker. The price of the combination will be $12.50 each. The maker will also market easily installed fan pumps listing at $7.50 with hose and gauge complete.—The Oakes Co., Indianapolis, Ind.

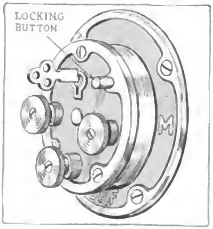
Direction Signal



Pomeroy's direction indicator

This signal provides the red rear light and also indicates Left, Right and Stop. The drawing shows electrical operation, there being three solenoids; two operate the swinging indicator lever to show L or R and the third controls a shutter which normally covers up the stop signal. Electric contacts are arranged on the steering wheel so that movement in either direction swings over the right and left lever, and for the stop signal there is a separate push button. In this form the apparatus costs $12 but it can be had without the stop signal for $9. Another pattern selling for $9 or $5, is the same in effect but has wire rope mechanical operation instead of the solenoids.—B. H. Pomeroy, Rochester, N. Y.

Lock for Connecticut Switch



Lock for Connecticut ignition system

To afford the car owner adequate means of preventing tampering with his Connecticut ignition system, the company has devised a simple lock which requires the use of a key only for unlocking it. It may be easily installed on any Connecticut automatic ignition switch now in use and hereafter is to be standard equipment. The lock is fitted to the inside of the switch button plate and is therefore completely inclosed. A feature of the new lock is that no key is required to lock the ignition though one must be used to unlock it. Furthermore it is impossible to lock any of the buttons in the On position. To the standard switch button face plate has been added a small button which when depressed operates the locking mechanism. To unlock the switch the key is inserted and given a one-half turn.

The device is attached to existing Connecticut automatic ignition switches by removing the three screws that hold the switch button plate which is taken off. During this operation each of the buttons must be in the Off position. The new plate is then put on.

The new plate and lock lists at $2.50 and is for replacement of the old plate only, which must be returned when the new one is installed. All keys are numbered corresponding to a number which appears on the locking button. Extra keys are 15 cents.—Connecticut Telephone and Electric Co., Meriden, Conn.

Klicket Ratchet Grease Cup

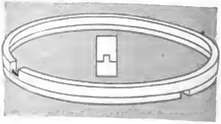
Klicket ratchet grease cup

With this grease cup it is always possible to tell exactly how much grease has been forced into the bearings. Also, as soon as the cap catches the thread, the simple interior ratchet device gives a click and clicks at every quarter turn thereafter, making it possible to turn the cap down as accurately in the dark as in the daytime and preventing waste of grease or dry bearings.

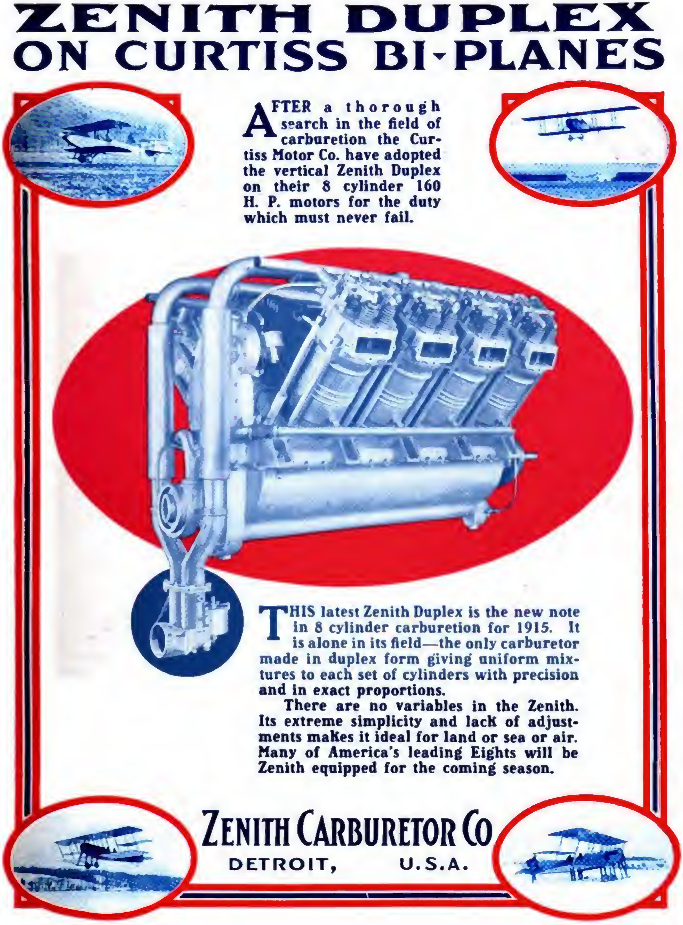
The cup can be successfully operated under all conditions with one hand. The makers guarantee to replace without charge any cup which becomes broken or from which the cap has been lost. As shown in the illustration, there are no outside wires or springs to become broken or bent, or to catch dust or dirt. Cups are made in all sizes and four finishes, steel, dull brass, polished brass and nickel-plated brass, prices ranging from 15 cents upwards.—American Stamping Co., Battle Creek, Mich.

Another Piston Ring

The Smith "Metallic" piston ring is one of the latest attacks upon the problems that surround piston ring making. Even pressure on the cylinder wall all round is obtained by the use of the superimposed ring principle, but the two rings are one above the other instead of there being an inner and an outer ring. There is a lip projecting upwards all round one ring, and a groove to correspond is cut in the other member. The ends of one ring come at a different point than the ends of the other so there is no slot right across the face as with the plain type of ring. The price is $1.50.—William V. Smith, Schenectady, N. Y.



Smith Metallic piston ring and section



ZENITH DUPLEX ON CURTISS BI-PLANES

AFTER a thorough search in the field of carburetion the Curtiss Motor Co. have adopted the vertical Zenith Duplex on their 8 cylinder 160 H. P. motors for the duty which must never fail.

THIS latest Zenith Duplex is the new note in 8 cylinder carburetion for 1915. It is alone in its field—the only carburetor made in duplex form giving uniform mixtures to each set of cylinders with precision and in exact proportions.

There are no variables in the Zenith. Its extreme simplicity and lack of adjustments makes it ideal for land or sea or air. Many of America's leading Eights will be Zenith equipped for the coming season.

ZENITH CARBURETOR CO

DETROIT, U.S.A.

You Will Prefer This Six Because—

It comfortably seats seven adults.

The wheel base is unusually long—125 inches.

The upholstery, of the best hair and bright French finish, long grain hand-buffed leather, is so soft, comfortable, deep and durable.

The 45 horsepower en bloc motor is so smooth, noiseless and economical.

The high tension magneto ignition is so dependable.

The electric buttons are so convenient.

The tires are so large—35 x 4½ inches all around, with non-skids on the rear.

In fact, you will wonder why people continue to pay $2000 to $2500 for Sixes WHEN THIS ONE COSTS BUT $1475.

Our dealer has a new Six for you.

See him at once. Delivery can be made immediately.

Handsome catalogue on request. Please address Dept. 38.

"Made in U. S. A."

THE WILLYS-OVERLAND COMPANY **Toledo, Ohio**

Other Models $795 to $1600. All prices f. o. b. Toledo.

JAN 1 2558
REFERENCE
Carnegie West Branch
MAGAZINE LOAN COLLECTION

The AUTOMOBILE

Vol. XXXII No. 17

NEW YORK, APRIL 29, 1915

Weekly
Price Ten Cents

MAGAZINE LOAN COLLECTION

Put it on *your* new Ford car

PRICE COMPLETE
$75.
F.O.B. BOSTON

WHEN YOU BUY yo
the dealer to instal
system. Think wh
in the way of added conver

The engine is cranked by pres
are controlled by a button.
high-priced cars are yours for
vestment.

Be sure it's "Gray & Davis"
specialists, backed by a reput
ity and efficiency. Guarante
satisfaction.

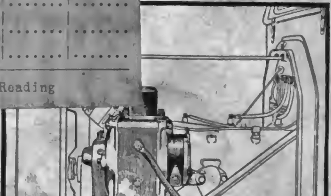
If you own a used Model T
Can be attached to any FORI
Simple, sturdy and designed
and weather condition.

Catalog On Re

Dealers — Supply Men

Write for particulars regarding this equipment. The fastest selling accessory in the industry.

GRAY & DAVIS, Inc. **Boston, Mass.**



Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

An Effective Spark at all Speeds
Never Before Has Been Possible
CONNECTICUT
B
M
AUTOMATIC
OFF

The quality of a spark at any speed depends upon how thoroughly the ignition system can saturate its coil at that speed.

Saturating a coil is accomplished by causing current to flow through it and the longer it is allowed to do so the more thoroughly the coil becomes saturated.

AUTOMATIC · IGNITION
CONNECTICUT

The magneto cannot generate enough current to saturate its coil thoroughly except at high speed.

In the storage battery of the car's starting and lighting equipment CONNECTICUT AUTOMATIC IGNITION has a source of current that is ample, uniform and inexhaustible.

Due to the protection afforded by the Automatic Switch, CONNECTICUT AUTOMATIC IGNITION is enabled to keep its primary circuit closed for the longest possible time between each successive spark, thus insuring thorough saturation of its coil at all speeds.

Better still its saturation period grows greater as motor speed decreases so that at low speeds, when carburetion is uniformly poorer, CONNECTICUT AUTOMATIC IGNITION delivers its hottest spark.

It is the only ignition system you should be satisfied to have on your car.

CONNECTICUT TELEPHONE & ELECTRIC CO., Inc., Meriden, Conn.

VOL. XXXII NEW YORK—THURSDAY, APRIL 29, 1915—CHICAGO No. 17

The AUTOMOBILE

Further Simplify Car Design

S. A. E. Cuts Cotter Pins 300 to 41—Four Fan Belt Widths — Adds Two Carbureter Sizes

By A. Ludlow Clayden

S. A. E. STANDARDS COMMITTEE IN SESSION

1—R. S. Lane, Engineer, Hyatt Roller Bearing Co.; 2—H. S. Pierce, Mechanical Engr., Link Belt Co.; 3—E. E. Sweet, Consulting Engr., Cadillac Motor Car Co.; 4—F. L. Morse, President and Treas., Morse Chain Co.; 5—F. M. Germane, Asst. Gen. Mgr., Standard Roller Bearing Co.; 6—H. D. Church, Truck Engr., Packard Motor Car Co.; 7—W. H. Allen, Mgr. Truck Tire Dept., The B. F. Goodrich Co.; 8—C. E. Clemens, Mechanical Engr., Perfection Spring Co.; 9—R. J. Nightingale, Mgr. Auto Sales, Willard Storage Battery Co.; 10—Russell Hoopes, Superintendent, Hoopes Bros. & Darlington, Inc.; 11—B. Nadell, Sales Engr., Stewart-Warner Speedometer Corp.; 12—A. L. McMurtry, Consulting Engr.; 13—J. G. Utz, Consulting Engr., Perfection Spring Co.; 14—K. W. Zimmerschied, Metallurgist, General Motors Co.; 15—A. L. Clayden, Engineering Editor, THE AUTOMOBILE, Class Journal Co.; 16—H. G. Osburn, Consulting Engr., National Metal Molding Co.; 17—R. M. Anderson, Chief Engineer, Stromberg Motor Devices Co.; 18—C. B. Whittelsey, Vice-president, Hartford Rubber Works Co.; 19—W. H. Palmer, Jr., Assistant Engineer, Electric Storage Battery Co.; 20—Stenographer; 21—N. B. Pope, Technical Editor, Automobile Topics; 22—D. L. Gallup, Professor, Gas Engineering and Consulting Engineer, Worcester Polytechnic Institute; 23—J. J. Aull, Mechanical Engr., The Lunkenheimer Co.; 24—A. C. Woodbury, Recorder of Standards Committee, S. A. E.; 25—C. W. Findeisen, Sales Mgr., Findeisen & Kropp Mfg. Co.; 26—C. F. Clarkson, Sec. and General Mgr., S. A. E.

DETROIT, MICH., April 22—The Standards Committee of the Society of Automobile Engineers met today in accordance with the program announced last week the 2 days previous having been spent in meetings of the various divisions and sub-divisions. In general, there was a great deal of progress reported, but not so much was passed and actually added to the standards of the society. There were some distinctly good discussions on subjects of vital interest and importance, notably on the question of what constitutes a glaring headlight, and how glare can be avoided.

Eight divisions made reports which show a considerable advancement in the work, except in one instance, the research division, where it was decided that the work in hand, namely, the formulation of a good engineering taxation formula, is impossible. It was desired to base this formula on the relative road destructiveness of vehicles. The miscellaneous division and the carbureter division have made reports which can be acted upon at the summer session. The other divisions to report were those on electrical equipment, discussing glare; electric vehicle, discussing the sclerescope test for tires; chain division, iron and steel and international standards.

MISCELLANEOUS DIVISION

1—W. F. Herst, Factory Manager, Brown-Lipe Gear Co. 2—J. G. Utz, Consulting Engineer, Perfection Spring Co. 3—W. A. Frederick, Chief Engineer, Continental Motor Mfg. Co. 4—N. B. Pope, Technical Editor, Automobile Topics. 5—E. E. Sweet, Consulting Engineer, Cadillac Motor Car Co. 6—E. H. Ehrman, Secretary and Factory Manager, Chicago Screw Co. 7—W. R. Strickland, Chief Engineer, Peerless Motor Car Co.

One of the most important new standards adopted for submission to the next general meeting was the latest work of the miscellaneous division, which has been to reduce the 300 sizes of cotter pins in use to some forty-one which cover all requirements. The scheme for doing this was to take three articles needing cotter pins, namely, yoke and rod ends, S. A. E. standard bolts, and U. S. A. standard bolts. It is necessary to have at least two lengths of pin to each diameter, and in some cases the U. S. A. bolts call for different length to those needed by the S. A. E. bolts although the diameter of cotter pin is the same. The table shows the suggested range of sizes which appear to cover every possible automobile requirement and will be put in use shortly. There was practically no discussion of the new standard, since all present at the meeting were agreed as to its common sense.

Fan Belt Widths Fixed

Another task of the miscellaneous division has been to find the number of sizes of fan belting in use and to reduce the widths to a smaller but sufficient range. Four sizes were found to be sufficient, 3-4, 1, 1 1-4 and 1 1-2 inch. It was remarked by Chairman J. G. Utz that there were a few belts in use of greater width, but that these were used only where a generator or some other accessory was driven off the same belt as the fan and the instances of this practice were so rare that they became scarcely a fit subject for standardization. On the question of thickness of belt, there were so many different kinds of belt, and so many different methods of making that

Cotter Pins

B. W. Gage		13	12	11	10	8	6
Nominal Diameter	1/16	3/32	7/64	1/8	9/64	11/64	13/64
No. Drill for Hole	48	36	30	28	21	11	2
Length of Shank:							
3/16	x						
5/16	x						
3/8	x	x					
1/2	x	x					
5/8	x	x					
3/4		x	xxx	x			
1		x	x	x			
1 1/8		x	x	x			
1 1/4			xx	x	xxx		
1 3/8			xx	x	x		
1 1/2				x	xxx		
1 5/8				xxx	x	x	
1 3/4				xx	xx	x	
2					xx	x	x
2 1/4					xxx	x	x
2 1/2						xx	xx
2 3/4							xx
3							xx

Note: x = Short series.
xx = Long series.
xxx = Questionable sizes.
See Table II for applications of these sizes

COMMERCIAL SPRINGS DIVISION

1—C. V. McRaig. 2—C. W. McKinley, Chief Engineer, Willys-Overland Co. 3—Chester E. Clemens, Mechanical Engineer, Perfection Spring Co. 4—C. F. W. Rye, Metallurgical Engineer, Carnegie Steel Co. 5—A. C. Bergmann, Efficiency Engineer, Standard Oil Co.

RESEARCH DIVISION

1—C. B. Veal, Professor of Machine Design, Purdue University. 2—D. L. Gallup, Professor Gas Engineering and Consulting Engineer, Worcester Polytechnic Institute. 3—R. M. Anderson, Chief Engineer, Winton Motor Car Co. 4—H. L. Connell, Member Engineering Faculty, Automobile Department, Central Continuation School

Applications of Standard Cotter Pins

Body Size of Bolt or Pin	Cotter Pins for Yoke and Rod Ends				Cotter Pins for S. A. E. Bolts				Cotter Pins for U. S. S. Bolts			
	Pin Dia.	Pin Length		Drill No.	Pin Dia.	Pin Length		Drill No.	Pin Dia.	Pin Length		Drill No.
		Short	Long			Short	Long			Short	Long	
3/16	1/16	5/16	1/2	48								
1/4	1/16	5/16	5/8	48	1/16	3/8	1/2	48	1/16	3/8	1/2	48
5/16	3/32	3/8	5/8	36	1/16	1/2	5/8	48	1/16	1/2	5/8	48
3/8	3/32	1/2	3/4	36	3/32	1/2	3/4	36	3/32	5/8	3/4	36
7/16	3/32	1/2	7/8	36	3/32	5/8	3/4	36	3/32	5/8	1	36
1/2	3/32	5/8	1	36	3/32	5/8	7/8	36	3/32	3/4	1 1/8	36
9/16					1/8	3/4	1 1/8	28	7/64	1	1 1/4	30
5/8					1/8	1	1 1/4	28	7/64	1 1/8	1 3/8	30
11/16									7/64	1 1/4	1 1/2	30
3/4					1/8	1 1/8	1 3/8	28	1/8	1 3/8	1 5/8	28
7/8					1/8	1 1/4	1 1/2	28	5/32	1 1/2	1 3/4	21
1					1/8	1 3/8	1 3/4	28	5/32	1 5/8	2	21
1 1/8					11/64	1 5/8	2	11	11/64	1 3/4	2 1/4	11
1 1/4					11/64	1 3/4	2 1/4	11	11/64	2	2 1/2	11
1 3/8					13/64	2	2 1/2	2	13/64	2 1/4	2 3/4	2
1 1/2					13/64	2 1/4	2 3/4	2	13/64	2 1/2	3	2

it was advisable to leave the subject of thickness alone. There was no discussion on this proposed standard.

Two New Carbureter Sizes

The carbureter fittings division had several subjects for discussion, the foremost being the desire expressed by some motorcycle and marine motor manufacturers for a .5-inch and a 5-8-inch S. A. E. standard size. This was granted by the meeting and it was understood that the proportions of these smaller instruments would be in accordance with those set for the existing standards. Three larger sizes are also needed, so it was stated, and the division is now at work deciding their proportions. The suggested dimensions were stated, but there was no discussion upon them and so they stand in abeyance till the division's report is complete. It is expected to present this part to the general meeting of the S. A. E. in June.

In presenting his report, the chairman of the division, J. J. Aull, said that there had been a complaint concerning the dimensions for side outlet carbureter flanges, the case for the three-bolt flange being argued. Since the case was isolated and not in agreement with the experience of the majority, the meeting decided that the standard approved at the winter meeting in New York should be perpetuated.

On the chairman's recommendation it was also agreed that a limitation of the distance between the cylinder block and the center line of the carbureter, on side-flange carbureters, was undesirable for standardization as it placed too much limitation on the detail design.

Another detail appertaining to carbureters which it is pro-

INTERNATIONAL STANDARDS DIVISION

1—K. W. Zimmerschied, Metallurgist, General Motors Co. 2—A. L. McMurtry, Consulting Engineer. 3—A. L. Clayden, Engineering Editor, THE AUTOMOBILE, Class Journal Co. 4—Coker F. Clarkson, Secretary and General Manager, Society of Automobile Engineers. 5—W. H. Allen, Mgr. Truck Tire Dept., B. F. Goodrich Co.. 6—C. W. Hartley. 7—C. B. Whittelsey, Vice-President, Hartford Rubber Works Co. 8—J. E. Hale, Experimental Engineer, Goodyear Tire & Rubber Co.

CARBURETER FITTINGS DIVISION

1—A. B. Browne, Consulting Engineer. 2—Geo. M. Holley, President, Holley Bros. Co. 3—J. J. Aull, Mechanical Engineer, The Lunkenheimer Co. 4—V. R. Heftler, President and General Manager, Zenith Carbureter Co. 5—C. W. Findeisen, Sales Manager, Findeisen & Kropf Mfg. Co. 6—C. P. Grimes, Technical Engineer, Wheeler & Schebler.

posed to standardize is the dimensions of the hot-air muff on the exhaust manifold.

Scientific Taxation Rating Hopeless

For a considerable time past the research division have been trying to discover some method of rating automobiles and other road vehicles which will give a figure of merit showing the relative destructiveness of road surface characteristic of any vehicle. In presenting his report, D. L. Gallup said that, with extreme reluctance, the division asked to be released from its labors on this subject, because it had arrived at the unanimous conclusion that it was impossible to find a formula of sufficient simplicity to make its use practicable. Records which might give experimental data are impossible to obtain either here or abroad, and it seems that conditions of traffic and of road making are changing so rapidly that it would not be possible to obtain proper data by any amount of work.

In presenting the report of the electrical equipment division no new standards were offered but it was reported that the question of getting some standard layout for starting motors with flywheel drive was being considered. Dimensions of fuses was another electrical matter that had already been a subject of standardization and that the details of the brass ends of fuse containing tubes was being considered.

It has been found that, despite the S. A. E. standard for bulb cases, the sockets had not become fully standardized, and also, where plugs were used for trouble lamps or what not, they were often unlike the standard bulb base, which is absurd. These matters are receiving attention.

Chairman K. W. Zimmerschied stated that he and several other members of the society had had an interview with the Detroit police commissioner and that the latter had said the cure for headlight troubles was to give up the present type of lamp with a parabolic reflector and a concentrated beam of light, substituting a much greater volume of diffused light spread through opalescent or ground glass. Previous to this point in the discussion the question of so setting the lamps that their rays were thrown slightly downwards was mentioned; this scheme did not have the approval of the Detroit police commissioner, because he considered it insufficiently fundamental.

The Downward-Pointing Ray

From the view that diffused light was a practicable substitute for concentrated beams there were several dissentients, and A. L. Riker remarked that he was sure the commissioner had never driven in the country after dark with diffused light only. In Mr. Riker's opinion the case was met with complete satisfaction when the lamps were depressed so that the focal ray struck the ground some 100 feet in front of the car on a level road. He also thought the matter could be helped by a limitation of the maximum candlepower allowed—that is, candlepower of the naked bulb.

Chairman Zimmerschied discussed some road situations where the downward pointing ray failed to carry out its purpose and showed that there were conditions wherein it actually made matters worse.

Mention was made of the new law in New Jersey that no direct ray must rise more than 54 inches above the road surface. Several members gave experiences showing that bending down the lamp supports freed them from trouble with police on cars which had previously been stopped frequently.

Chairman Zimmerschied, in summing up, said that the discussion resolved itself into two questions: 1—What was the best test for glare? and 2—under what conditions should it be applied?

The worst case where glare or dazzle was most serious was the case of two cars meeting on a dark country road. The easiest case was that of a car running through lighted streets. Obviously what was glare in the former case might

CHAIN DIVISION

1—H. F. Funke, President, H. F. Funke & Co., Inc. 2—H. S. Pierce, Mechanical Engineer, Link Belt Co. 3—F. L. Morse, President and Treasurer, Morse Chain Co. 4—W. A. Rockenfield, Engineer and Sales Manager, American High Speed Chain Co. 5—J. R. Ceutley, Engineer and Manager Chain Dept., Peter A. Fresee & Co., Inc. 6—W. W. Totman, Mechanical Engineer, Sales Dept., The Whitney Mfg. Co.

ELECTRIC VEHICLE DIVISION

1—F. A. Whitten, Chief Engineer, General Motor Truck Co. 2—E. P. Chalfant, Secretary, Electric Automobile Manufacturers' Assn. 3—Alex. Churchward, Vice-President, Gray & Davis, Inc. 4—T. H. Schoepf, General Engineer, Westinghouse Elec. & Mfg. Co. 5—A. J. Slade, Consulting Engineer. 6—W. H. Conant, Mgr. Detroit Branch, Gould Storage Battery Co. 7—A. C. Woodbury, Recorder of Standards Committee, S. A. E. 8—E. J. Ross, Jr., Mgr., Sales Engr. Dept., Edison Storage Battery Co. 9—T. L. Lee, Chief Engineer, North East Elec. Co. 10—Unidentified. 11—Bruce Ford, fourth Vice-President, Electric Storage Battery Co.

not be so in the latter. While the points raised were interesting and also important it was necessary to close the discussion owing to pressure of other business, but the spirited argument which took place promises a lively discussion for the summer meeting.

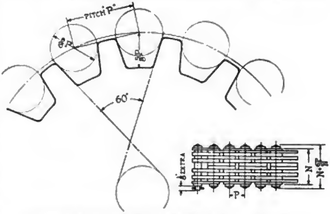
Resiliency of Solid Tires

Another somewhat lively discussion took place on the suggestion by the Electric Vehicle division, that a sclerescope test be standardized for testing the resiliency of solid tires used for electric vehicles. The point at issue is that the tractive effort required to drive an electric car or truck is affected by the suitability of the tire for the road, and that a change of the rubber used can raise or lower the tractive force required. The sclerescope suggested consists of a tube containing a hammer or weight which is dropped against the tire, the tube being meanwhile held in an upright position with its base or open end in contact with the top of the tire tread. The weight is released and the distance of rebound measured, this giving a measure of the resiliency of the rubber.

There was immediate objection on the part of the tire makers, their representatives in the persons of W. H. Allen and C. B. Whittelsey pointing out that resiliency was not the only thing desired in a tire. The most resilient tire need not be the easiest from the tractive effort viewpoint, as instance the ideal case for rolling resistance of a hard steel tire on a hard steel rail. Thus on smooth paved streets a hard tire would show a lower tractive resistance than a softer and more resilient tire. Conversely, on rough cobble stones the highly resilient rubber would be better than the harder quality.

In reply to this criticism, A. J. Slade, chairman of the division, said that the electric vehicle users needed some easy test for tires. If the sclerescope were not going to give it the tire makers ought to come forward with a test which anyone could make and which would actually be of value. In reply, it was pointed out that tire makers themselves would be glad of such a test and the fact that a simple testing machine is not forthcoming is not due to any lack of work of investigation by the tire makers.

When it was first suggested that silent chains, such as are used in motor camshaft drives, might be standardized as to pitches and widths there was a general impression that the case was hopeless, owing to the number of differences between the practice of one manufacturer and another. However, despite this natural pessimism, the chairman of the division, F. L. Morse, was able to report substantial progress. The division has not yet got any standards ready for adoption, but it has some close recommendations for consideration,

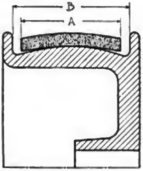


Suggested method of laying out silent type of chain

Pulley for Fan Belt

Proposed Standard Dimensions

Nominal Belt Width	Limits, Belt Width, A	Limits, Pulley Width, B
3/4"	23/32 to 25/32	.870 to .880
1"	31/32 to 33/32	1.120 to 1.130
1 1/4"	1 7/32 to 1 9/32	1.370 to 1.380
1 1/2"	1 15/32 to 1 17/32	1.620 to 1.630



Standard fan belt widths and tolerances

ELECTRIC EQUIPMENT DIVISION

1—W. H. Conant, Mgr., Detroit Branch, Gould Storage Battery Co. 2—Alex. Churchward, Vice-pres., Gray & Davis, Inc. 3—A. L. McMurtry, Consulting Engineer. 4—A. D. T. Libby, Engr. and Patent Attorney, Splitdorf Elec. Co. 5—T. L. Lee, Chief Engineer, North East Electric Co. 6—Unidentified. 7—W. L. Bliss, Chief Engineer, U. S. Light & Heating Co. 8—Russel Huff, Consulting Engineer, Packard Motor Car Co. 9—H. G. Osburn, Consulting Engineer, National Molding Metal Co.

and it is hoped that it may be possible to create some standards soon, possibly at the summer meeting. The drawing herewith shows suggestions only and engineers are warned against making use of it because it will probably be altered before final adoption. It is published solely to show the lines along which the division has been working and not by any means as adopted practice.

Confusion with Bell Housings

The insistence upon the need for caution in publishing suggested standards, as mentioned above, was illustrated well by some bell housing standards which were published in suggested, and not final, form. One or two engineers reading the literature without proper care took it that the designs were standards and forthwith used them. The result was considerable trouble and confusion when the division afterwards found good reasons for making some alterations before setting up the standard bell housings. Chairman Zimmerschied reported to the meeting that there was a deadlock at present on the question of whether eight or ten bolts should be used in the three smallest sizes of bell housings. He hoped this could be cleared up before long.

Iron and Steel

This report was extremely brief as it consisted of the addition of one new chrome nickel steel to the list of standard materials and the alteration of the vanadium content in another. It was also decided to discontinue the specification analysis for steel castings and a recommendation substituted that specifications of the American Society for Testing Materials be considered when it is desired to order steel castings to chemical specification.

Some fresh matter relating to heat treatment and alloy steels is in progress and will come up for report at the summer meeting.

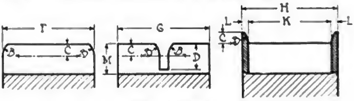
Chairman J. G. Utz of the miscellaneous division reported progress on a variety of small investigations. Speedometer drives and drives for governors were being considered but it appears that the standards set, if any, will have to be of fairly wide limits. The standards on mechanical tire pump drives are being redrafted, this being rendered necessary by reason of the introduction of electrical equipment subsequent to setting up the old standards.

The S. A. E. screw standard is to be amplified by setting a tolerance for the threads. Good progress is being made with the reduction of number of hose connections and clips. Mr. Utz said that the division hoped a very very small number of sizes would suffice to meet all requirements.

Standard dimensions for piston rings and ring grooves are now well advanced, and it remains to determine the depth of groove only. Widths and tolerances have been drawn up and it is thought that the dimensions suggested will prove universally acceptable.

Other matters in the hands of the division are: sections of brake and clutch linings; position of car, chassis and motor number plates; and standard license tags.

The first report of the newly-created international standards division was presented by Chairman A. L. Clayden, who announced that there had been one meeting at which it was decided to confine present attention to the matter of solid tires. Educational literature is to be prepared.



Rim Sections

Chain Width No.	Width Over All Tension Members	F		G	Pitch	C	B	D	H	K	L	M Minimum
		Single Side Bar	Double Side Bar									
	N	N—.135	N—.26	N	P	$\frac{P}{4}$	$\frac{3P}{8}$	$\frac{P}{2}$	N+P	N+$\frac{P}{2}$	$\frac{P}{4}$	$\frac{5P}{8}$
4	½	.365	.240	½	⅜	3/32	.014	3/16			3/32	.234
6	¾	.615	.490	¾	½	⅛	.187	¼			⅛	.312
8	1	.865	.740	1	⅝	5/32	.234	5/16			5/32	.390
10	1¼	1.115	.990	1¼	¾	3/16	.281	⅜			3/16	.468
12	1½	1.365	1.240	1½	1	¼	.375	½			¼	.625
14	1¾	1.615	1.49	1¾	1¼	5/16	.468	⅝			5/16	.781
16	2	1.865	1.74	2	1½	⅜	.562	¾			⅜	.937
18	2¼	2.115	1.99	2¼	1¾	7/16	.656	⅞			7/16	1.093
20	2½	2.365	2.24	2½	2	½	.750	1			½	1.250

P=Pitch of chain.
N=Width over all tension members.

Prosperity Wave Hits Detroit Parts and Accessory Makers

In Spite of Constantly Increasing Facilities and Working Forces, Manufacturers Are Striving Day and Night to Meet the Tide of Orders from Car Makers and Dealers

By L. V. Spencer

DETROIT, MICH., April 24—The same wave of prosperity that has deluged the car manufacturers here has reached the parts and accessory makers as well. Every one in this latter class who would talk about business conditions was so filled with optimism that the rather tight times of the past fall stood out in even more striking contrast than ever before.

It has been said that the automobile industry is enjoying remarkable prosperity, but most people take that to mean the manufacturers of automobiles, cars only; whereas these concerns' prosperity reflects immediately on the parts makers and on the producers of fittings, such as carbureters, magnetos, horns, etc., of necessity. It is a sort of reciprocal prosperity, for each class of makers depends upon the other.

Probably the parts and accessory makers are being pressed even harder than the automobile makers, for the former have demands from makers everywhere to meet, and a car maker can be more insistent than a dealer. The car maker has to pacify the dealers' demands for deliveries, whereas the parts maker must pacify the automobile manufacturer who is much nearer home and is harder to put off.

Orders in Avalanches

Like the car builder, the parts man was hesitant last fall to build up a very large stock, for it was impossible to foresee just what the spring would bring in the way of business, and now he regrets this for orders have come with such a rush that it is almost impossible to take care of them. Some of the leading parts people are refusing to take orders now for June and July delivery, so far ahead are they sold, yet they hesitate to tell the customer for fear of losing his business.

Work Day and Night

Day and night shifts are the rule in a great many of the plants, while at least one other is going still further and building large additions to an already immense plant. There is one very notable example of large parts orders for immedite delivery having to be turned away.

The Timken axle plant is manufacturing at a feverish pace to take care of orders. Business for May and June is characterized as being way out of sight, judging from present demands. Recently the Timken company took over the Metal Products Co. plant, and in this it is making the axles for Chalmers, Hudson and National, principally. In this factory as well as in the main plants there are 2,500 men. All are on full time, and in many departments there are day and night shifts. The Timken-David Brown Co., affiliated with the Timken-Detroit Axle Co., and maker of the worm axles of that name, is running day and night and has been for the past 3 months.

Big Domestic Demand

In addition to the purchase of the Metal Products plant, Timken is adding some new factory buildings to the main plant. One of these is well under way, and will be used principally for the expansion of the David Brown worm gear department. It will give them at least double the present worm gear making capacity when the new machinery is all installed. Timken factories are working almost entirely on domestic business and the demand is stiff. Unless something unforeseen happens, there is every indication that this will be one of the busiest summers Timken ever had.

Property across the street from the present Timken plants is owned by the concern, and measures 1,000 by 500 feet approximately. It is the intention to start building this up at once. When completed these additions will house the power plant and the drop forging departments. The present forge shops will be removed entirely, and a four-story addition put in its place. As the forge is a one-story factory, the same ground will then have four times the floorspace. The contemplated additions when completed will more than double the present forge facilities. The additions involve $750,000.

Continental—325 Daily

Continental motors are another much-sought Detroit product. The plant here is now turning out 175 a day and the Muskegon, Mich., factory is building 150 a day, these latter being mostly truck engines, although there is some passenger car work going on there. Detroit plant has 1,800 men and the Muskegon works employs 1,500. Continental business is 25 per cent better than at this time a year ago, and day and night shifts are the rule at both plants.

Gemmer 20 Per Cent. Gain

At this time the Gemmer Mfg. Co., steering gear maker, has booked fully 20 per cent. more business now than last spring. The plant is running with its full quota of from 350 to 400 men, and the machine departments are operating night shifts as well. The output of complete steering gears, including the steering wheel, etc., varies from 360 to 400 a day, depending upon conditions. Unless there is an unforeseen drop, business will be exceedingly good with Gemmer, and there is no reason to look for any falling off, as there is plenty in sight.

Busy Radiator Factory

The Long Mfg. Co., which makes radiators principally, is exceptionally well satisfied with conditions, and, in the words of one of the officials, the concern "feels very comfortable." The output approximates 175 radiators a day, and the aim is to make a radiator per day per man. As an indication of how this compares with other times, it might be said that at no time in its history has Long had over 250 men in its employ, showing that the present is well above the average. Long goes in for tractor and heavy truck work extensively, due to the peculiar adaptability of its type to that class of service. There are now

(*Continued on page* 782)

European High-Efficiency Motors

Part III

Valves Are Timed Differently from Old Type Motors—Crankshaft Design Important—Effect of Offset Crankshaft—Lubrication Generally by Pump—Conclusions

By S. Gerster

THE camshaft must be calculated under bending, torsion being almost a negligible value. Fig. 15 shows the cam in the position of the greatest acceleration of the valve. The direction of the effort P is distant r from the center. In making calculations of a camshaft under flexure, it is only necessary to calculate by the sides of the cams working under the most disadvantageous conditions, for they only come into action one at a time. If the shaft is laid out as shown in Fig. 16, the moment of flexure can be established as follows:

$$P_1 = P \times \frac{a}{l}$$

The bending moment M_f becomes

$$M_f = P_1 \times b = \frac{P \times a}{l} \times b$$

If W indicates the moment of resistance of the section R — R and s the tensile strength of the metal, we can obtain

$$s = \frac{M_f}{W}$$

= 5,700 to 7,000 pounds per square inch.

Effect of Valve Timing

The timing of high-efficiency motors differs considerably from that of the old type. Exhaust valves are opened as much as 62 degrees before dead center, and they are kept open until 15 degrees after upper dead center, Fig. 17, in order to obtain a complete scavenging of the cylinder. For slower-speed motors this timing is not so satisfactory, and it is therefore advantageous to give only 52 degrees exhaust lead and 10 degrees lag to the closing, if the motor is not an extreme type.

The same difficulties are met with in the intake valves, a satisfactory timing for high speeds having disadvantages for slow running. Modern racing motors are timed according to Fig. 18, very often with 2 degrees lag in the opening of the intake and 30 degrees lag in the closing. At a certain moment, at the beginning of the aspiration, all the valves are open. When the motor has two intake pipes and two carbureters, each one connected up to a series of valves, it is advantageous to have a different timing. For the valves passing the charge at low speeds the timing of a slow-speed motor is given, Fig. 19, with 15 degrees lag to the intake so that the intake and the exhaust valves do not open together; for the high-speed valves the timing indicated above is used, as shown in Fig. 18. It is preferable to begin laying out the cam by a tangent to the primitive circle of the cam, taking care not to make the cam diameter too great.

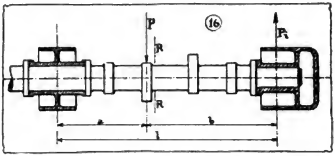
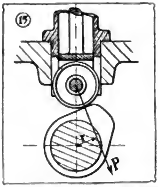


Fig. 16—Layout of camshaft for calculating moment of flexure

The clearance i, between the pushrod and the valve stem, can be from 0.3 to 0.8 millimeter, or .0117 to .0312 inch. In order to obtain a silent motor this clearance, i, must be made as small as possible, but doing this increases the difficulties of machining and keeping the motor in tune. The angle of rotation α of the cam, which corresponds with the clearance i, can be expressed, Fig. 20, by

$$\cos \alpha = \frac{R + r}{R + r + i}$$



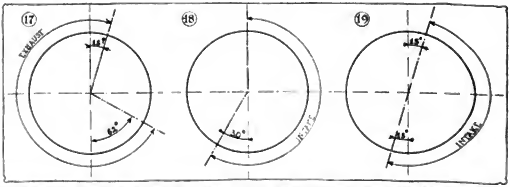


Fig. 15—Left—Cam in the position of greatest acceleration of the valve. Fig. 17—Left Center—Exhaust valves open 62 degrees before dead center and remain open until 15 degrees after upper dead center. Fig. 18—Right Center—Timing of modern racing motor with 2 degrees lag in intake opening and 30 degrees lag in the closing. Fig. 19—Timing of a slow-speed motor with 15 degrees intake lag

α is the angle of action of the cam corresponding to the duration of lift of the valve.

Crankshaft Design

The crankshaft is often termed the heart of the motor, and is an organ which should receive the greatest attention. Unfortunately, engineers are to be met totally ignorant of the principles of the design of this organ. Firms with the highest reputation have had to revise their theories again and again, and one leading firm produced in 1913 an 85-millimeter, or 3.35-inch bore motor with a crankshaft of 42 millimeters, or 1.65 inches diameter, which broke after short use. It was replaced by a crankshaft of 48 millimeters, or 1.89 inches, diameter which also broke; finally a 52-millimeter, or 2.05-inch, shaft gave satisfaction. In these high-speed motors vibrations are set up which it is practically impossible to calculate, and manufacturers have merely had to adopt co-efficients which have been proved sufficient in practice. Formerly crankshafts and connecting-rods were designed on the assumption of a pressure of 550 pounds at the moment of explosion in the cylinder; but it was seen that this was insufficient, and at the present time 700 pounds is adopted, although diagrams do not indicate such a high pressure.

Let P_x be the total pressure on the piston at the moment of explosion and p_x the initial pressure in the combustion chamber,

$$P_x = S \times p_x = \frac{\pi \times D^2}{4} \times p_x$$

The majority of four-cylinder motors are now made with three main bearings, some with five, but a very few small high-efficiency motors have a two-bearing crankshaft. Ball bearing crankshafts are frequently found, although the wear of these bearings is somewhat rapid. The cause of this wear is the carbon deposited in the lubricating oil in the crank-chamber. In order to get really good results it is necessary to protect the ball bearings by means of felt washers from the oil within the base-chamber and to have a special oil feed which assures the bearings a constant supply of fresh and pure oil. This is the ideal arrangement, but for racing motors it is sufficient to put a washer before each bearing so as to protect it from the greatest projections of oil.

Calculations for this type of crankshaft are made according to Fig. 21.

P_{x_1} and P_{x_2} become:

$$P_{x_1} = \frac{P_x \times a}{c}$$

$$P_{x_2} = \frac{P_x \times b}{c}$$

The bending moment of the section X — X becomes

$$M_{x-x} = P_x \times b.$$

The moment of the section Y — Y becomes

$$M_{y-y} = P_x \times d$$

and the moment of the section Z — Z becomes

$$M_{z-z} = P_x \times e.$$

The section of the crankpin X — X is generally hollow, and the metal in these sections generally works at a pressure of

$$s = \frac{M_{x-x}}{W}$$

$= 7,000$ to $7,500$ pounds per square inch.

If W is the moment of resistance, the steel employed is nickel steel with an elongation of 14 to 16 per cent. The center web A is calculated for a load of 7,000 to 7,500 pounds per square inch.

$$s = \frac{M_{y-y}}{W} = \frac{M_{y-y}}{\frac{b \times h^2}{6}}$$

The section is rectangular or as shown in Fig. 22.

The webs B are calculated in the same manner with $s =$ 5,200 to 6,500 pounds per square inch.

About 3 years ago much higher values were accepted for touring car motors. Then the crankpin was under a pressure of 15,000, the web A, 10,400 to 13,000, and B, 5,700 to 7,000 pounds. The surface of the crankpin is calculated for the connecting-rod according to the explosion pressure. Thus, p_f the pressure per square inch, we obtain

$$p_f = \frac{P_x}{F}$$

$= 500$ to 600 pounds per square inch

if F represents the surface of the crankpin, length multiplied by diameter. For the main crankshaft bearings we accept $p_f = 400$ to 500 pounds per square inch. When ball bearings are used, it is possible to take bearings suitable for the load at 1,800 revolutions, instead of 3,500 and more.

There are certain cases, particularly two-cycle motors with piston pumps coupled to the main pistons, where the efforts of inertia have to be considered. In these cases it is necessary to ascertain the effort of inertia of the connecting-rod and the piston. In the two positions of the crank shown in Fig. 23 the effort of inertia acts on the crankpin and for the calculations we can consider the masses of the piston and the crankpin added to the center of the crankpin and af-

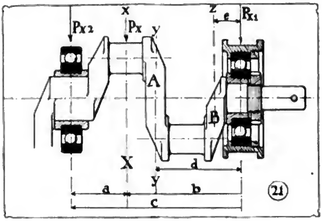


Fig. 21—Above—Ball bearing crankshaft with felt washers protecting the bearings from the greatest projections of oil

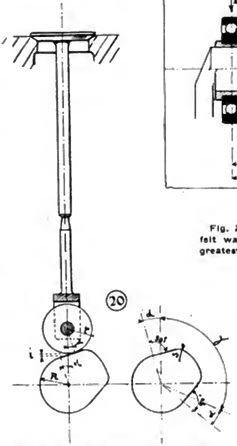


Fig. 20—Left—Illustrating the angle of cam rotation which corresponds with the clearance

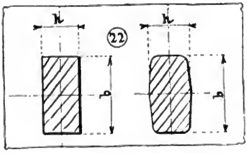


Fig. 22—Sections through crank webs calculated for loads of 5,200 to 7,500 pounds per square inch

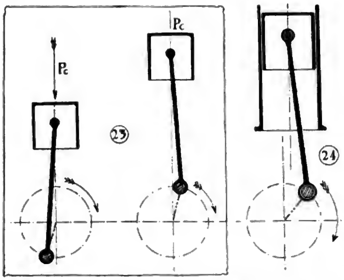


Fig. 23—In the two positions illustrated the effort of inertia acts on the crankpin. Fig. 24—Illustrating the crankshaft offset in relation to the axes of the cylinders. When the pistons are light it is desirable to offset as much as suitable for an equal distribution of the efforts at 2,500 r.p.m.

fected by centrifugal force. In this case P_c, the greatest effort becomes

$$P_c = \frac{M \times v^2}{R}$$

M being the mass of the piston and of the connecting-rod or their weight G divided by g we obtain

$$M = \frac{G}{g}$$

v being the circumferential speed of the crankpin, or

$$v = \frac{\pi \times 2R}{60} = \frac{\pi \times R}{30}$$

R being the radius of the crankpin. It may be found that the effort P_e becomes greater than the effort P_x of the explosion and if that is the case it is necessary to design the crankshaft with the effort P_c.

Effect of Offset Crankshaft

The question of the offset of the center of the crankshaft in relation to the axis of the cylinders, Fig. 24, has its importance in this case. The lateral efforts on the cylinder walls are exercised regularly on the two opposite walls, except at the moment of explosion, when the efforts are balanced. P_x acts downwards and P_c upwards. In this particular case it is necessary to offset in the contrary direction, but only slightly and for very high speeds. But as the motor operates comparatively rarely at its highest speed, it is not necessary to offset if the pistons are relatively heavy. On the other hand, when the pistons are light it is advisable to offset as much as suitable for an equal distribution of the efforts at 2,500 revolutions. Either above or below satisfactory results are not obtained.

In modern motors the wristpin is preferably fixed in the connecting-rod and mobile in the piston, according to the general American practice. This gives a greater bearing surface and facilitates the lubrication. The following formulæ dealing with the wristpin have not changed to any great extent from those applied to the older types of motors.

The bending moment is considered as M, Fig. 25,

$$M = \frac{P_x}{2} \times \frac{L}{2}$$

and the tensile strength of the metal s, when W is the moment of resistance of the section.

$$s = \frac{M}{W} = 420 \text{ to } 560 \text{ pounds per square inch.}$$

For the lubrication we adopt a coefficient

$$p_f = 2{,}100 \text{ to } 2{,}400 \text{ pounds per square inch}$$

if F is the surface to be lubricated.

$$F = 2(d \times 1)$$

$$s = \frac{P_x}{F} = 2{,}100 \text{ to } 2{,}400 \text{ pounds per square inch.}$$

The connecting-rod should be made as light as possible, in order to reduce the mass of the moving parts. As to its length, it is advisable not to reduce to too great a degree the ratio length of rod to stroke of motor.

If L is the length of the connecting-rod from axis to axis and C the stroke of the motor we can adopt

$$L/C = 4/_1 \text{ to } 3.5/_1.$$

In ordinary construction we adopt

$$L/C = 4.2/_1 \text{ to } 4.5/_1.$$

Stresses in Connecting-Rod

The connecting-rod has to be calculated under simple compression and bending by compression. Very often the connecting-rods are tubular with a cylindrical boring and the exterior slightly conical. The central section F — F has to be calculated. Under simple compression the calculation is as follows, F being the surface.

For the double T section:

$$F = (B \times H) + (b \times h)$$

$$s = \frac{P}{F} = 15{,}500 \text{ to } 17{,}500 \text{ pounds per square inch.}$$

This is calculated for racing motors, while for ordinary motors it is 13,000 to 15,000 pounds. For circular sections the same values are adopted. The margin of safety under bending by compression is calculated according to the example shown in Fig. 27 and the formula

$$M = \frac{\pi^2 \times E \times J}{P_x \times L^2}$$

M is the co-efficient of safety;

E the modulus of elasticity;

J the moment of inertia, axis B — B, Fig. 26;

P_x the stress on the connecting-rod, and

L the length measured as shown in Fig. 26.

The co-efficient M is chosen between 3.5 and 4 for high-speed motors, while for ordinary construction it may be M = 4.2 to 5. The steels employed for the connecting-rods of high-efficiency motors have a tensile strength of 104,000 to 130,000 pounds per square inch and an elasticity of 12 to 14 per cent. They are completely machined, whereas milder steels are employed for ordinary motors and are generally stamped.

Delivery of Oil Pump

Different methods of lubrication are adopted. The old type splash system has been abandoned completely. Generally, a pump is used, delivering the oil under pressure through the hollow crankshaft, or maintaining a constant level. For a motor having plain main bearings the most simple method is to lubricate under pressure, with a direct feed to each bearing; the crankshaft being bored, with an oil passage opposite each bearing; the flow of oil to the wristpins is a simple matter. For this good results can be obtained by a pump delivery of oil to troughs under each bearing. Delivery to the connecting-rod lower-ends is either by means of circular grooves at the side of the main bearings, or by means of dippers and a constant level trough under each rod.

The output of the oil pump for a high-efficiency, four-cylinder motor of 70 millimeters bore should be about 20 quarts per minute. For a motor of 100 millimeters bore the delivery should be 35 quarts. Older type motors which did not run beyond 1,700 r.p.m. had pumps delivering 6 to 10 quarts. The most commonly employed gear pumps have a delivery V in liters per minute.

$V = M \times 2 \times N \times F \times h$, when

n = the number of revolutions above 500;
N = the number of teeth of each pinion, 8 to 12;
F = the surface of the hollow of one tooth, see Fig. 28;
h = the height of a tooth .75 to 1.5 inches.
The metric pitch is 2.5 to 3.5.

Conclusions

This type of motor is almost invariably cooled by means of a water pump running at the motor speed. It is generally coupled up with the magneto, though sometimes placed on the opposite side.

Certain manufacturers have produced small, high-efficiency motors with thermo-syphon cooling; but the water pipes must be of considerable diameter and a great quantity of water must be carried round the cylinders. It may be considered that the maximum for thermo-syphon is a four-cylinder motor of 65 millimeters, or 2 1-2 inches bore for which $V_3 = 65$ quarts.

Some High-Efficiency Sixes

With the exception of very small motors, the exhaust and intake manifolds are independent of the cylinder casting. For the intake this is necessary on account of the large diameter of the pipe, and for the exhaust on account of the excessive heat which would be retained. Very few high-efficiency motors have the intake manifold cast with the cylinders, even when the motor is of small dimensions.

Up to the present it is the four-cylinder motor which has given the best results as a high-efficiency type. From a motor with four cylinders of really very small diameter it is possible to obtain very high power. Nevertheless, a small number of manufacturers have produced high-efficiency, six-cylinder models. The main principles which govern the four-cylinders apply to the sixes, and where these principles have been understood thoroughly the difficulties which were met with in the early models have been avoided. In the design of the gas passages the only change is one of diameter. Both camshafts and crankshafts have to be strengthened for the high-efficiency six in the same proportion as for the high-efficiency four.

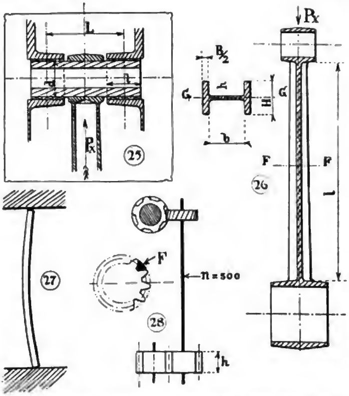


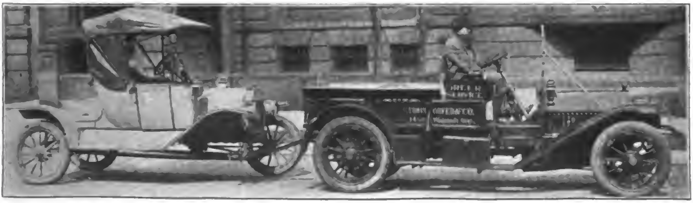
Fig. 25—Layout of wristpin for calculating bending moment. Fig. 26—How the connecting-rod is measured for calculating the margin of safety. Fig. 27—Diagrammatic illustration of principle followed in calculating margin of safety in connecting rod-bending under compression. Fig. 28—F is the surface of the hollow in one tooth of the gear used in an oil pump

A One-Man Ambulance for the Injured Car

A SIMPLE device for towing a disabled car which may be operated by one man, under all conditions and irrespective of which of the car's wheels may be affected, is in use by the Erwin Greer Automobile Co., Chicago, Ill. It consists of two lengths of T-section iron, 12 feet long, bent at an angle of about 10 degrees at a distance of 2 feet from one end. The other end of each length has hooks bent on it to enable it to engage either front or rear axle, as required. As long as there are two wheels on either end of the car to be towed, the device may be used.

The object of the bend is to allow the towed car to ride as near level as possible, while the ends of the T lengths may be anchored to the frame of the towing machine, as shown in the accompanying illustration. It is very simple to attach the device, which may be easily made.

If one of the rear wheels of a damaged car is useless, the T lengths are hooked over the rear axle and the car towed in backwards. In this case it is necessary to block the steering gear so that the wheels will not deviate from a straight course. When a front wheel is affected, blocking the steering gear is unnecessary as the device is designed to hold the wheel or wheels nearest it clear of the roadway, literally converting the towed machine into a two-wheeled cart, only the wheels farthest from the towing car touching the ground.



Illustrating the use of the one-man ambulance for towing a disabled car to the repair shop, as used by the Erwin Greer Automobile Co., Chicago, Ill., the front wheel of the towed car being lifted from the ground

The Engineers' Forum

Takes Exception to Lieut. Bryan's Recommendation of Low-Test, Easily-Vaporized Oil—Claims Such Oil Makes Mixture Over-Rich, Causing Loss of Power

By Chas. E. Duryea,
Consulting Engineer.

PHILADELPHIA, PA.—Editor THE AUTOMOBILE:—The article on oil by Lieutenant G. S. Bryan, in THE AUTOMOBILE for March 25, contains a lot of good meat but also some errors. What he says about the temperature of cylinder walls is probably true but, unfortunately, it is not possible to run an engine without a piston and it is the piston that gets hottest and its effect must be taken into account.

Finding the Proper Oil Test

It will need no argument to convince the reader that, except in some special shapes of engines, the center of the piston head is the hottest place in the motor. The cylinder head center, even if air-cooled, gets some cooling from the air but the piston head gets very little cooling from the gases confined in the crankcase. Its heat must pass to the piston walls and through the oil film to the cylinder walls. And it is the heat of the piston walls near its head that makes the trouble. How hot this is I do not know but I can tell how to find out the proper oil test required. Work the engine as hard as possible, as, for example, in hill climbing and then listen for pounding. Try adjusting the mixture and spark so as to be sure it is not due to pre-ignition. Having eliminated these possibilities, it may be accepted as certain that the piston runs onto a dry surface at the top of the stroke and this added friction is what causes the pounding. Now give the engine a shot of oil from a hand pump or feed a little into the intake pipe and see if the pounding stops. It most probably will. This proves that the trouble is lack of oil and that the oil is not of high enough fire test or there is not enough of it.

Effects of Different Oils

Next, compare the quantity needed to run the engine with full power and free from this pounding. In my run of 1,000 miles in 10 days accompanying the New York to Boston run of 1902, I took only 1 gallon of 800 fire test Duryaoyl with me besides having the cylinder cups and crankcase filled as usual. This gallon of oil carried my three-cylinder 4 1-2 by 4 1-2 engine from Reading, Pa., to New York City via Boston, 750 miles, with perfect lubrication although I had frequent altercations with the contestants as I passed them all twice daily. To get back to Reading, 150 miles, I had to buy 1 1-2 gallons of such oils as were to be found at the garages and then had to nurse the engine to prevent overheating and pounding. The last half-gallon secured at Philadelphia was Duryaoyl and the way we took the Pennsylvania hills after that proved the engine not pounding because of carbon but all right with proper oil. Tests like this are not hard to make. On the same run was Wally Owen with a Gasmobile of same bore and stroke and number of cylinders and he used more oil each day than I carried.

Another error is that the lubricating oil must vaporize if mixed with the fuel. This is impossible. The air passing through a carbureter is so nearly saturated with the vapor of gasoline that nothing heavier can be vaporized. And if vaporized the lubricating oil would never "condense on the walls" for the walls and cylinder are hot and tend to further vaporize. Just the reverse is necessary and the fact. The oil is dissolved in the gasoline and as the gasoline is sprayed each small globule of liquid carries its proportion of oil. The gasoline turns to vapor by losing from its outside until nothing but the oil is left in the tiniest globule imaginable. But it is oil just the same as ever and it oils everything with which it comes in contact. Compare some of this oil taken from the crankcase with some before mixing with the fuel and no difference is apparent.

Results with Low-Test Oils

Users who wish success with this mixture method of oiling should be particularly careful to get oil that does not vaporize at any temperature likely to be found in the crankcase or transfer passages because if a low-test oil is used it may get hot enough to vaporize and this would make the charge over-rich and make the engine miss and lose power. Reducing the amount of gasoline by readjusting the carbureter will, of course, help a little but a few misses permit the engine to cool down below the critical vaporizing point and then the carbureter must be opened once more.

Argument for Two-Cycle, Air-Cooled Motor

Many a perfectly good two-cycle motor has been blamed because the cheap low-test oil fed into its crankcase turned into vapor and interfered with its carbureter action. If the Lieutenant had fought his car for the biggest part of 24 hours, covering 75 miles and torn out, cleaned, and put back both the electric and gasoline systems before discovering that the trouble was with the oil, as I once did, he would be more careful how he advises people to select "an oil that has a low flash test and is easily vaporized."

I am pleased to see dissertations on oils. If users knew more about oils they would favor the high-heat, high-economy, air-cooled motor instead of bothering with the water-cooled type with its plumbing system and its blankets for winter use.—CHAS. E. DURYEA, Consulting Engineer.

Favors Front Radiator in Peace—Dash Position for War

BUFFALO, N. Y.—Editor THE AUTOMOBILE:—The communications appearing in the Engineers' Forum for April 22 in defense of placing the radiator in front of the motor, answering Mr. Morrison's article in the Forum the week before advocating the dashboard position, seem to me particularly sensible. For example, Mr. Huff points out that, while radiator protection is a highly important consideration in designing a car or motor truck for use in warfare, for ordinary conditions in our peaceful country there are comparatively few cases of punctured radiators due to the exposed position of the cooling reservoir. Also, in this connection, Mr. Younger brought out a very good point when he said that something must be placed in front of the car or truck to bear the brunt of a collision affecting this part of the vehicle, and, if only a thin sheet steel hood or bonnet is offered as resistance to the impact, the obstacle will be driven in on the motor, a much more important part and more difficult and expensive to repair.

What About Heat in Summer?

I have frequently endeavored to understand the mental attitude of the designer who placed the radiator at the dash, behind the motor, apparently with the idea of greater protection and improved appearance, but there are so many advantages in the favor of the front location that I have been utterly unable to do so. Mr. Morrison, for example, claims as an advantage of the dashboard position that in cold weather the heat from the radiator could be used to warm the front section of the car. I would like to know how much of an advantage the slight heat obtained in this manner would be when the driver thinks of the possibilities of a blistering hot day in summer with this little amateur furnace toasting his toes, for the almost imperceptible heat obtained in winter would be considerably multiplied in hot weather.

Mr. Morrison's contention that the location of the radiator behind the motor presents no great engineering or constructional difficulties is reasonable enough, but, by all means, why bother with it at all since the only real argument in its favor, from an engineering standpoint is that it permits of more perfect stream lines with a corresponding reduction in the wind resistance? As to the improvement in appearance with the use of a dashboard radiator and its resulting sloping hood, opinions are far too divided on this subject for me to even venture a conjecture as to the possible verdict of the public, which is, after all, the great deciding force in matters of this kind.

Accessibility Greatest with Front Location

As regards accessibility, it seems to me that everything is in favor of the front location, whereas with the dashboard type, the radiating surface must be larger, to compensate for its position behind the warm motor and away from the cooler air outside the hood, and repairs would be more difficult and expensive, to say nothing of the increased cost of manufacture.—R. E. BURROWS, M.E.

Recent Court Decisions—Words and Phrases

By George F. Kaiser

FROM time to time words and phrases come up in connection with the automobile trade, the meaning of which is important, but not generally known, as for instance—Fully Equipped, Unfair Competition, Restraint of Trade and Buildings Used Exclusively for Residence Purposes.

In a recent case decided in the Canadian Courts, it was held that Fully Equipped, as used in an automobile contract, could not be construed to bind the manufacturer of an automobile to furnish non-skid tires.

Suit arose on an automobile contract and the point was raised that as the car was to be delivered fully equipped, the buyer would not have to accept delivery if plain tread tires were furnished as part of the equipment.

The court decided, however, that an automobile might be fully equipped with plain tires in view of the fact that it was shown by parole evidence that, according to the usage of trade, plain tires, and not tires of a more expensive character, were meant by that expression.—*Halifax Automobile Co. vs. Redden, 48 N. S. (Nova Scotia)*, 20.

Restraint of Trade

Whether or not there was a Restraint of Trade was the point in issue in another late case. An agreement had been made by one partner to sell out his interest in a hack line. He stipulated that he would not operate a competing line as long as the buyer continued in business.

The court decided that this agreement was not one in restraint of trade and when the seller started in business again in competition with the persons with whom he had made the contract, the latter were entitled to an injunction and damages.

The court said: "Contracts in partial restraint of trade are now generally upheld as valid when they are agreements by a seller of a business not to compete with the buyer in such a way as to decrease the value of a business; by a retiring partner not to compete with the firm; by a retiring partner not to do anything to hinder the business of the partnership; by an assistant or agent not to compete with his master or his employer after the expiration of his term of service; by the buyer of property not to use it in competition with the business retained by the seller, or an agreement made by the lesser of property not to use it in competition with the business of the lessee."—*Nickell vs. Johnson, 172 S. W. (Kentucky)*.

Buildings Exclusively for Residences

The meaning of the words Buildings Used Exclusively for Residence Purposes in a city ordinance was recently determined by the highest court of Illinois.

A dealer applied for a writ of mandamus against the village of Oak Park to compel it to grant him a permit to build an automobile garage and salesroom. He was at first successful in his application, but the Supreme Court of Illinois on appeal reversed the case and held that he was not entitled to relief.

An Oak Park ordinance provided that "it shall not be lawful for any person or corporation to locate, build, construct or maintain in the village of Oak Park on any site where two-thirds of the buildings within a radius of 500 feet of the proposed site are '*used exclusively for residence purposes*' a building for a public automobile garage without the written consent of a majority of the property owners, according to frontage, within a radius of 500 feet of the proposed site of the building."

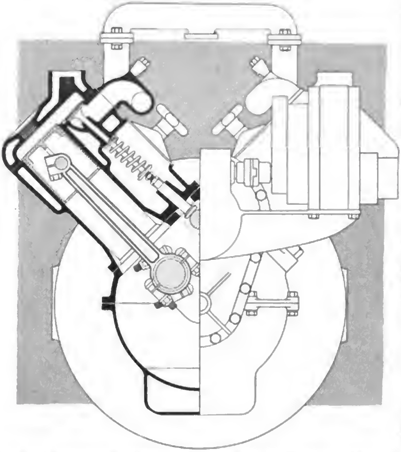
The dealer could not get the necessary number of consents and attacked the ordinance on the ground that it was void, unreasonable, arbitrary, unnecessary and prohibitive.

There were thirty-eight buildings used for residence purposes, eight business buildings, one public garage, one church, three private barns and twelve private garages within the 500 feet radius.

The Supreme Court said that in construing the words Buildings Used Exclusively for Residence Purposes, the private garages used in connection with the residences would not prevent the residence buildings from being counted as exclusive residences and that therefore two-thirds of the buildings within the radius would have to be counted as residential buildings. As the ordinance was held reasonable and valid, decision was rendered in favor of the village.—*Keller vs. Village of Oak Park, 107 N. E. (Illinois)*, 636.

Herrmann Eight Uses Splash Oiling

Two Berling Magnetos Set at 90 Degrees Furnish Ignition—Other Types Easily Fitted—Thermo-Syphon Cooling—Cylinders Are Offset—Valves Set at an Angle



Part section through eight-cylinder Herrmann motor, showing accessibility of valves

THE HERRMANN ENGINEERING CO., Detroit, Mich., has placed before the public an eight-cylinder motor of moderate size which develops 35 horsepower at 2,000 r.p.m. It has a bore of 2 1-2 inches and the stroke is 4 inches, giving a ratio of 1.6, and a piston displacement of 156.7 cubic inches. Two magnetos are used and lubrication is by splash. Cooling is by thermo-syphon.

Cylinders Are Offset

The new member of the eight-cylinder clan has several noteworthy features, but it adheres in the main to generally-accepted good practice. The cylinders are cast in blocks of four and arranged in the usual V form, but they are offset sufficiently to allow the connecting-rods to be placed side by side in pairs on each crank bearing. The cylinder heads are removable, and the crankcase is made entirely of aluminum with no part of it integral with the cylinders. Split horizontally into two sections, it conforms very closely to average practice.

The single camshaft, carried directly above the crankshaft on two bearings, has sixteen integral cams, which bear directly upon the valve tappets. To make this possible, the valves are positioned at a slight angle to the centerline of the cylinders which they serve, thus bringing the lower ends further from the cylinders than the valve heads and allowing a straight upward thrust on the valves from the cams. This construction therefore does away with any intervening rockers between cams and tappets, and at the same time the valve heads are close to the cylinders, requiring no larger valve pockets than would be necessary if they were straight-acting valves. Of course, the valves might still be made to act from the camshaft direct by locating them parallel to the centerline of the cylinders but further out. This, however, would lengthen the valve pockets, increase the amount of metal and consequently increase the weight of the engine. There would also be less room in the V between the two sets of cylinders.

These valves seat at a slight angle to the horizontal, but this, as well as the drilling at the angle are simple machine jobs. The valves have an overall diameter of 1 1-4 inches and a clear opening of 1 1-8-inches, and the springs and adjusting nuts are readily reached through the plates in the V. This method of actuating the valves is unquestionably the simplest that could be devised, and the attendant reduction of moving parts with the incidental lost motion, however slight, connected with same, is a commendable feature, especially for a small motor of this kind.

Two Magnetos Used

The Herrmann engine is probably one of the first to use magneto ignition and the sparking function is provided for by two Berling magnetos, one at either end of a cross shaft at the front of the engine. The drive for this shaft is at its center by a spiral gear connection with the camshaft gear. This makes a very symmetrical construction, and each magneto serves its own set of four cylinders, it being possible to drive them at engine speed in such a system. It is only necessary to set them at 90 degrees to each other when the action of each is the same as for a four-cylinder engine. But, should the customer not desire this kind of ignition, the Herrmann concern points out that since the bracket carrying the two magnetos and their drive is mounted on the gear cover, it can be removed without disturbing the engine construction, and whatever type of ignition required fitted in its stead. This allows a very flexible design.

The timing gears themselves are spirally cut and completely housed at the front.

Thermo-Syphon Cooling

Cooling is by thermo-syphon, which finds its most efficient use in the eight-cylinder engine due to the peculiarities of design which lend themselves most successfully to the free flow of the cooling water. In this respect, the Herrmann engine seems very well designed, for the water spaces are unusually large for a small engine, providing good jacketing of the valve pockets and upper part of the valve stems. The water outlets connect to the inner upper edge of the cylinders, which point is the highest in the cylinders.

The Detroit concern is among the first to employ splash oiling for an eight, and in this design claims to take care of the lubrication problem simply and effectively. There is a plunger pump feeding oil from the oil base to the connecting-rod troughs, and from these it is sent up into the cylinders and to the main bearings by splash. This system is claimed by the maker to work out very satisfactorily in practice.

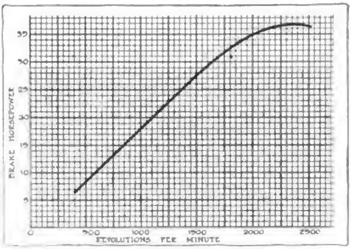
Single Carbureter Employed

The intake manifolding is arranged in bridge fashion. That is the design calls for a single carbureter with a vertical outlet, which is hung below the cross manifold that connects to each set of cylinders.

The engine is furnished with or without a bell housing to take a gearset, and when the unit power-plant feature is required, the housing can be cut out wherever the customer desires to put the motor-generator, providing electric cranking and lighting are to be fitted.

Following are the important dimensions, supplementing those already given:

Crankshaft bearings—
  Front—1½ inch diameter by 3¾ inches length.
  Rear—1½ inch diameter by 3⅛ inches length.
Connecting-rod bearings—
  1½ inch diameter by 1⅜ inch long (two per crank).
Camshaft bearings—
  Front—1½ inch diameter by 2½ inches length.
  Rear—15/16 inch diameter by 2 9/16 inches length.
Length from front of magneto to end of cylinders (hood length)—23 in.
Overall height—19 inches.
Overall width—19 inches.



Horsepower curve of Herrmann eight-cylinder motor

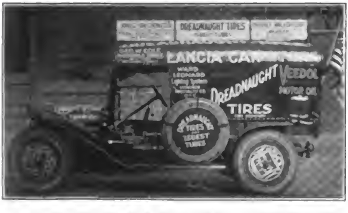
The accompanying illustrations show the motor in section and also the horsepower curve, which as already stated, indicates that the motor develops 35 horsepower on the block at a speed of 2,000 revolutions per minute. The motor section shows the bridge type of manifold used with the vertical connection for the single carbureter. It also illustrates the accessibility of the valves through the cover plates.

New Engineering Building for Schebler Plant

Engineering building now in course of construction as an addition to the plant of Wheeler & Schebler, Indianapolis, Ind.

INDIANAPOLIS, IND., April 24—Wheeler & Schebler, makers of the Schebler carbureter, have under construction a two-story, 30 by 70-foot addition to their plant which will be used for engineering purposes. The structure will increase the floorspace of the factory, which is already over 300,000 square feet, by about 4,200 square feet and will contain the engineering offices, drafting room, laboratory, experimental machine and pattern shops on the second floor. The first floor will be the testing laboratory, refrigerating plant, test car and experimental car garage. About eighteen men will be employed in the building, which will soon be completed.

Start Transcontinental Test for Dreadnaught Tires



Lancia car which is now on its way to San Francisco on a transcontinental test of Dreadnaught tires. Three extra shoes are carried. Note tackle on fender for rough road work and special cross-country type of body

BALTIMORE, MD., April 24—The Dreadnaught Tire & Rubber Co., this city, has started a Lancia car equipped with its tires on a 10,000-mile run from New York City to San Francisco. Before leaving New York, the tires were inspected and marked by a committee which will re-examine them on the return of the car from its journey and then make a report.

The interior of the car is arranged a la Pullman sleeper, the berth being suspended from the roof, though leaving sufficient room above for the long rack on which the lighter luggage is carried. No tent is required, the tailboard being very long and, when dropped outward, is completely covered by a single curtain, keeping the interior snug and dry. The company guarantees its tires for 7,500 miles and expects that the run will be completed on the original casings. D. LaPorte is in charge of the test and Harry Goss acts as pilot.

As may be seen in the accompanying illustration, the outside of the car is fairly covered with the advertisements of the manufacturers whose equipment and supplies are used on the run.

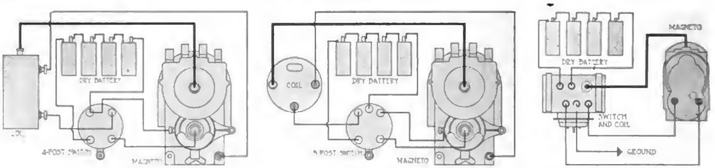


Fig. 1—Wiring diagram showing complete layout of electrical equipment on Little four

The Rostrum

Wants Information on 1910 Thomas

EDITOR THE AUTOMOBILE:—I have a 1910 Model M Thomas car, six-cylinder, and with a bore of 4.25 and a stroke of 4.5. What is the proper oil level in the crankcase and oil chamber?

2—How do you put the oil in the crankcase?

I have had trouble with the oil leaking out of the coupling between the gearset and the clutch and I plugged the hole in the shaft from the gearset and thus stopping the flow of oil. Will I experience any trouble by doing this?

3—How long should a magneto run without overhauling and what is to be done to keep a magneto in first class condition?

4—What is the average life of a spark plug?

5—I am using a Stromberg carbureter and when I throttle it down the engine stops; when it is speeded up to 20 miles per hour, it skips and backfires through the carbureter. How can I remedy this?

I find on climbing hills, the engine slows down and does not show the power expected, although the compression is very good.

6—What is the gear reduction and what speed should it show when in good mechanical condition?

7—What is the best oil to use on the engine?

8—Is the idea of putting an old shoe over a new one and sewing both together feasible? Does it take more power to drive a car so equipped?

Lynn, Mass. F. J. HADDEN.

—You should put 7 pints of oil in the crankcase between the front breathing tube on the left side of the motor and the rear breathing tube on the same side. The oil is placed in both these tubes above the left side of the motor, toward the motor front leg and left side of motor rear leg. The top is a funnel shaped tube with a screen cap. It can be removed by pulling it directly off.

2—This is answered under question 1 partly. When the oil leaks the trouble is that the packing either at the front or rear end of the main driveshaft is worn out. The packing is worn out of the ring thus causing the leak. Remove the coupling, take off the packing nut and repack with gerlock or candle wicking. If oil flows from the crankshaft into the clutch, plug this by driving a piece of pine wood in as a wedge. This will do no harm.

3—A magneto will run through an indefinite period of years without overhauling. There are many which have been in use more than 5 years without having received practically any attention beyond an occasional drop of oil. To keep a magneto in first class condition it should be oiled in accordance with the maker's directions and kept scrupulously clean.

4—The average life of a spark plug is also an indefinite quantity but 2 years may be said to be a conservative estimate.

5—From what you state it is evident that either the gasoline line is clogged, is too small in diameter, or bent at some point so that a sufficient flow of gasoline is not obtained to give the carbureter the amount necessary to supply the motor when speeding at above 20 miles per hour.

It may also be possible that the float mechanism has become disarranged in some way so that the level is not up to the correct height. This would also cause the motor to stop when throttled down, due to the fact that since the gasoline level is not up to the correct height the suction is not sufficient to lift the gasoline from this lower level and the motor would naturally stop for lack of gas.

6—The gear ratio might be either 3.25 to 1; 3.5 to 1 or 3.75 to 1. You can determine this by putting a chalk mark on the fly wheel, jack up one side of the car, put a chalk mark on the tire and make one complete revolution of the motor. The revolutions of the rear wheel should then be counted and divided by two since the action of the differential will multiply the throttle of the wheel. When in good mechanical condition this car is capable of between 55 and 60 miles per hour.

7—The best oil to use is a light vacuum grade.

8—While it would not be advisable to put an old shoe over a new one and sew both together, it is a very good scheme to sew two old ones together. While a certain percentage of more power is required to operate the car with this equipment than with a single tire, it will no doubt result in a direct saving where the two shoes are used.

Removing Wheel from Floating Axle

Editor THE AUTOMOBILE:—I am the owner of a 1914 Moon five-passenger touring car. The right hand rear brake drum is leaking grease which has worked its way from the differential casing.

Will you please let me know through the Rostrum how the rear wheel is taken off the axle housing, the same being a floating type?

I succeeded in withdrawing the axle, but do not understand how the wheel should be removed.

New Orleans, La. **J. E. Schenck.**

—The six nuts on the live axle flange which bolts to the wheel should be removed and then the live axle pulled out. There are two nuts on the end of the axle tubing, one of which is a locknut. These should be removed and the wheels can then be pulled off. There are annular bearings in the wheel and they come off with it.

Timing When Flywheel Is Unmarked

Editor The Automobile:—Would you please advise me in your next issue the valve timing of a Buick model 16, as the flywheel is not marked?

2—Can you advise me of some way to test a coil which is used on a Buick model 16?

Defiance, O. **J. C. Hanna.**

—The valves can be timed as follows: Adjust the pushrods and rocker arms to obtain the clearance of .015-inch between the end of the rocker arm and the valve stem, with the valve lifter roller on the back of the cam. Then, set the camshaft to close the exhaust valve when the piston is 1-16-inch past the upper dead center and to open the inlet valve when the piston is 3-32-inch past upper dead center.

2—Two different coils are used on the model 16 Buick, the Remy and the Splitdorf. There is no positive way to test these coils except to see that the primary circuit is all right when the vibrator works, and that the secondary is all right by obtaining a good spark on short-circuiting the coil.

Wiring Diagram of Little Four

Editor The Automobile:—Will you please draw a sketch for me of the wiring on the Little car, making sure to note where the different colored wires go on the magneto?

Winona, Minn. **A. Reader.**

—The wiring of the Little car is shown in Fig. 1. This is a complete diagram and will show where all the connections are made.

Adjustment of Type B Stromberg

Editor The Automobile:—Please give all adjustments for Model B-3 Stromberg carbureter.

2—What would you advise to use to clean out a radiator that seems to be full of flaky rust?

3—Can I use a 33 by 4 tire on a 32 by 3½ clincher rim? If not, what can I use that is bigger than 32 by 3½?

Scranton, Pa. **R. P. H.**

—The type B carbureter is a concentric type having a spray nozzle PN mounted in the center of the carbureter, and in the center of the float chamber, with its point 3-16 of an inch above the normal gasoline level and surrounded by a modified venturi tube. This nozzle is proportionate in size to the carbureter and never needs attention or adjusting.

After the carbureter is installed and the gasoline turned on, note the level of the gasoline in the float chamber. It should be about 15-16 of an inch from the lower edge of the glass marked X. This level is adjusted at the factory and should be right. In case it is obviously wrong remove the dust cap D and turn the adjusting screw S until the proper level is obtained. If the gasoline is too high, screw the nut down. If gasoline is too low, screw the nut up. Do not change unless absolutely necessary.

To start the motor, close the valve S3 in the hot air horn H. The motor should then start on the second or third turn of the crank; if not, open the valve and it ought to start on the next turn. Great care should be taken to see that this valve is instantly opened as the motor starts and is kept so.

Turn up the adjusting nut A until the spring S1, which is the low speed spring, seats the valve lightly. See that the high-speed spring above B is free and does not come into contact with the nut on top of the auxiliary air valve stem. Start the motor and turn nut A up or down until motor idles properly. This is the low speed adjustment.

Advance the spark and open the throttle. If the motor backfires through the carbureter, turn high speed adjusting nut B up until backfiring ceases. If with this adjustment and running at low speeds motor gallops, or the carbureter loads up, the mixture is too rich. The nut B should then be turned down until galloping or loading up ceases. This is the high-speed adjustment. The spring above nut B should always have at least 1-32 inch clearance between it and the nut at the top when the motor is at rest.

If after adjusting the nut A until the mixture on slow speed is correct you find that the valve is off the seat while the motor is at rest, it indicates that the nozzle is too large. If you find that nut B has to be turned up so far that the high speed spring is in contact with the small nut on top of the air valve stem when the motor is at rest, in order to get proper mixture on high speed, the nozzle is too small. To remove the nozzle take out drain cock DC in the bottom of the carbureter and then use a regular screw-driver. Nozzles are numbered, according to drill gauge sizes. For instance: Number 59 nozzle is larger than number 60.

2—Strong solution of washing soda and water.

3—Yes.

Graphite Grease Is Good Spring Lubricant

Editor The Automobile:—I have just read the article in The Automobile for March 25 describing the new Maxwell racing cars and would like to have this explained. You state that the cars used no differential gears. How do they get the different speeds on the rear wheels?

2—What type of differential do they use?

3—I drive a 1912 model 38 Buick and there is a slight squeak in the front springs. Some mechanics advise using a graphite grease between the leaves while others say not to, as it will cause the leaves to spread or slip. This does not seem possible as I understand that there is a center pin.

Berkeley, Cal. **P. J. Saunders.**

—The cars do not use any differential mechanism whatever and hence no compensation for different speeds is made on the two rear wheels.

2—This is answered above.

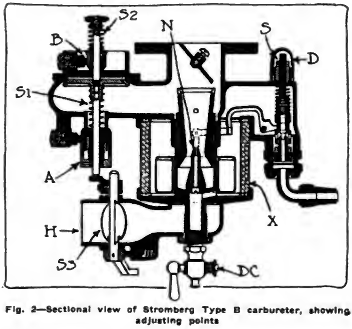


Fig. 2—Sectional view of Stromberg Type B carbureter, showing adjusting points

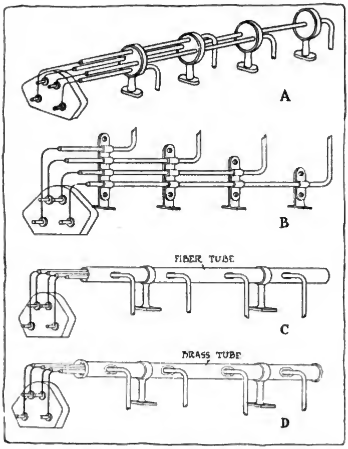


Fig. 3—A—Method by which the wires can be separated from one another to avoid static effects. B—Another method of separating wires to avoid static effects. C—With this arrangement static effects are sometimes felt. D—Running wires through brass tubing does not avoid static effects

3—The use of graphite grease between the leaves of the spring is very effective in preventing squeaks and there can be no possible objection to its use for this purpose. It is intended that the leaves of the spring slip freely over one another.

Home-Made Acetylene Welding Torch Fails

Editor, The Automobile:—Can you give me the requirements for becoming a member of the Society of Automobile Engineers?

2—What is the cause of an acetylene welding torch flashing back continually? I made the torch myself. The lead is first quality. No. 1 bronze and tips are made from soft brass rod. It worked finely for a while, then began to flash the moment the work was hot enough to weld. All my tips act the same. Can you tell me if there is any metal I can use for tips that will not flash back? How are the torches made that do not flash?

Somerville, Mass. J. T. F.

—The requirements for becoming a member of the Society of Automobile Engineers are exactly parallel to those for entering any other engineering bodies, that is, you must satisfy a committee that you are familiar enough with the art to be able to represent the standing of the body of members. You should address the secretary of the Society of Automobile Engineers, 1790 Broadway, New York City, who will furnish you with an application blank for membership, together with information regarding the different grades of membership in the Society.

2—The fact that you have made the torch yourself renders it remarkable that you have had at least some degree of success. The difficulties that have attended the invention of a suitable torch for oxy-acetylene welding are almost proverbial and it is only within very recent time that any success has been had. The first torch was invented by Edmund Fouché which was a high pressure type and some time afterwards the same man invented a low-pressure type torch. The nozzles of all torches suffer from the intense heat, but the direct cause of backfiring is generally due to holding the torch too close to the work which begins to radiate heat and then fires the gas. The heating effect of backfiring has lately been overcome by the use of water-cooled torches.

Static Electricity in High-Tension Systems

Editor The Automobile:—Will you kindly let me know a way to re-harden permanent magnets that have been through fire?

2—How wide a gap will a 3-8-inch spark in the open air jump under the compression of the modern automobile motor? A 3-16-inch spark?

3—Does static electricity ever interfere, to any extent, in high tension ignition systems? If so, how?

4—How can a condenser be tested with ordinary measuring instruments?

5—Does the new Splitdorf-Apple motor generator have two different windings on the armature? If not, how does it take care of the large current in cranking the motor without burning out?

San Francisco, Cal. A. S.

—Hardening of magnets is a most particular operation and is done by a score of mechanics who do nothing else. It is work that involves the qualifications of an expert and hence it is impossible to give hard and fast instructions regarding this matter. It would be much cheaper in the long run to obtain a new set of magnets from the maker.

2—A spark which will jump 3-8 inch in open air at any and all speeds, will work at approximately 1-32 inch under compression. A 3-16-inch spark will work at 1-64-inch under compression, under certain conditions. A spark of the size mentioned would work under a great deal larger gap, but, for reliability and to obtain the greatest value from the spark, the figures given are most advisable to use.

3—Static electricity interferes to a great extent in high-tension ignition systems if provisions are not made for taking care of same. The precautions necessary to take consist of correctly placing the high-tension wires that run from the magneto distributer to the plugs. Illustrations showing the various arrangements which can be made are given in Fig. 3.

4—A condenser can be tested by ordinary measuring instruments. The amount of charge it will take and the discharge it will give can be measured most directly by means of a galvanometer.

5—The new Splitdorf-Apple motor generator has only one winding on the armature. This winding is of sufficient size and of sufficient conductivity to safely handle the starting current delivered by the storage battery.

Firing Time of 45-Degree Eight

Editor The Automobile:—I will be obliged for information regarding how H. C. Chatain fires his eight-cylinder engine; two blocks of four cylinders set at 45 degrees to each other and having two outer crank pins, with crankshaft at 180 degrees with the two minor ones. I can only see the cylinders fired 45 degrees after the other and then 135 degrees, 45 degrees and again 135 degrees which makes one revolution.

If that is the case, could the engine run without vibration when the explosions are so unequally distributed?

Chicago, Ill. J. B.

—One cylinder fires 45 degrees, the sequence of firing being 45 degrees, 135 degrees, 45 degrees then 135 degrees and so on as per your understanding. If you will carefully read the paper you will note that the vibration set up by the mass of the moving parts is completely explained for an engine of 90 degrees, also for one of 45 degrees. In regard to the torque reaction, the 45-degree engine is obviously not as good as the 90-degree engine. To describe the action of the engine in an ambiguous way, so-called smoothness of operation of a 45-degree engine will be better than the ordinary four-cylinder design but not so good as the 90-degree engine. Special conditions due to its application are largely reasons responsible for the adoption of this design, and therefore you should consider your problem as separate and not necessarily draw conclusions from Mr. Chatain's engine, although it is doing its particular work satisfactorily.

Better to Fit New Camshaft

Editor The Automobile:—I have a Buick model 32 and am going to have the cylinders reground, new pistons and rings fitted and would like to know if I could increase the power and speed of this motor by shortening the outer end of the rocker arms thus making the valve have a wider opening. If so, please tell me how much to shorten it. Would it help any to advance the camshaft a notch or so ahead?

Rochester, Ind. Walter Ross.

—You would not secure satisfactory results by attempting to do this, but if you desire to change your firing and the characteristics of your motor it would be better for you to fit an entirely new camshaft.

Pumpshaft Too Light for Starter Mounting

Editor The Automobile:—Could a single unit starting and lighting system be used on a model 38 Buick and connected on the shaft driving the present pump and magneto; by using the shaft to start the motor, instead of the flywheel, or is this not practical?

2—What is the maximum speed of this motor as to miles per hour, also r.p.m. in a runabout model?

3—About what would be the cost of installing self-starter on this model? At present the car is equipped with a Vesta lighting system and a 6-80 Vesta battery.

Phillipsburgh, N. J. G. H. Z.

—A single unit starting and lighting motor generator could not be applied to the pump shaft of the model 38 Buick because the shaft and its bearings are not sufficiently heavy to take the torque necessary in cranking this motor. The compression is quite high and a considerable strain would be imparted to the bearing surfaces and the shaft itself in the momentary high-torque condition necessary in obtaining the initial cranking moment.

2—The maximum speed of the motor is about 2,600 r.p.m. The maximum power, however, is developed at 1,900 r.p.m. and at a gear ratio of 3.5 to 1 which is generally used on direct on these cars in connection with 34-inch wheels, the speed would be equal to 55 miles per hour, approximately.

3—It would be impossible to give an exact figure on the cost of installing a starter on this model as we have no record of any installations and the cost would greatly depend on the device chosen and the manner in which it is installed.

Front Wheel Drive Lessens Skid

Editor The Automobile:—Driving the front wheels does undoubtedly lessen the tendency to skid as W. H. P. suggests in The Rostrum for April 8, but as you point out it is hardly a practical remedy. There is a better way. First, what causes it? Try pushing a load on a slippery floor and note your feet slip badly. Put that load on your shoulder and note the slightness of any tendency of your feet to slip. This is all there is to it. Carry the weight on the drivers instead of requiring them to push it and skidding practically vanishes. This has been proven for the last 15 years by vehicles having most of the weight on the drivers. It is the eventual answer. And instead of driving the front wheels which carry the heavy motor and too much of the weight, the future construction will put the motor at the rear where the work is to be done. Then we will hear less about skidding.

Philadelphia, Pa. Chas. E. Duryea.

Motor Will Not Throttle Down

Editor The Automobile:—I have a car which has given me no end of trouble. It all seems to be in the motor. This motor will not throttle down below 15 or 20 miles per hour and this is very annoying as I cannot stop with the motor running without it sounding as though it was coming out of the car. . I recently had the magneto changed but I still have to run on batteries, the magneto firing very irregularly.

If this motor could be throttled down and the motor be made to run on the magneto, I would be very thankful for any information from you.

Immediately on closing the throttle the motor stops, all this while on the battery.

Goldsboro, N. C. R. M. Pettway.

—The probable cause of this trouble is that you are not securing a rich enough mixture at low speeds. If you will change the needle valve adjustment on the carbureter which will provide a rich mixture and then if necessary cut down on the air supply the motor should run at low speed. Another possible cause of this trouble is that the spark plug points are so far apart that you do not get a good spark until the motor has speeded up to such a degree that a high current is generated. Possibly another solution to the problem would be that you have an air leak somewhere in the intake line which permits too lean a mixture at low speed. Go over all joints in the intake line very carefully and see that there are no leaks there. A hissing sound when the throttle is opened suddenly is an indication of an air leak in the intake.

Wants Details of Timken Jackshaft

Editor The Automobile:—Can you give me any detailed description of the Brown-Lipe gearbox, such as is used in connection with the Timken jackshaft on the 1914 model Modern truck 1,500-pound capacity, as for adjustments?

Eureka, Cal. A. R. Carrico.

—A detailed drawing of the Brown-Lipe gearbox such as that used in connection with the Timken jackshaft on the 1914 Modern truck is given herewith. This is the model 50 jackshaft transmission of the Brown-Lipe gear company and is furnished especially to both in a unit with the Timken Detroit Axle Co. jackshaft. The detail is given in Fig. 4.

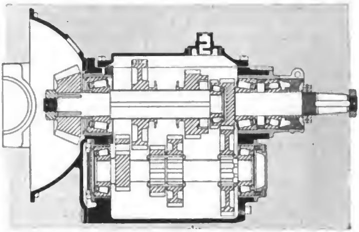


Fig. 4—View of Brown-Lipe gearbox as used in connection with Timken jackshaft

Outline of a System for Standardizing the Combination of Spring Elements Required for Motor Vehicles

(The Improvement of Spring Systems—XII)

By M. C. K.

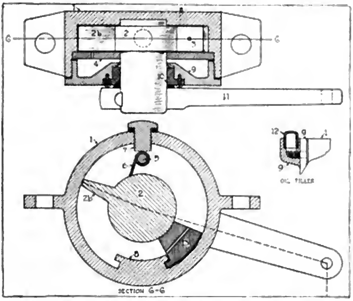


Fig. 7—Type of rebound check whose action is uninfluenced by load changes. With independent adjustment for regulating oscillation period. Similar action needed for all vehicle springs. See description on page 767

WIDER interest has been shown in conclusions than in reasoning and attempted demonstration of principles during the period while these articles have been running. It appears that the subject gains in actuality by having conclusions stated in advance and having the reasons for them stated afterwards. The preference for this order may be based on the idea that readers should be enabled to pass preliminary judgment with regard to the probable practical value of the reasoning before going to the trouble of following it. The writer yields to this view and, with a change of his original plan, presents in the following an outline of the principal conclusions with regard to spring systems to which the study of shocks and vehicle movements seem to lead. The only manner in which they could be shown completely and definitely would be in connection with detail designs of vehicles of the different classes, as in all cases there must be adaptation to established types of construction, and such elaborate work is here out of question, but enough can be said and shown to indicate to the practical builder of motor vehicles whether the constructive possibilities appeal to him and whether he will care to follow the reasoned justification of the conclusions in subsequent articles.

The elements in the demonstration which are lacking are mainly those which would take the form of showing that IN ALL CASES of road shock much bouncing of the vehicle body and of the running-gear can be avoided without increased force of impact or vibration by cutting the spring rebound short—even abruptly—at the point of static equilibrium of the spring against its load; further, that retardation of the rebound spring stroke constitutes the most suitable means for regulating the period of oscillation and becomes fully acceptable if the retarding becomes automatically stronger after sharp shocks and the spring system affords a progressively increasing resistance to spring compression; and, further, that sufficient range and softness of spring action coupled with compactness and working capacity or immunity under overload, is also best secured through a progressively decreasing flexibility.

Other conclusions have already been partly accounted for and relate to the cushioning for horizontal shocks, both longitudinal and lateral, and the advantage of employing non-vibrating material for the wheels of running-gears which are not protected against shocks by air tires. The latter conclusion was based mainly upon the observed fact that solid rubber tires are compressed by their loads almost to the limit of their compressibility and therefore transmit vibrations quite freely, through the metal of the springs, from all shocks except those due to impacts at uncompressed portions of the tire.

In the matter of constructive means for mitigating horizontal shocks it was provisionally understood that the writer can suggest only certain compromises with the requirements—different for the different classes of motor vehicles—but he believes that in other respects the system for combining spring elements which he presents in this article can be taken up and developed rationally by a vehicle builder for any given set of service requirements and can be made to cover a wider range of service conditions, both mechanically and economically, than any other combination of elements which has come to general notice in practice or theory. In this respect its merit can be judged directly by all who have practical experience, while the theoretical demonstration of the suitability of the combination for reducing both shocks and bouncing of the vehicle body to a minimum is yet to be made for a number of different and typical impacts—comprising single and compound impacts on one side or both sides of the vehicle, with the latter moving straight ahead or backward, in a curve and uphill or downhill, with load and without load—and must be made by means of charts representing the movements and forces to which the body and running-gear are subject under these different conditions.

Need of Testing Station

Such charts, while they can be sketched to one's own satisfaction by constant recourse to approximations and offhand experiments on the road, are found difficult to present convincingly, even if they are limited to the conditions applying, for example, to a medium size delivery wagon with hard tires, but, as referred to in a previous instalment, they might be produced automatically with a rather simple testing equipment for vehicles with air tires as well as for heavy utility wagons, and it is to be hoped that such a testing equipment may be established somewhere in the industry (preferably by a tire or spring-making concern) to make all reasoning on the subject more convincing to the practical man.

As will be seen, either half-elliptic springs—including C-springs and platform springs as modifications of this type—or cantilever springs can be adapted to the conclusions arrived at, or *vice versa*, but cantilever springs present special inducements, being applicable in relatively short lengths. A device for checking rebound, with or without retardation of the rebound stroke, plays a rather important part in the proposed standardization of elements, as it can be adapted to perform other useful functions, such as absorbing lateral shocks and correcting that "roll" of the vehicle body for which the cantilever spring is blamed (with more or less justification, the fault lying partly in the load distribution with relation to the wheelbase).

Combination Meeting All Requirements

Taking stock of the conclusions rapidly, it is now seen that a system planned in accordance with them must meet the following requirements, in addition to those ordinarily made which relate mostly to refinements in comfort: It must include (1) an element, such as an air spring, which can be made load-supporting and whose resistance to compression can be made so rapidly progressive as to impart the required measure of progressivity to the whole combination of which it is a part; but this element can be omitted if the load of the vehicle is practically constant and leaf springs of very ample dimensions can be employed; (2) a rebound check which stops spring extension with close reference to the position in which it is in equilibrium with its static load; (if it does not check at this point, independently of load changes, shocks received in quick succession are likely to become much aggravated at the second or third of the successive impacts); (3) design features which will serve to reduce the force of horizontal shocks, and these features must be much more effective for vehicles with hard tires than for those with air tires.

Standardization

Quick response to slight shocks, a certain steadiness in the resistance against lateral and pitching movements of the vehicle body, the proper consideration of economy of manufacture, sightliness and the absence of all need of special attention in upkeep, are of course features that must be demanded, and, in fact, a revised spring system should not only meet the vehicle requirements but also the industrial demands for standardization, or an arrangement enabling manufacturers to cover widely varying vehicle requirements with a product in which the elements may be produced in only a few variations of dimensions. An air spring, with its possibilities for division in compartments, to vary the volume, and for varying the degree of inflation, is in this respect attractive, affording a chance for restricting the variation of leaf spring dimensions. And a rebound check with a suitable damper adjustment can also be made to answer equally well for all work ranging from very heavy to heavy, from heavy to medium and from medium to light, without any finer distinctions, if it is designed with this requirement in view.

As the question of a suitable installation of an air spring in a motor vehicle is not without practical difficulties, it would be desirable to show a definite mode of installation in connection with the accompanying sketches, Figs. 1 to 6, but the writer refrains from showing specific construction at this point, as the type to be preferred depends largely upon the design of the vehicle frame. Air springs are now employed in different forms. The Westinghouse air spring of the piston type, the Cox air cell of spherical shape and the Hoffmann construction of the diaphragm type (belonging to the Saurer concern, so far as known) are examples. Even the ordinary air tire may be looked upon in the same light, though it co-operates with the vehicle springs without any other mechanical bond between the two than the action of gravitation which affects the tire and the spring at approximately the same instant.

The Air Leakage Problem

It can be made plain that the essential properties of an air spring needed for the system can be secured in practice without involving an onerous change in frame design, and the sketches therefore show this feature diagrammatically in several forms, each a mere symbol of the properties it represents. It should be non-leaking and should require no attention, once the pressure is adjusted to the vehicle, and these qualities can be secured. To secure them is a smaller problem, when the utility of solving it is realized, than most of those which steel makers, tire makers and vehicle builders have been called upon to solve in the past. The writer will therefore not urge or describe the method he at present considers the best for securing non-leak and no-attention properties as well as a ready command of the progressive scale of resistance to flexion. It is also true that any other spring unit affording a sharply progressive resistance to flexion can take the place of an air spring, so far as the functioning of the system is concerned, but the regulation of the rapidity of action and reaction is probably more conveniently effected with air as the elastic element than with any other material.

An air spring can have its principal dimensions inside or outside of the frame, in any convenient place, provided the range of movement which it is to allow the leaf spring, in addition to the leaf spring's own flexing movement, is effected at the place where the leaf spring abuts against it.

Air's Contrasting Functions

In the plan for standardization the air spring serves two purposes. One is to give range and flexibility, in any desired degree, in connection with a leaf spring which is too short and stiff to act suitably alone, or, in case of operating with a half-elliptic spring, to give strength and working capacity to a leaf spring which separately would be too weak and flexible. The importance of having an element which in this manner releases leaf spring design from its practical limitations and permits their dimensions to be subordinated without harm to other vehicle design requirements was dealt with in articles X and XI. The other purpose is to supply the progressive resistance which gives great flexibility for light loads and light shocks and also sufficient range of action for overloads and sharp shocks. (For comparison it may be mentioned that the most efficient arrangement employed at present for obtaining a wide range of good action comprises a platform spring in which the action of the transverse member is limited to work with the light loads and shocks and the half-elliptics strong enough alone for the middle range, while an overload spring secured transversely in the frame above the axle helps to take care of extremes). The period of oscillation of the air spring can be regulated by introducing a resistance element in its operation, as well as by the quantity of air used and by its tension, the period being lengthened by resistance and by reducing the air volume but shortened by increasing the tension. These are factors which can be calculated and proportioned suitably for each case, still leaving great freedom in the selection of the leaf spring dimensions. If the oscillation period of the air spring is regulated separately, the regulating action which can be effected by means of the damper adjustment of the rebound check is to that extent relieved and can be reserved for the free end of the leaf spring, but in the case of fast vehicles with running-gear of light weight the free end of the leaf spring is perhaps better left unrestrained, so as to oscillate rapidly for the small inequalities of the road (performing the function for which it is frequently contended that auxiliary coil springs are useful). In the case of vehicles with heavy running-gear the damper action may be desirable to reduce tire wear, and at all events it can be employed to correct faulty speed of the air spring.

In connection with all of the sketches, Figs. 1 to 6 inclusively, it may be best to note that their proportions, as well as the shapes, are haphazard and crude, and also that in reality the air spring element can be smaller in proportion as the leaf spring comes nearer to the dimensions which would enable it to do all the work alone.

The Effects Obtained

One of the simplest forms of the proposed equipment is indicated in Fig. 1 and may be suitable for very light cars and other vehicles for which the location of the air spring, on the outside of the frame, and the necessity for inflating it occasionally is not objectionable. A quarter-elliptic is pivoted to the frame, and the driving thrust can be delivered through it. It rests against a short tube similar to a section of tire tube (with air tube lining) which is closed at both ends and backed by a curved flange with cups at the ends, riveted or otherwise secured to the vehicle frame reach. Flexion of the leaf spring causes an increasing area of the air tube to be acted upon in the measure as the static or shock load increases and also shortens the active portion of the leaf spring; the latter element in the action is softened, however, because the fabric does not constitute a rigid fulcrum but one permitting the spring to bend along its entire length. The oblique position of the leaf spring causes the axle A to recede under shock, so as to afford some cushioning of the horizontal shock component. The rebound check R prevents separation of the spring elements and moderates the rapidity of oscillation in the manner explained in connection with the description of this device, Fig. 7. It is in this case shown in the form in which the two arms, F and G, carry the box R, and these arms can be made so substantial, as well as flat and springy, as to serve to cushion lateral shocks and to obviate too much roll of the vehicle body at turns, and on other occasions when a tendency to roll develops. A pitching movement of the vehicle body, such as is likely to occur in case of an abrupt stop or retardation, especially when going downhill, and which consists in sudden unloading of rear springs and overloading of front springs, is also prevented by the normal action of the rebound check. (But a running-gear which is very light at the rear may be raised from the ground by an unusually sharp action of this kind, or the friction with the road may be so much reduced as to cause skidding—as well understood in the case of sharp turns of racing cars, where the retardation causes the pitching and the turn the further concentration of loads on the outside wheels in the curve—and this is one of the few good arguments against lightweight wheels and axles.)

All Varieties Work Alike

All the functions here mentioned with reference to Fig. 1 will be observed to apply also to the designs indicated in Figs. 2, 3 and 5, and their peculiarities can be covered briefly. In Fig. 2 the cantilever spring, with fixed front pivot, has a lever L secured under its clip and shackled at its other end to transverse T of the vehicle frame. By means of this lever the air cell C is suitably actuated. Being inconspicuously mounted inside of the frame and secured to the transverse in any preferred manner, the air cell can be constructed on any one of the plans which will prevent leakage and produce an exact and predetermined scale of flexibility. The air spring on one side can readily be connected with that on the other, if this is found desirable with a view to getting increased flexibility for one-sided shocks, and thereby compensate for the additional friction which is caused in these cases by torsion of the leaf spring and flexion of the arms of the rebound check.

Fig. 3 is shown with a rebound check of the same type as in Fig. 7, with the cantilever spring shackled in front and with a transverse rod V connecting the springs on opposite sides of the vehicle. The lever L is longitudinal inside of the frame and is moved by V on which it is journaled. It is pivoted to the frame in front and the driving thrust can be delivered through it. The air cell is secured longitudinally on the inside of the frame.

Best Shape of Flexible Cell

That the air cell is shown in all cases with a flexible element of elongated form and with a longitudinal curvature is because a flexible element affords the simplest construction, the elongated form gives the smallest flexion of fabric and the shortest mechanical actuating movement for a given displacement of air, and the longitudinal curvature permits flexion to the extent of an equal opposite curvature without stretch of fabric and therefore with a minimum of stress and deterioration. This is illustrated in Fig. 4. As a flexible tube subjected to pressure from within tends to straighten out, this design also facilitates mounting, the pressure holding the tube against its backing and into its end cups or abutments. Practically only the matter of establishing security against gradual leaking is to be taken care of additionally.

In Figs. 1, 2 and 3 the air spring supports the load and is figured for an initial flexibility much greater than that of the leaf spring. To avoid too great initial flattening under the mere static load, it may be desirable to relieve the air spring of a portion of it. Fig. 5 shows one way of doing this. The three-armed lever, inside of the frame, is pivoted to the frame reach at D, while the transverse rod V passes through the lower arm, and the third arm actuates the air cell C. The static load support is thereby divided between D and C. Probably more suitable methods may be devised.

With Half-Elliptics

When the system is applied to half-elliptic springs, the cushioning effect against the horizontal component of shocks which is obtained from the cantilever springs in some measure by giving their movement a slight rake, is perhaps best secured by special means, especially by using converging radius rods capable of yielding slightly in both directions and so connected as to obviate turning of the axle by one-sided shocks, as referred to in previous instalments. This matter is here not entered upon further, except in connection with heavy vehicles which do not benefit from air tires.

The half-elliptic springs can be made very flexible, as their relation to the air spring provides the additional carrying

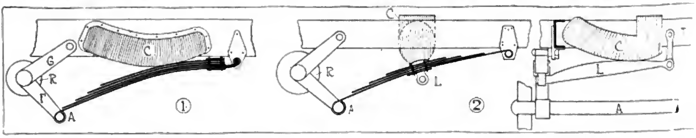
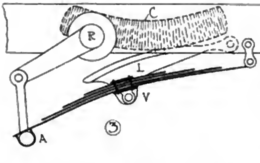
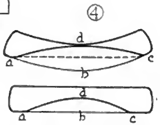


Fig. 1—Complete combination of spring elements reduced to its simplest form; for light cars with air tires, including cyclecars, delivery carts, etc. Fig. 2—Diagram, in side and end views, of general arrangement of spring elements for cars of medium weight





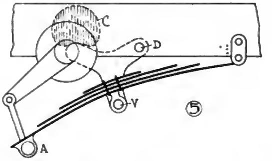


Fig. 3—An arrangement of elements which can be made suitable for motor vehicles of any class. Fig. 4—Illustrates shape of flexible cell in which fabric is never stretched by flexion; adc (flexed) no longer than abc. Below it is a cell whose fabric is stretched or strained by flexion; adc > abc. Fig. 5—A method for relieving air cell of part of static load

capacity. They may be made, for example, to fit the vehicle without load, so as to remove all load from the air spring when the vehicle is not in use. Fig. 6 indicates one of many possible ways of arranging the combination. The two upper arms of a rhombic lever, starting from the axle inside of the frame, are curved so as to raise a suitably shaped plate which compresses the air cell, the latter lying alongside of the reach. The rebound check can then convenently be on the outside.

Modifications for Front Springs

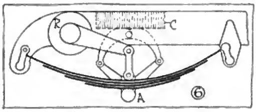
For front springs the cantilever spring construction, in some form, should be suitable, giving naturally a horizontal yield, and if the load on the front axle is practically constant the air cell can be small or may be replaced by a fulcrum just sufficiently yielding to admit of proper flexion, although the front pivot for the spring is fixed. The arms of the rebound check can be robust enough to help keeping the axle from swaying out of its lateral alignment, considering that the leaf spring can be very short if a flexible fulcrum is used. With an oblique position of the spring, the steering rod should probably by preference be of the transverse type, but this is a question best decided on the drawing board with reference to other car construction details in each case.

Rebound Check and Damper

A rebound check of such construction that it will perform the functions required is shown in sectional views in Fig. 7. It is of the hydraulic type, operating with oil. Lever 11 actuates shaft 2, in one piece with which is the piston vane 2*b*. When the vehicle axle goes up, piston 2*b* is turned downward in the interior chamber of casing 1, which is separated from the smaller front compartment by plate 4, through which the shaft passes. Driving the oil before it, piston 2*b* by this movement raises the free piston 3 on the other side of the shaft in the inner chamber. This movement is unrestricted, as the oil passage is always large past the lower stop 8 and the valve flap 6 turns freely around the fixed pin 5 when the liquid moves in this direction. Plug 7 can be screwed in or out to adjust the return flow, but cannot reach and interfere with valve flap 6. Any given adjustment can be protected by a thin locknut under its head. When the vehicle axle begins to turn back, after the force of a shock has been exhausted, the liquid is started in the opposite direction by piston 2*b*, and if plug 7 is flush with the inner wall of the chamber the flow is scarcely restricted, though valve 6 does not open, and in that case no appreciable restraining influence upon the rapidity of the spring and axle rebound is exerted until the free piston 3 has reached back to the position from which it was started. This it will do at the same moment, practically, when piston 2*b* gets back to its initial position, which is that corresponding to the position of the axle when the vehicle is at rest. A small hole through piston 3 allows a slight bypassing of oil—very slight when the movement is sharp—but the effect is the same when piston 3 goes up as when it goes down, so that the time for its return to stop 8 is not affected. The moment, however, stop 8 is reached, piston 3 opposes any further upward movement of piston 2*b* and thereby any further downward movement of the vehicle axle and any further rebound or extension of the spring. The only yielding element in the check comes by forcing oil through the small hole.

If an earlier retarding of the rebound stroke is needed in order to lengthen the period of vibration, plug 7 is adjusted to retard the oil circulation for the whole rebound. Thin oil can be used, so that temperature will have no appreciable influence upon the degree of retardation. The action of the free piston remains unchanged, except that the forces it must resist become smaller.

Fig. 6 — Diagram of an arrangement which can be used with half-elliptic springs. Air cell could also be actuated as in Figs. 2 and 3



If the static load of the vehicle becomes smaller or greater, the initial position of piston 2*b* is changed, but that of piston 3 remains what it was, except for the moment when the change of load is effected. It returns automatically to stop 8 by gravity whenever piston 2*b* is not suddenly moved, the small hole permitting this movement. The whole action is therefore unaffected by load changes.

Other features in the construction have reference to durability, avoidance of friction and noise, as well as the total avoidance of oil leakage by removing pressure from the shaft bearings. Any oil escaping from the interior chamber by way of the bearing in plate 4 enters the front chamber which is also full of oil. A small hole in plate 4 (on that side where there is no pressure) equalizes the contents, and a copper gasket ring between screw cover plate 9 and an inserted bronze bearing bush completes the protection, and the bearings are long and large, besides. As neglect of these factors have interfered with the utility of other hydraulic devices, it seems necessary to mention them, although they are only indirectly connected with the subject of an improved spring system.

There remains to be mentioned some suitable expedient for reducing the force of horizontal shocks for vehicles operated with hard tires, as the means proposed are admittedly insufficient unless the assistance received from air tires in this respect can be counted upon. The writer at this point finds no solution, even tentative, for vehicles which are relatively light and are supposed to be driven at higher speeds than 15 or 20 miles per hour. But for heavy vehicles intended for slower driving with large loads, a certain wheel construction appears to present some inducements which may be worth investigating, so much more as the same construction no doubt

(*Continued on page* 783)

3 1-2-Ton Hall Truck Enters Field

Substantially Built of Standard Parts—2 1-2-Ton and 5-Ton Models Planned—Seat and Dash Welded Steel Unit

LATEST to enter the truck field is the Lewis-Hall Iron Works, Detroit, Mich., which is an old established plant not connected with the automobile business until the bringing out of this new truck. Doing a structural steel business, the founder of the concern, Henry B. Lewis, has been located here for more than 25 years. Last year he associated H. S. Hall with himself under the present organization which was incorporated for $175,000. Mr. Lewis is president and treasurer, while the active management is shouldered by Mr. Hall, the vice-president. The concern is regarded highly in Detroit, and is of unassailable standing.

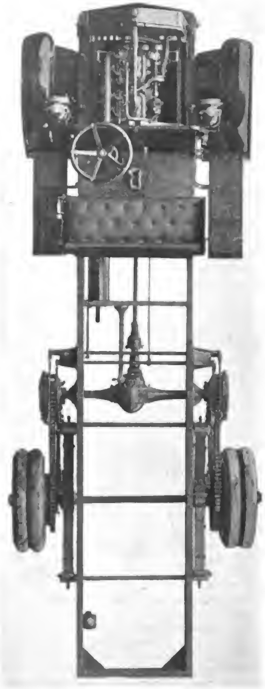
In addition to having a complete plant for the making of structural steel parts, the concern maintains a machine shop equipment, and is thus happily situated for truck manufacture. The chassis and frame are constructed by the company. W. K. Ackerman, formerly with two other truck concerns, is the designer.

Line Will Be Complete

The new Lewis-Hall product is known as the Hall truck, and is strictly an assembly proposition, making use of Timken axles, Continental engines, Brown-Lipe gearsets, Gemmer steering gears, Mayo radiators, etc. Though details of only the 3 1-2-ton model are given out at this time, the concern is planning to have a complete line of vehicles to meet all classes of service. Later, then, there will probably be a Hall 2 1-2-ton model and a 5-ton type. However, the model here described is typical of the Hall make, and will serve to indicate what the general design of the other models will be.

Unit Power Plant

The Continental engine used is the 4 1-2 by 5 1-2 four-cylinder L-head type with the cylinders cast in pairs. The gearset is in unit, and the whole assembly is hung from a special auxiliary frame separate from the main frame. This is commendable construction for heavy duty service, and thus any twisting or weaving to which the main frame is subjected is not transmitted to the engine unit, a feature of design which is very desirable.



Plan view of 3 1-2-ton Hall truck chassis

This motor has a factory rating of 45 horsepower, while the S. A. E. formula accords it 32.4 horsepower at 1,000 r.p.m. The lubrication system is of the combination force feed and splash type which should be of special advantage in truck service. The cooling is another important point to be considered for truck work, and it is taken care of by a centrifugal pump mounted on the engine base and driven at engine speed. The Mayo radiator is a cellular type and is carried on specially-designed spring buffers so that road shocks and jarring will not hurt it under normal conditions. There are coil springs above and below the carrying point, enabling the mounting to take the rebound as well as the road shock.

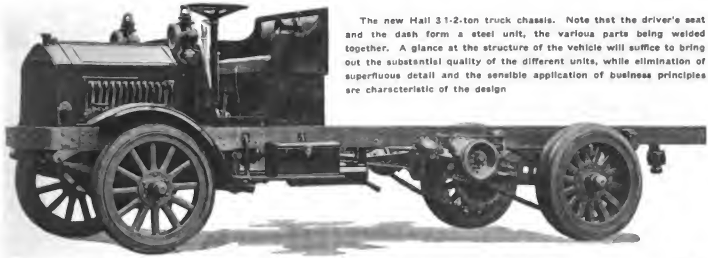
The motor uses a Zenith carbureter, in connection with which a Kramer governor is fitted which is of the intake type. It is set to get the maximum engine power at 1,140 r.p.m. The carbureter has a special by-pass to take fuel used on the idle or slow speeds through a passage directly into the butterfly valve in the governor, which valve also acts as a port to open and close the by-pass as needed. It is stated that good fuel economy results from this arrangement. Single ignition by Eisemann magneto is employed.

Truck Is Substantially Built

The chassis construction presents no unusual features of design, but appears to be substantially built along conservative and conventional lines. The drive from the three-speed gearset back to the jackshaft is through a shaft having two universals, one at either end. The jackshaft is the regular Timken design with a ratio of 3 3-7 to 1, standard. Other ratios to meet special service are optional, however.

Then from the jackshaft, the power is sent to the rear wheels through roller chains of 1-inch width, and 7-8-inch roller form. The pitch of the chain is 1 1-2-inch. The Timken rear axle is of the dead type and the springs attach to it substantially, and run outside of the side members of the frame to their mountings. Timken bearings are used throughout the axles and the gearset.

The total gear ratio from motor to rear wheels is 9.39 to 1, standard with other ratios optional, as stated above. The springs measure 52 by 3 1-2 inches, rear, and 45 by 2 1-2 inches front. The leaves have tapered points. The braking system employs one set of brakes on the jackshaft and the other on the rear wheels. Those on the jackshaft, the service set, have 12-inch drums.



The new Hall 3 1-2-ton truck chassis. Note that the driver's seat and the dash form a steel unit, the various parts being welded together. A glance at the structure of the vehicle will suffice to bring out the substantial quality of the different units, while elimination of superfluous detail and the sensible application of business principles are characteristic of the design

while the emergency brakes on the wheels act on 18-inch drums and expand internally.

The frame for the Hall truck is manufactured with all accessories such as brackets, step hangers, and so on, in the concern's plant from a special rolled steel channel stock. The channel is 6 inches deep, and the metal 7-16 inch thick. The frame measures 39 inches across.

Seat and Dash Form Steel Unit

The seat and dash construction is worthy of comment, being made from steel and welded together to make one unit. This will remove any tendency to rattle and is a substantial way of building these parts. Sockets are provided for the attaching of a top for the driver's cab. The gasoline tank goes under the seat and can hold 32 gallons.

Steering gear is worm and sector in design, and the wheel, mounted horizontally on a vertical shaft, is on the left, with control levers in the center. A feature which lends to the appearance of the truck is the use of crowned fenders. These are substantial and free from rattles.

Loading Space of 145 Inches

The standard wheelbase of this 3 1-2-ton model is 144 inches, which gives a loading space of 145 inches without body overhang. Optional lengths of wheelbase from 10 to 18 feet are obtainable, and frames up to 24 feet are to be had to meet special haulage conditions. The standard tire equipment calls for single front tires and duals in the rear, both sets of which are 36 by 5 size.

The standard chassis price is $2,800 with driver's seat and dash. The option of electric starting and lighting equipment at $150 additional, and of rear wheel and tire equipment of 40 by 5 size, dual, at $50 extra, are exemplary of the provision made for taking care of any requirements. Rear springs of 5-ton capacity are also fitted at an extra cost of $10.

Commerce Jitney Bus on 1,500-Pound Chassis

FOLLOWING the lead taken by several other manufacturers, the Commerce Motor Car Co., Detroit, Mich., has placed upon the market a jitney bus, which at the same time may be used as a station, hotel and baggage bus.

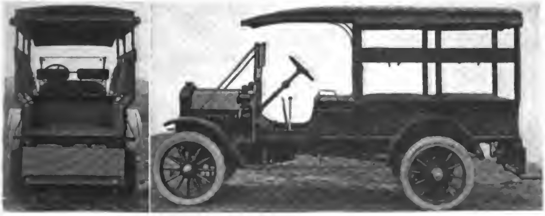
The bus is known as model S J R and is listed at $995. In general construction it is similar in all particulars except the body to the 1,500-pound trucks made by the same company and which sells at $975.

The new bus has room for nine passengers in addition to the driver. The seats are in pairs of two, so that if only four passengers are in the bus the other four rear seats can be folded up out of the way and the space used to carry the luggage. Entrance is from the rear with one seat next to the driver.

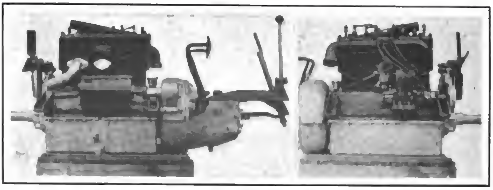
The length inside is 73 inches, the width 42 inches. Between seat backs the width is 48 1-2 inches. The height inside is 56 1-2 inches and the width of the aisle 15 1-2 inches. There is a clearance of 10 1-2 inches between the floor and the seats, while the height of the tail gate is 12 inches. Wheelbase of the vehicle is 107 inches and the tread 56 inches. A four-cylinder Continental 3 1-2 by 5 power plant is used. The carbureter is a Holley, the ignition Eisemann and the gearset of the three-speed type.

The rear axle is a Salisbury three-quarter floating. The wheels are of the artillery type and are shod with pneumatic tires 33 by 4, front and rear.

Gray & Davis starting and lighting system is furnished at an additional cost of $125, while gas lights and Prest-O-Lite tank are $35 extra.



Rear and side views of the Commerce combination jitney, station, hotel and baggage bus. Note how the seats fold out of the way when not in use



Side views of the Clark motor used with the Kearns Trio

Quick Detachable Bodies on Kearns Cars

Runabout Touring or Light Delivery Types Interchangeable Within 10 Minutes

SOMETHING new in the way of a combination car has been brought out by the Kearns Motor Car Co., Inc., Beavertown, Pa. It is known as the Kearns Trio and, as the name expresses, is a three-in-one car unit which can take the form of either a runabout, a touring car or a light delivery wagon of 800 pounds capacity.

Change Back of Foredoor

This three-body car is different from previous combinations because the entire body is not changed but only the part back of the foredoor. By slipping on the extra rear portions of the different bodies, the three combinations are made. With this arrangement the car is always the same from the radiator as far back as the rear end of the door to the driver's compartment. Beyond this point the additions which are slipped in place make the car either roadster, touring or commercial. The car can be bought in chassis form without any of the bodies, or it can be bought with any one of the three or the complete outfit. When sold with a runabout body it is styled Model R, with the touring body Model T and with the delivery body Model D. Any of the bodies can be attached within 10 minutes, there being but four bolts to remove. All the other parts of the car are contained in the cowl section and other parts of the permanent chassis and hence there need be no change in wiring or gasoline connections.

One of the advantages of this style combination car is that should it be desired to change bodies later, it can be done readily and if the car is ever put upon the used car market, it can be furnished with a delivery body after it has served its period as a passenger design.

Follows Standard Practice

Mechanically, there is nothing about the car which deviates very strongly from standard practice except in the method by which the three bodies are attached. The touring car is a five-passenger design and other than its detachable arrangement gives the appearance of a lightweight design of ample roominess. The details are all of standard design as would be expected in a car which is assembled from the products of the parts makers.

The motor is made by the Clark Engine and Boiler Co., Kalamazoo, Mich., and is a four-cylinder block design giving a 2.875 by 4.5-inch power plant. The cylinders are cast in a unit with the top half of the base from gray iron and are reamed to standard size. The cylinders are interchangeable and are provided with waterjackets which pass completely around each cylinder head is cast separately and can be readily removed to reach the combustion space for the purpose of removing carbon or reaching the valves for grinding. The lower half of the crankcase is made of aluminum alloy and is entirely in one piece with the oil pan at the bottom. The center half and top half of the crankcase form a full housing over the flywheel, to which is bolted the gearbox. The motor is suspended at four points.

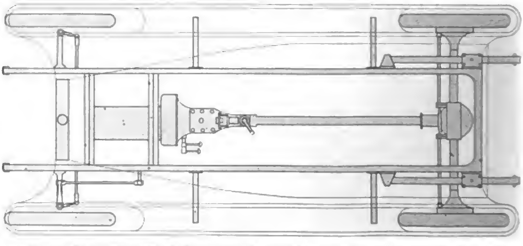
Valves Are Accessible

The valves are all on the left side of the motor and are operated through mechanism which is entirely inclosed. The valve can be reached for adjustment by removing a side plate which is held in place by means of a large hand nut. Both inlet and exhaust valves have a working diameter of 1.25 inches and all the working parts are hardened and ground. The pushrods are mushroom design of nickel steel, hardened and ground.

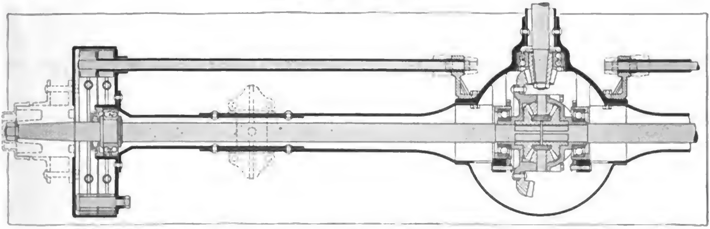
The pistons are gray iron castings, being of the same material as the cylinders. The rings are also cast iron and the piston pins are open hearth steel hardened and ground. The connecting-rods are drop forgings from open-hearth steel and are I-beam in section and heat-treated to give the best possible rigidity. Each of these rods is kept to an absolute uniformity in manufacture by machining to jigs.

Camshafts Made in One Piece

The camshafts are drop forged from open-hearth carbon steel and are also hardened and ground, being manufactured in one piece. These shafts are carried on three bearings with cams designed to provide a quiet action. The crankshaft is



Plan view of chassis employed for the new Kearns product with three interchangeable bodies



Sectional view of rear axle and brake mechanism on Kearns car

a drop forging from open-hearth steel, heat treated and ground. It is carried on three main bearings which are lined with die-cast nickel-babbitt. The sizes of the bearings are 1.625 by 2.5 inches at the forward end, 1.625 by 1.875 at the center and 1.625 by 3 inches at the flywheel or rear end. The diameter of the crankshaft is 1.625 inches. These shafts are balanced both dynamically and statically on each motor.

Silence an Aim Throughout

Throughout the motor the design has been made with a view towards securing silence as far as possible. Some of the representative features which make for this end are helical timing gears, inclosed valves, and main bearings of ample size. The cams are also designed to give an easy lift and the valve adjustments are such that play can be taken up between the valve stem and end of the pushrod.

Thermo-Syphon Cooling

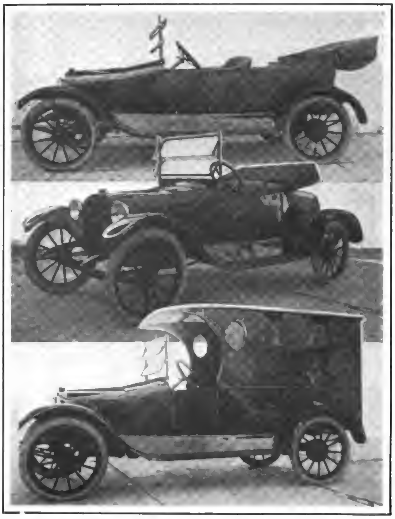
Cooling is by thermo-syphon, the water header being cast directly with the cylinder head, as shown in the illustrations herewith. The water pipes are so designed that connections can be made to the radiator without bending the hose. The exhaust manifold is cast iron and the inlet manifold is cast within the waterjacket of the cylinder, being designed for a side inlet carbureter bolted directly to the cylinder wall. Lubrication is a combination force feed and splash system, the oil being pumped positively to the main bearings and also into splash pockets beneath each connecting-rod.

Power is delivered through a multiple disk clutch to a three-speed gearset which has the change speed lever mounted directly in the center. The rear axle is a three-quarter floating design and the differential can be taken out of the rear housing plate without taking down the entire axle. Axle shaft diameter is 1.25 inches and it is carried on a double row of ball bearings. Both emergency and service brakes are inclosed and operate against the same drum being of the expanding type. The brakes are worked through equallizers attached to the central part of the axle, one brake being worked by a tube and the other by a rod which passes through the tube.

Electric Lighting Standard

The head lamps are attached in an original manner being directly in connection with the bonnet. The lamps are light and put no strain according to the claims of the company, upon the radiator. Electric lighting is supplied with the car which markets for prices between $650 and $750 according to which outfits are specified. The wheelbase is 107 inches, the tread standard and the tires 30 by 3 1-2. It is stated that a speed of 45 miles per hour can be made.

Ample room is provided in the bodies and the fitting has not been neglected. The space back of the seat in the delivery wagon is 39 by 58 inches, affording ample room for light package room, etc., up to 800 pounds. The runabout is especially adapted for carrying luggage in the rear, the space back of the seat being 15 inches high by 36 inches long and 40 inches wide. The touring car is a five-passenger design and is upholstered in heavy black mule skin with soft hair cushions. Spare tires are carried on the rear and equipment is complete with an extra rim. The touring body includes robe and foot rails with one man top.



Three bodies which can be fitted optionally and interchanged within 10 minutes on the Kearns chassis

Service Is N. Y. Engineers' Subject

Metropolitan Section of S. A. E. Discusses Truck Makers' Obligations to Customers—Arguments for Improvement in Systems, Providing for Inspection, Etc.

NEW YORK CITY, April 23—Service and the Commercial Car Engineer was the topic of the regular April meeting of the Metropolitan Section of the Society of Automobile Engineers which was held last night at the service station of the Autocar Co. in this city. The paper was by B. B. Bachman, assistant engineer of the company, who demonstrated his points later during a tour through the building participated in by the members present. A digest of the paper follows:

It is an undoubted fact that the present is an age of service. Leaders in all lines of endeavor have recognized the value and benefit to be derived from a competitive standpoint, in excelling in this much advertised phase of modern business. The retail merchant, the expressman, the contractor, hotel proprietors at resorts and in our cities, realizing the need of leading their competitors or of getting into a competitive position, are turning to this new tool as a means to attract patronage.

A large majority of these prospective or actual users of commercial vehicles are not in a position to care for them outside of the necessary routine matters of lubrication, minor adjustments, cleaning, etc., and in these feel the need of expert advice and assistance. In addition to this, the early attempts at developing motor vehicles necessarily were based upon experience gained from the earlier cars constructed for passenger transportation. They were therefore full of imperfections and to this fact many of the pioneer users of motor vehicles can testify.

Therefore, to meet the need created by the lack of knowledge of the operator, and, second, to reenforce the unavoidable mechanical defects of the cars so as to minimize their effects to the user, and, third, to keep in close contact with the cars in actual service so as to collect data which will enable the builder to improve his product—to a point which will gradually eliminate the second factor—there has arisen the service department operated by the builders of commercial cars, and to a lesser extent, passenger cars.

The Organization of the Branch

Having briefly outlined the reasons for the existence of the service department, it would seem to be in order to sketch the development of the organization and in doing this the author must draw on the experience of the company with which he is connected.

The Autocar Co. entered into the manufacture of commercial vehicles in 1907 and prior to that time had been marketing its passenger cars in the customary manner through agents and two branch houses. Upon entering the commercial field, however, the officers of the company recognized the need of closer co-operation with their customers as outlined above and the policy of marketing through branches was adopted. This led to the organization of the Autocar Sales Co., operating in New York and the Autocar Sales & Service Co., operating in Philadelphia, Boston, Providence, Newark, Baltimore and Chicago. In addition to these, there is an agency in Los Angeles and agencies in smaller points, principally appointed by the branches.

The organization of these branches is roughly, as follows: first, the accountants which have, in the nature of things, close relation with the financial department of the parent company; second, the sales department operating under the advice and direction of the factory sales manager; third, the service department, including the repair shop and stock rooms operating in harmony with the production manager and engineer of the factory. It is with the last phase of the organization that this paper will attempt to deal.

Functions of Service Department

The functions of the service department are first, the repairing and overhauling of customers' cars; second, inspection service, both to customers garaging at the branch and those not doing so; third, the supplying of repair parts for customers who do their own repair work.

The head of this department is the mechanical superintendent, or service manager, and under him the repair shop foremen and storekeeper. The first and third functions mentioned above are obvious and need no elaboration. The second is covered as follows: Those customers who garage at the branch may avail themselves at a slight extra charge of a nightly inspection covering minor adjustments and lubrication. Those who do not garage at the branch but who are located within reasonable distance may by appointment with the mechanical superintendent bring their cars to the branch for inspection and adjustment. Where these are of a minor nature, there is no charge, but where there is material or extensive time involved, the need for such work is reported to the owner and upon receipt of his order the work is done and charged for.

A traveling inspector covers the territory within a radius of approximately 25 miles of the branch, visiting customers in these points monthly. Any minor adjustments which he makes are not charged for, but where he sees the need for certain major repairs, he reports to the owner and if possible, makes them immediately. If material is needed which must be procured from the branch, he reports to the superintendent who arranges a convenient time with the customer when this work can be done. In this way the inspection service is made of real benefit to the customer and is still self-supporting and does not become an unreasonable burden on the manufacturer.

Service Department and Engineer

It can be readily seen that the service department in its various activities can be of inestimable value in assisting the engineer.

In the first place, the repair orders and the record of the work done in the repair shop contains an invaluable fund of information, relative to the portions of the mechanism which, in the hands of the user, give trouble, either due to inherent defects in the design or construction, or to the misuse and abuse to which the car is subjected by the operator by reason of the demand of his business or his lack of skill and knowledge of the mechanism which he is handling.

There can be no question but that a vehicle, to be commercial and practical, must be so constructed as to not only stand up under the normal and legitimate uses to which it should be subjected but also so far as possible to those abnormal and illegitimate uses which are the result of conditions as they are and not as they should be.

It may be said with a great deal of truth that the user should and must learn the operation of his car, but the engineer who takes that attitude and does not recognize his responsibility in learning the practical phases of the situation can never succeed in producing anything but a beautiful child of theory which may or may not be able to do the work for which it was intended, but which enters its field of usefulness with an appalling handicap.

To this end the repair orders and inspection reports are carefully scrutinized and the data obtained tabulated for comparison, thus giving a basis for determining the merit of various forms of construction and the direction in which development work should be carried.

Assistance by the Engineer

The data obtained as explained before is also used to bring the efficiency of the various branches up to a common place. This is done by sending reports at intervals to the various branches showing the average cost of repairs at the various points for comparison.

In addition to this specific investigations are made on detailed repairs over definite periods and figures for comparison obtained on, say, connecting-rod repairs and adjustments, brake repairs, etc. This has the effect of creating a spirit of friendly rivalry which raises the efficiency of the whole organization. To further this work and obtain the maximum benefit, the engineer, or his representative, visits at regular intervals, all the branches and investigates the methods of doing various jobs and the tools and appliances used. Finally, at intervals regulated by the engineer, the superintendents are all gathered in conference at the factory and these various points all gone over in detail.

At these meetings the comparative repair costs are carefully gone over and the experience of those points having the better showing is given for the benefit of all. There is also an opportunity at this time for an inspection of the factory and a study of improved methods of construction and production.

The result of this policy has been the gradual refinement and perfection of the product, the satisfying of the user and the building of a close knit, high grade, harmonious organization which operates to accomplish one object.

Discussion Considers Ideals

The pith of the discussion was on how close the practical service plant could reach the idealistic condition as recognized by the majority of automobile manufacturers. Many brought up the relation of the sales department to the service department, pointing out that the claims of the salesmen for the service department were often exaggerated in securing sales and this condition afterwards resulted in misunderstanding with the user of the truck. W. P. Kennedy stated that, in his opinion, the ideal condition would be if the manufacturer could guarantee the annual service costs to the consumer. He pointed out, however, that this was hard to reach because of the great demands made by some consumers on the service station, which, while out of proportion to the initial price of the truck, are often granted for policy's sake.

Joseph Anglada asked Mr. Bachman, the author of the paper, what he believed would be the just method to handle a hypothetical case such as the breaking of an axle or wheel, for instance, which in turn caused the fracture of other parts of the car. He wanted to know if Mr. Bachman thought that under such circumstances the car manufacturer was in duty bound to replace all the parts broken or not. Mr. R. McA. Lloyd, chairman, asked if there should not be a definite radius of action to the service work of a factory. He asked specifically if there should not be some arrangement in the outlying districts for garages to handle the work in order to expedite repairs for truck users in the outlying district.

Henry G. McComb, engineer of the Gasoline Division of the General Vehicle Co., stated that it is the experience of his company that it is best to secure the services of the best maintained garage in each district. He stated that it is the practice of his company to go into a certain locality and pick out the cleanest garage, as it is always the case that a clean garage does good work. He made the somewhat startling statement that only two or three service stations in the New York City district are clean and the mere fact that the others are not kept up to the best standard in this direction shows that the work must suffer.

Another line which the discussion took and which was participated in by several of the members present, was whether the head of the service station should be a business man or a mechanic. Arguments were advanced on both sides but the consensus of opinion seemed to favor the business man since he would be better equipped to be a master of the broader phases of service rather than in its mechanical details. The service manager should be on a par with the sales manager, and these two departments should be absolutely divorced from one another.

Bachman Sums Up

In summing up, Mr. Bachman stated that he did not believe that it would be ever possible to reach the idealistic condition in service. He brought up the view which has often been held that this state could be reached through the service contract system in which a certain maintenance guarantee is given with the sale of the truck. He stated that his company had to abandon this and others have also.

Answering Mr. Anglada's question regarding the extent to which the service department should make good on repairs, he stated that it was a matter for investigation as to who was responsible for the damage. If the entire damage was due to a defect in the material or design of the car, the company manufacturing the car stands back of it and defrays the expenses.

At the business end of the meeting, the secretary's report showed that a gain in membership of fourteen has been made since the last meeting of the section, bringing the total membership up to 155. After the discussion, A. B. Cumner, of the Autocar Co., took the engineers through the service building and pointed out the systems by which the repairs and garaging of the cars are looked after.

After the meeting the members adjourned to a neighboring restaurant where a supper provided by the Autocar company was served. The meeting was well attended, considering that it fell upon the same day as the Standards Committee meeting in Detroit, there being about sixty present.

New York City, April 24—"Why Service Conditions Should Be Investigated and Recommendations Made Before Selling a Customer," is the title of an address that will be delivered by Vernon Monroe, president of the International Motor Co., at the motor truck convention in Detroit on May 5 and 6. Another one of the nine papers that have been arranged for is "What Can Be Done to Improve Conditions in the Truck Business?" to be delivered by J. R. Van Allen, of the Atterbury Motor Car Co.

New York City, April 24—Among the papers to be presented at the convention of the National Electric Light Assn., San Francisco, June 7 to 11, 1915, will be two of particular pertinence to electric vehicles. "The Electric Vehicle and the Central Station" will be presented jointly by J. F. Gilchrist and A. J. Marshall; W. P. Kennedy will prepare a paper to be read by Mr. Edwards, chairman of the committee on accounting of the N. E. L. A., on methods of accounting costs of operating electric vehicles.

The Automobile

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, April 29, 1915 No. 17

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico -One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - - -One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Things That Count

TAKEN together the reports of the divisions of the standards committee, though brief, suffice to show once more how great a work the Society of Automobile Engineers is doing. The matters in hand just now are perhaps not so spectacular as some of the past work of the standards committee, but their usefulness is none the less immeasurable. For instance, to find 300 different sizes of cotter pins in use on automobiles and to reduce them to forty-one that will meet all requirements is an achievement which is apt to pass without due credit, because the article in question is so insignificant. Yet a moment's thought shows us that thousands of people will benefit in time and money because of the elimination of some 259 useless sizes of cotter pins.

Although it is at the very commencement of its labors and has nothing whatever as yet to its credit, the new division whose duty is to endeavor to fix international standards that will be common throughout the world has a road before it full of opportunity for great achievement. Coming nearer home, the experiments being made on headlight glare will react on the daily life of the majority of the inhabitants of this country. It is the mission of the S. A. E. standards to bring order out of chaos, and the progress reported at Detroit last week shows that the work is being carried on more expeditiously than ever.

Real Prosperity

THAT day and night shifts, constantly increasing facilities and working forces do not suffice to enable Detroit parts and accessory manufacturers to keep up with the spring rush of orders will hardly be taken as an indication that the prosperity characterizing the automobile industry throughout the recent period of business depression is of the inflated variety. Here and there reports have arisen to this effect from time to time but no one has appeared to substantiate them and no evidence to support such rumors has appeared. Meanwhile the prosperity in both automobile and accessory branches continues; day and night shifts and rapidly increased manufacturing facilities are the rule and still the orders grow steadily from day to day.

Annealing

THE importance of proper annealing must not be overlooked. In these days when the necessity of getting the most out of a given steel is so well recognized it seems hardly possible that great care should not be taken in the heat bath. On the other hand, however, many of the failures that are rather vaguely laid at the door of the crystallization myth are simply due to a lack of care in the annealing after the metal has been worked at a temperature at which its interior structure is upset.

Whether or not an actual change takes place in the crystalline formation of the steel under repeated stresses does not materially influence the fact that proper annealing will give these parts which are subject to repeated stresses a greatly increased lease of life. If those who either slight the work of annealing altogether or who do it in a manner which does not thoroughly reorganize the disturbed crystalline formation, would only study the micrographic photographs of specimens of cold-worked material before and after annealing they would quickly see the necessity for accuracy in this practice.

Sheets and bars of steel are often rolled and worked at temperatures which are so low that distortion of the inter-molecular structure cannot help but result. A neglect of the annealing in its entirety is rare, but it is not uncommon to find it neglected in part. The temperature of the entire piece will not be raised to that in which a reformation of the crystals takes place because the part is not left to soak a sufficiently long time in the heat of the annealing furnace. The result is that the exterior portion of the piece which has been raised to a higher temperature is strong and solid, whereas the interior forms a weak core without the strength to withstand the stresses of hard work.

There is a safe method to pursue in annealing, namely, determine first the critical point of the metal with which one is dealing or, in other words, the point at which the carbon passes into solid solution with the iron, and then allowing the metal to remain in a furnace which has a heat sufficiently above this temperature to make sure that the part will be heated throughout.

200 Delegates for Detroit Truck Convention

At Least 36 Concerns To Be Represented, Some Sending 4 Men—Complete Program

DETROIT, MICH., April 28—The Motor Truck Convention to be held here May 5 and 6 is already an assured success, more than 200 delegates being a conservative estimate of the expected attendance as judged from acceptances received by the National Automobile Chamber of Commerce to date.

The following concerns have notified the Chamber of Commerce that they will have delegates present:

Adams, Armleder, Atterbury, Autocar, Baker, Chase, Commerce, Couple-Gear, Denby, Federal, General Motors, General Vehicle, Indiana, Kalamazoo, Kelly, Kosmath, Maccar, Mack and Saurer, Moon, Menominee, Packard, Pierce-Arrow, Reo, Republic, Selden, Signal, South Bend, Standard, Sternberg, Studebaker, Velie, United, Walter, Waverley, White and Wilcox. Many of these concerns are sending four or more.

The program is practically complete and gives promise of being one of the most interesting. Papers are generally limited to 20 minutes with 40 minutes for discussion and those delegates to take leading parts in discussion have already been notified of what will be expected of them.

The convention opens on Wednesday, May 5, at 1.30 p. m., which follows the regular meeting of the N. A. C. C. Board of Directors held during the forenoon.

There will be a theater party Wednesday evening at the Detroit Opera House. On Thursday there will be two sessions, a forenoon one beginning at 9.30 and and an afternoon one at 1.30. The complete program follows:

WEDNESDAY, MAY 5.

10 a. m.—12:30 p. m.—Meeting of N. A. C. C. Board of Directors
12:30—1:30 p. m.—Get-acquainted Luncheon, Banquet Hall, Statler Hotel.

First Business Session.

1.30 p. m.—Address of Welcome by Charles Clifton, President National Automobile Chamber of Commerce.
1:45 p. m.—Appointment of Chairman.
1:45—2 p. m.—Announcements
2:00—5:30 p. m.—Papers and Discussions.
How Can Physical Problems that Militate Against Economical Use of Trucks Be Improved?
By D. Beecroft, Directing Editor Commercial Vehicle.
What Can Be Done to Improve Conditions in the Truck Business?
By John W. Van Allen, Atterbury Motor Car Co.
How Can the Used Truck Question Be Handled?
By W. L. Day, General Manager, General Motors Truck Co.
Can Manufacturers Have a Standard Service Policy?
By Alvan Macauley, Vice-Pres. Packard Motor Car Co.
Appointment of Committee on Service Policy Resolution.

WEDNESDAY EVENING, May 5.

8:00—11 p. m.—Theatre Party, Detroit Opera House.

THURSDAY, MAY 6.

Second Session.

9.30 a. m.—12:30 p. m.—Papers and Discussions.
Can the Dealer Make Money Selling Motor Trucks, and If Not, What Is His Function?
By Robert O. Patten, Sales Manager, Pierce-Arrow Motor Car Company.
Advantages of Selling on Time Payments and How Such Sales Should Be Handled.
By W. T. White, President The White Company.
Why Service Conditions Should Be Investigated and Recommendations Made Before Selling a Customer.
By Vernon Munroe, President International Motor Co.
Is There a Need for Motor Truck Shows or Demonstrations and What Form Should They Take?
By M. L. Pulcher, Vice-Pres. Federal Motor Truck Co.
Appointment of Committee on Show or Demonstration Resolution.
12:30—1:30 p. m.—Buffet Luncheon.

Third Session.

1:30—5:30 p. m.—Papers and Discussions.
Can a Standard Load Rating Be Devised and Approved by the Manufacturers?
By H. Kerr Thomas, Asst. Manager, Pierce-Arrow Motor Car Co.
Appointment of Committee on Load Rating Resolution.
The Clayton Act and Powers of the Federal Trade Commission.
By Charles Thaddeus Terry, General Counsel for the N. A. C. C.
Extra Papers and Discussions
Reports of Committees on Resolutions.

To Open Yellowstone Park to Tourists

WASHINGTON, D. C., April 24—Secretary of the Interior Lane this week approved the plan to open Yellowstone National Park to automobiles this summer under regulations which will later be prescribed and has fixed August 1 as the date for their admission. This is the only national park which motorists have not hitherto been allowed to use. In 1913 the Interior Department threw open Yosemite National Park to motorists, under careful regulations, and it has resulted in a very much wider use of that park.

The problems in the Yellowstone were more complicated, as there is a very heavy stage traffic over the roads, which hitherto have not been in satisfactory shape to be thrown open to automobiles. The stage travel in the Yellowstone this summer will be particularly heavy, and the secretary deemed it advisable not to let the machines in until the late summer, when the superintendent of the park will have everything in readiness for their admission. Telephone lines are to be extended and checking stations established at important junction points, so that the machines can be kept under absolute control. The privilege is extended to pleasure vehicles only.

Plans carefully worked out by officials of the Interior Department, with the cooperation of the army officers at the park call for a schedule which will keep the automobile traffic entirely independent of the stage traffic. All the regular traffic will move in one general direction in making the circuit of the park, the automobiles leaving half an hour before the stages, both morning and evening, from the different entrances or from the intermediate stations at which they are checked in.

It is expected that the road through the park will be a link in the highway to the Northwest, and will give the motorist who is contemplating a western trip an opportunity of seeing several of the other national parks. Mt. Rainier and Crater Lake National Parks could be visited and the motorist continuing his tour through California could visit the expositions at San Francisco and San Diego, and cross over the Sierra Nevadas on his return journey, through the Yosemite National Park, over the scenic Tioga Road which Secretary Lane has just accepted on behalf of the Government.

Except at its main entrance through the valley of the Yellowstone on the north, the Yellowstone National Park is entirely surrounded by natural forests. To the north are the Gallatin and Absaroka National forests. On the east the Shoshone and Beartooth, on the south the Teton and on the west the Targhee and the Madison. The central portion is practically all an undulating volcanic plateau having an elevation above the sea level of about 8,000 feet. This comprises an area of about 2,000 square miles out of the total of 3,350 of which the park is composed. The park is 52 miles across from north to south and 54 miles from east to west.

It is in the geysers and canyons that visitors will find their chief interest. Excelsior is the largest geyser, having a crater of 300 feet long and 200 feet wide. It has not been active since 1890. Another geyser, probably about the most interesting, is Old Faithful which at regular intervals of from 65 to 70 minutes throws a column of hot water 2 feet in diameter to a height of from 125 to 150 feet. The eruption lasts from 4 to 4 1-2 minutes. The Giant at intervals of from 2 to 4 days throws up a column to a height of 250 feet for 90 minutes.

The Grand Canyon which the Yellowstone has cut for itself through the rocky bed has produced scenic effects which are claimed to be unequaled. Its length is 24 miles and is from 600 to 1,200 feet deep. Its ragged, broken walls which are inclined at very steep angles are of a richness of color which is beyond adequate description.

Champion - Frontier Suit Ended

Business of Frontier Specialty Co. Transferred to Champion —Frontier Licenses in Force

TOLEDO, O., April 24—The Champion Spark Plug Co., of this city today signed papers which transfer the entire business of the Frontier Specialty Co., Buffalo, N. Y., to the Champion company. By this transfer the legal controversy between the Frontier company and the Champion company over the question of priming spark plugs comes to an end, the suit brought by the Frontier concern against Champion in November, 1914, for infringement of the Simms and Shea patents covering priming plugs being dismissed.

The licenses issued by the Frontier company covering its priming plugs will remain in force under conditions as existing before, with such concerns as Benford Mfg. Co., Sharp Spark Plug Co., Emil Grossman Mfg. Co., Rajah Auto Supply Co., Bigsby Mfg. Co., Reflex Ignition Co., and A. R. Mosler Co.

The Champion Spark Plug Co. will henceforth manufacture the All-In-One plug known as the original spark plug with priming cup.

Internal Gear Drive Assn. Is Formed

DETROIT, MICH., April 26—An organization of the makers of the internal gear drive type of truck rear axle and of truck manufacturers using this design of axle has just been effected here under the name of the Internal Gear Drive Assn. Headquarters have been secured in the David Whitney Building, and George M. Davis has been made manager.

Among the members of the new organization are the Torbenson Gear and Axle Co. Newark, N. J.; the Russel Motor Axle Co., North Detroit; the Celfor Tool Co., Buchanan, Mich.; the Republic Motor Truck Co., Alma, Mich.; and the Denby Motor Truck Co., Detroit. In addition there are several concerns now contemplating taking on this type of drive for at least some of their models, and also some of the accessory people, but the names of these are withheld at this time.

The main object of the organization is to become a clearing house for information on this type of drive. An educational campaign among dealers and users is to be inaugurated, thus to acquaint them with exactly what the type is.

Mr. Davis states that it will not be the policy to fight other types of rear drive, but rather to promote the internal gear without reference to others' constructions.

Market Reports for the Week

NEW YORK CITY, April 27—Market prices this week were steadier. Changes for the most part were as usual in the metals. Lead was constant at $4.17 1-2 per 100 pounds. Bessemer steel and open-hearth steel remained unchanged at $19 a ton, with large sales. Gasoline was strong at 12 cents a gallon. Both electrolytic and Lake coppers were strong and higher this week, the former closing at a 3-4-cent gain and the latter at a 1-cent gain. Both reached new high marks for the year, electrolytic at 18 cents on Monday and Lake at 19 cents on the same day. Tin closed at a drop of $4.00 per 100 pounds after a fluctuating week. About 2,000 tons of this metal is in steamships at dock in this city, but little, if any, will be available for April delivery. Consequently tin for prompt shipment is scarce. The rubber market was steady with the demand restricted to small lots and offerings light. At the closing on Monday, Fine Up-River Para came down 1 cent in price, closing at 60. Rubber shipments are steady. No changes occurred in the oils and lubricants markets.

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Antimony	.22½	.22½	.23	.25	.21	.21	—.01½
Beams & Channels, 100 lbs..........	1.31	1.31	1.31	1.31	1.31	1.31	......
Bessemer Steel, ton.	19.00	19.00	19.00	19.00	19.00	19.00	......
Copper, Elec., lb..	.17¼	.17¾	.17¾	.17¾	.17¾	.18	+.00¾
Copper Lake, lb..	.18½	.18½	.18½	.18½	.18½	.19	+.01
Cottonseed Oil, bbl.	6.65	6.70	6.59	6.65	6.60	6.60	—.05
Cyanide Potash, lb.	.21	.21	.21	.21	.19	.21	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime...	.92	.90	.90	.90	.90	90	+.02
Lead, 100 lbs......	4.17½	4.17½	4.17½	4.17½	4.17½	4.17½	......
Linseed Oil.......	.62	.62	.62	.62	.62	.62	......
Open-Hearth Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, refined.	..	..	..	..	..	..	......
Rubber, Fine Up-River, Para......	.61	.61	.61	.61	.61	.60	—.01
Silk, raw, Ital.....	3.90	..	3.90	..	..	3.90	......
Silk, raw, Japan...	3.50	..	3.50	..	..	3.50	......
Sulphuric Acid, 60 Baume.......	90	.90	.90	90	.90	.90	......
Tin, 100 lb.......	46.00	43.00	41.50	42.00	42.00	42.00	—4.00
Tire Scrap........	.04¾	.04¾	.04¾	.04¾	.04¾	.04¾	......

Cartercar Plant To Be Closed

DETROIT, MICH., April 26—Through reliable sources it has been learned that the General Motors Co. will close the Cartercar Co. plant at Pontiac, Mich., with the termination of the present year's output. The closing date has been set for the latter part of May, probably the 22d.

It is the intention to manufacture in the Cartercar plant the new light six which the General Motors organization has now in the process of development. This will use a Northway engine, and will sell under $1,000. It is the intention to manufacture somewhere in the neighborhood of 30,000 of these the first year, providing the parent company can get its organization so far perfected as to make this possible.

No details of the new General Motors six are available at this time, but it is understood that it will be a worthy competitor for the lighter sixes now on the market and selling at around $1,000.

Ford to Pay Over $15,000,000 in Rebates To Car Buyers

DETROIT, MICH., April 28—Henry Ford's plan of profit-sharing will be carried out this year, according to an announcement by the manufacturer himself. Mr. Ford said yesterday that $50 would be repaid to every buyer of a car in the year following announcement of the plan. The plan called for a rebate upon the purchase price of each car if 300,000 cars were built and sold by the Ford Motor Co. during its fiscal year, August 1, 1914, to August 1, 1915. This production is now assured with a month to spare.

If, as announced in THE AUTOMOBILE for April 22, the production reaches 325,000, the fulfillment of its tentative promise to purchasers will mean the payment of $16,250,000.

Studebaker Discounting Notes

NEW YORK CITY, April 27—A. R. Erskine, first vice-president and treasurer of the Studebaker Corp., Detroit, Mich., states that the company has, during the past month, used a moderate portion of its cash resources in anticipation of approximately $2,500,000 of the company's outstanding serial notes, maturing $800,000 annually between September, 1915, and March, 1922. The notes were purchased in the open market and cancelled. Of the $8,000,000 of these serial notes originally issued, approximately $5,000,000 have been redeemed.

Fisk Profits Gain Over $300,000 in 1914

CHICOPEE FALLS, MASS., April 22—The annual report of the Fisk Rubber Co. for the year ended October 31, 1914, just issued shows net profits of $942,204 as compared with $606,001 in 1913. After taking out inventory, adjustment and reserve, amounting to $160,000, the balance for dividends amounts to $782,204, as compared with $488,312 in 1913. This year the first and second preferred dividends amounted to $350,000 as compared with $285,833 the previous year. The surplus amounted to $432,204 as against $202,479 in 1913.

General Electric 1914 Profits $8,970,963

NEW YORK CITY, April 22—The General Electric Co.'s gross sales in 1914 were $90,467,692 compared with $106,477,439 in 1913. Profits from manufacturing aggregated $8,970,963, against $10,260,605, while the income from other sources brought the total income up to $11,855,383 as against $14,065,789 in 1913.

The net profits amounted to $11,287,827 as compared with $13,489,357 in 1914. The 1915 profits were equal to 11.12 per cent. earned on $101,485,700 capital stock, against 13.2 per cent. earned on $101,381,200 in the previous year. After paying interest and dividends, the company carried to the surplus account $3,145,061 against $4,908,675 in 1913.

The company increased its manufacturing floorspace by 940,000 square feet during the year, but most of this was under construction when the year began. The expenditures during the year, for additions and improvements to manufacturing plants, aggregated $6,006,955, and the amount written off from the earnings was $4,370,792. The net book value of the company's plants on December 31, 1914 was $31,063,331.

Master Carbureter Buys Air Compressor Plant

DETROIT, MICH., April 26—The Master Carbureter Corp., with general offices at Woodward and Hancock avenues, has purchased the real estate and plant of the American Air Compressor Co., 1523 Fort street, west, and will move there early in May.

The structure just purchased is one story high 100 by 225 feet. From 100 to 150 men are to be employed with a view of making 200 to 250 carbureters a day, or about three times the present production.

The Detroit factory will take care of the business all over the country except the west, which is taken care of by the Master Carbureter Co., Inc., of Los Angeles, Cal., which makes an average of fifty instruments a day.

U. S. C. C. Discusses Price-Cutting

CHICAGO, ILL., April 23—Price cutting of automobiles and other manufactured articles has been the chief subject of discussion of the committee on the maintenance of re-sale prices of the Chamber of Commerce of the United States of America which has been in session here at the University club and the offices of the chamber. Automobile manufacturers were represented by Henry B. Joy of the Packard company. This committee was appointed in the latter part of 1914 and made a preliminary report at the convention of the chamber in Washington on February 5 of this year. The convention at that time instructed the committee to investigate the elements of price maintenance problem and stated in such a way that these statements could be made the basis of a referendum or general vote of the organization members of the National Chamber.

March Exports 3,767 Motor Vehicles

WASHINGTON, D. C., April 28—*Special Telegram*—Exports for March show that 1,339 commercial vehicles valued at $4,723,563 and 2,428 passenger cars valued at $1,958,302 were shipped to Europe. For the 9 months ending with March, commercial vehicle exports were 6,313 valued at $18,737,487. Passenger cars numbered 11,562 valued at $9,555,751.

YOUNGSTOWN, O., April 23—The present stockholders of the Youngstown Sheet & Tube Co. have taken practically the entire $5,000,000 issue of the new stock authorized several weeks ago.

Dividends Declared

The following dividends have been declared: Stewart-Warner Speedometer Corp., Chicago, Ill., quarterly dividends of 1 1-2 per cent. on common and 1 3-4 per cent. on preferred, payable May 1 to stock of record April 26.

DETROIT, MICH., April 26—S. H. Humphrey, factory manager of the Hupp Motor Car Co., for the last 2 1-2 years, has resigned to become works manager of the Chalmers Motor Co., July 1. He succeeds H. H. Pinney, third vice-president and works manager of the Chalmers company during the last few years.

A successor to Mr. Humphrey has not yet been appointed.

Automobile Securities Quotations

NEW YORK CITY, April 26—War talk and rumors had a direct influence on the securities market this week. Prices were lower and the gains were few and small. A few of the most important changes are as follows: Packard common and preferred 15 and 4 points higher respectively; General Motors common, 9 points and preferred 1 1-2 points higher, and J. I. Case preferred, 2 points higher.

Changes in the tire prices were mostly declines. Goodrich preferred dropped 1-2 point; Goodyear preferred went down 1-2 point; Kelly-Springfield common and second preferred both went down 4 points; Miller Rubber common declined 5 points and Swinehart stock, down 10 points.

There were a few small drops in the accessories securities as follows: Stewart-Warner common and preferred, 1 point; and Texas company stock, 5 points.

Quotations in the Detroit exchange were slightly higher. The following stocks showed gains; Chalmers common 3-4 points and preferred, 2 points; Continental Motor common and preferred, 2 1-2 and 2 points, respectively; Packard common and preferred, 23 and 5 1-4 points, respectively; Studebaker common, 1 point. In the inactive stocks, Kelsey Wheel went up 5 points.

	1914		1915		Wk's Ch'ges
	Bid	Asked	Bid	Asked	
Ajax-Grieb Rubber Co. com	200	..	285	..	..
Ajax-Grieb Rubber Co. pfd	98	102	100	..	..
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	80	82½	80	87	+2
Chalmers Motor Company com	..	82	93	98	..
Chalmers Motor Company pfd	..	90	92	94	..
Electric Storage Battery Co.	49	50	..	..	..
Firestone Tire & Rubber Co. com	284	290	455	460	..
Firestone Tire & Rubber Co. pfd	107	109	110	112½	..
General Motors Company com	74½	75½	145	147	+9
General Motors Company pfd	89½	90½	100½	102	+1½
B. F. Goodrich Company com	24½	25½	48	49	+2
B. F. Goodrich Company pfd	86	89	101	102	— ½
Goodyear Tire & Rubber Co. com	168	173	239	240	+1
Goodyear Tire & Rubber Co pfd	95	96½	104	105	— ½
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	15¼	16	—1¾
International Motor Co. pfd	..	15	31½	32	— ½
Kelly-Springfield Tire Co. com	..	..	130	132	—4
Kelly-Springfield Tire Co. 1st pfd	..	..	84	85	..
Kelly-Springfield Tire Co. 2nd pfd	..	..	130	140	—4
Maxwell Motor Company com	8	8½	49	51	+2
Maxwell Motor Company 1st pfd	34	35	81½	83	+ ½
Maxwell Motor Company 2nd pfd	12¼	13	38	40	+ ½
Miller Rubber Company com	..	..	180	188	—5
Miller Rubber Company pfd	..	..	104	105	+3
New Departure Mfg. Co. com	122	124	137	138	..
New Departure Mfg. Co. pfd	105½	107	106	110	..
Packard Motor Car Co. com	103	..	101	..	+15
Packard Motor Car Co. pfd	94	98	97	..	+4
Peerless Motor Car Co. com	15	..	20	21	..
Peerless Motor Car Co. pfd	..	75	..	55	..
Portage Rubber Co. com	..	25	35	38	+1
Portage Rubber Co. pfd	..	75	85	88	..
Reo Motor Truck Company	7¼	8½	14¾	15¼	..
Reo Motor Car Company	19½	20¼	32⅛	33¼	— ⅛
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	50	54	67	69	—1
Stewart-Warner Speed. Corp. pfd	99	101	102	104	—1
Studebaker Corporation com	26½	27½	66	68	+3
Studebaker Corporation pfd	82½	83½	100	102	+1
Swinehart Tire & Rubber Co.	60	65	80	90	—10
Texas Company	139	140	137	139	—5
U. S. Rubber Co. com	53½	54½	69	71	..
U. S. Rubber Co. pfd	99½	100½	106½	108	— ½
Vacuum Oil Company	215	220	209	212	+1
White Company pfd	97	100	103	108	..
Willys-Overland Co. com	60½	62½	118	120	—7
Willys-Overland Co pfd	88	90	100½	102	+ ½

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS.

Chalmers Motor Co. com	..	83	92	95	+ ¾
Chalmers Motor Co. pfd	88½	91	95	98	+2
Continental Motor Co. com	150	..	177½	187½	+2½
Continental Motor Co. pfd	..	80	82	85½	+2
General Motors Co. com	74	76	144	146	+1
General Motors Co. pfd	93	92	100	102	—1
Maxwell Motor Co. com	8	9	47½	49	—3½
Maxwell Motor Co. 1st pfd	34	35	81	..	—1
Maxwell Motor Co. 2nd pfd	12	13	37	39	—1½
Packard Motor Car Co. com	103	..	103	110	+23
Packard Motor Car Co. pfd	94	98	99	..	+5¼
*Reo Motor Car Co.	20¼	21¼	32½	33½	— ⅛
*Reo Motor Truck Co.	8⅛	9¼	14½	15¼	+ ⅛
Studebaker Corp. com	..	..	66	68	+1
Studebaker Corp. pfd	..	..	99	101	..

INACTIVE STOCKS.

*Atlas Drop Forge Co.	..	21	..	26	..
Ford Motor Co. of Canada	..	560	600	..	..
Kelsey Wheel Co.	190	200	195	..	+5
*W. K. Prudden Co.	..	21	..	21	..
Regal Motor Car Co. pfd	..	40	12	20	..

BONDS.

General Motors, notes, 6s, 1915	..	..	..	..	..
Packard Motor Co. 5s, 1916	..	..	..	..	..

---

*Par value $10; all others $100 par value

Wheel Tax Declared Invalid

Illinois Supreme Court Decision Hits Chicago Financial Blow—Nearly $500,000 Lost for 1915

CHICAGO, ILL., April 22—As a result of a decision handed down by the Supreme Court in Springfield, Ill., yesterday, motorists of Chicago will not be compelled to pay a wheel tax to the Municipal authorities hereafter, in addition to a fee for license and registration to the state treasury.

In the test case brought by Joseph Dehner against the City of Lincoln, Ill., the Supreme Court decided that the wheel tax was invalid. Judge Craig, who handed down the decision held that the annual license fee which motor car owners are required to pay to the state is a tax, and that double taxation exists when motorists are required to pay a municipal tax also. This was the contention of the attorneys of the Lincoln resident, who sought to have the city ordinance there declared unconstitutional.

The decision of the Supreme Court struck the city of Chicago a terrific financial blow; it means that Chicago is to be deprived of at least two-thirds of an annual income which reached $726,129 for 1914, and which has been climbing so steadily, it was expected to reach the $1,000,000 mark within a short time. During the last five years, Chicago has collected $3,146,218.88, from this source of revenue, divided as follows:

1910	$560,212.08	1913	$676,961.47
1911	585,157.46	1914	726,129.05
1912	596,757.87		

The opinion applies to passenger vehicles alone, and does not declare invalid the state wheel tax law. Motor trucks, and horse drawn vehicles are not mentioned in the decision, and apparently are not affected. Dehner refused to pay a wheel tax imposed by the ordinance, and was fined $25 by a local Justice of the Peace. The Circuit Court reversed the decision. The case was then taken to the Supreme Court and the action of the lower tribunal was sustained.

In sustaining the action of the lower court, however, the Supreme Court says: "The ordinance in question is in square conflict with Section 12 of Motor Vehicle Action of 1911, which prohibits the imposition of local licenses on vehicles of certain types. The ordinance in question is against both spirit and letter of the law."

As the result of this decision, Chicago will be deprived of more than $500,000 annual revenue, which has been used to pay the expenses of street repairs, and hundreds of men will be thrown out of work in the street repair department until provision can be found for an appropriation to carry on this work. City officials believe that Chicago has received a knock-out blow as the result of the Supreme Court decision on the wheel tax law.

New Plates Every 3 Years in Iowa

DES MOINES, IA., April 22.—The thirty-sixth general assembly of Iowa has just ended its session with a record of legislation on good roads and motor vehicles which is popular among the motorists and good roads enthusiasts of the state.

Changes in the law governing the registration of automobiles are especially approved by motorists. The new law provides that number plates shall be issued only every 3 years instead of every year as at present. This will save the motorists the annual worry over new number plates. The fees shall be a lien upon the motor vehicles and penalties shall be collected for delinquency. Under the new law the plates may be made at state institutions. The new law provides also that the state automobile department shall charge 50 cents, instead of $1 as at present, for extra number plates. All new provisions will go into effect July 1, 1915.

35 Cents Per H.P. for California

SACRAMENTO, CAL., April 23—The Mouser bill regulating automobile taxation was passed by the assembly during the second week of this month. The bill aims to change the system of licensing and registration. It imposes a registration fee of 35 cents per horsepower on all automobiles, a graduated license scale for commercial vehicles and a $5 fee for all electric vehicles not used for commercial purposes.

The bill differs from the one introduced by Senator Birdsall in March and which passed the senate this week, in the matter of rating. This bill requires the payment of 40 cents per horsepower. Among its features are: license plates need not be changed each year, but a small disk will be attached indicating the year; speeders on a second conviction shall lose their licenses for 6 months; S. A. E. formula for rating horsepower; tax on commercial vehicles changed so that they are rated according to weight of the unloaded car, ranging from $5 up to 4,000 pounds to $20 for 8,000 or more pounds; and all automobiles formerly exempted from license fees, except Federal-owned cars, are included under the tax.

Ohio Halves Dealers' License Fees

COLUMBUS, O., April 24—The bill reducing automobile dealers' licenses from $20 to $10 has been passed by both houses of the assembly and is now up to Governor Willis for signature. Little opposition was offered to the bill, which was supported by automobile clubs and the Ohio Automobile Assn.

The senate unanimously passed the bill providing for the transfer of license tags from one car to another, by the same owner, by making a payment of $1 for re-registration.

A bill was introduced in the senate last week providing that headlights on automobiles shall not shine higher than 3 feet from the roadway for a distance of 75 feet in front of the car. Steps were taken at once to kill the measure before it got to the floor of the senate. In the bill, the question of judgment was left entirely to the justice of the peace, the mayor or other peace officer before whom the charge was brought.

Practically all cities in the state have dimming ordinances, and motorists generally do not believe it is wise to enact a dimming law to cover the highways of the state.

N. Y. May Tax Trucks More

ALBANY, N. Y., April 24—Hereafter motor trucks will have to pay the same registration fee in this state as passenger cars, provided Governor Whitman signs the Hewitt bill which passed the legislature today. The fee up to 25 horsepower is $5 and from 25 to 35 horsepower, $10.

Motorcycles, heretofore not taxed, must pay a fee of $2.

There also was little opposition to the Sullivan bill which provides that, regardless of the age of the car, the same fee must be paid. Heretofore cars 4 years old have been given a half rate.

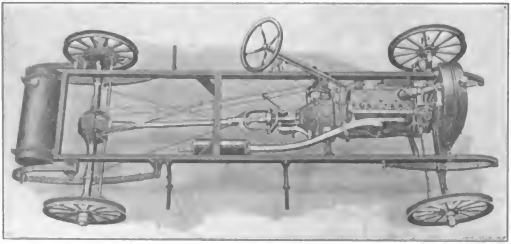
The Sullivan-Hewitt bill, which would have doubled the fee on passenger cars, was killed through the efforts of the Automobile Trade Assn. of New York State.

On April 21 the Wicks bill was passed through the legislature. This measure provides that all vehicles shall carry lights from 1 hour after sunset to 1 hour before sunrise and is a law that will aid materially in reducing the number of accidents. The bill will become effective July 1 and will force all vehicles to carry lights or subject the offender to a fine of $10 upon arrest by police officers in any part of the state. New York City is not affected, however.

DETROIT, MICH., April 21—Giving its liabilities as worth $329,650.71 and its assets as worth $422,391.13 the Detroit Body Co., has filed a voluntary petition in bankruptcy. The principal creditor is the First and Old Detroit National Bank, which hold claims totaling $170,679.81. The company's real estate is listed at $167,520.86 and the machinery and equipment at $91,308.81. Last March Judge Arthur Tuttle, of the United States federal court, declared the concern bankrupt, following an involuntary petition filed by the Russell Wheel & Foundry Co., Detroit, and other creditors.

Hercules Touring Car and Roadster on Market

LOUISVILLE, KY., April 24—The Hercules five-passenger touring car, $595, with Federal electric starter, $55 extra, and a roadster at the same price, are now being built by the Kentucky Wagon Mfg. Co., makers of the Urban and Old Hickory trucks. A town-car, details of which have not yet been announced, will be placed on the market next fall. The touring car formerly sold for $550 but a number of refine-



Plan view of Hercules chassis, built by the Kentucky Wagon Mfg. Co

ments and improvements, including the lengthening of the wheelbase from 104 to 110 inches and the addition of a gasoline tank at rear have been made.

The body is of clean design. Regular equipment includes electric lights, a clear and rain vision windshield, easy folding top, quick acting curtains, speedometer, electric horn, pump, jack, tire repair outfit, tools and tire irons.

The car has a four-cylinder Lycoming motor with inclosed valves, the cylinders being block cast, the bore is 3 1-4 inches and the stroke, 5; a leather-faced cone clutch is used; gear ratio, 4 1-4 to 1; force feed and splash oiling system with sight feed on dash; unit power plant; thermo-syphon cooling; honeycomb radiator; float feed and jet type carburetion. Gasoline feed is by Stewart vacuum system.

The tires are 30 by 3 1-2 non-skid on the rear; 31 by 4 tires are extra as are demountable rims. The front axle is of solid drop forged I-beam; the rear axle is floating.

While the Kentucky Wagon Mfg. Co. has a contract to manufacture Hercules cars, the Hercules Sales Co. controls the selling rights.

This concern was organized last January with a capital stock of $100,000. Officers of the company are: A. H. Ross, Louisville, president, Charles Kelso, New Albany, vice-president; C. L. Caron, secretary and treasurer. Four hundred agents are now being supplied with demonstrators.

Weber Is Maxwell Assistant Manager

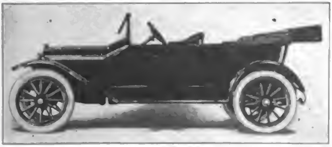
DETROIT, MICH., April 27—Orlando Weber, who has been in the automobile industry since its inception, has joined the Maxwell Motor Co. as assistant manager, in which capacity he will carry much of the responsibilities of active management, relieving Walter E. Flanders, president and general manager, of a great deal of the burden of the company's affairs. He will devote considerable of his time to the sales end of the business.

Monitor to Concentrate on Four-Cylinder

COLUMBUS, O., April 26—The Cummins Auto Sales Co., this city, formerly central Ohio agent for the Krit, has made the final announcement of the specifications for the new Monitor which is to be manufactured by the company. The plans are to drop the manufacture of the eight-cylinder car and to devote all of the attention of the firm to the four-cylinder car. There will be one chassis with two bodies, a touring car and a runabout.

The Monitor 4-30, as the car will be known, is built on a 108-inch wheelbase chassis. The car will be completely equipped with electric lights and starter and will sell for $795 for the touring body.

The motor will have a bore of 3 3-4 inches and a stroke of 4 1-4 inches. It will be manufactured by Golden, Belknap & Swartz. The cylinders are bloc cast, with removable head. Lubrication is by force feed to main bearings, splash system being used for balance of lubrication. Water circulation is by thermo-syphon with 2-inch pipes. The motor is a unit power plant with multiple-disk clutch and center control. Transmission is of the selective type, sliding gear. For ignition the Splitdorf high-tension magneto is used. A 12-volt Disco electric generator and motor is used for starting and lighting. Semi-elliptical springs are used in front and special type springs in the rear.



New Hercules five-passenger touring car, selling at $595

NEW YORK CITY, Aprl 26—The Hercules Instrument Co., Inc., Mount Vernon, N. Y. has acquired from the Benford Mfg. Co. of that city the sole rights to manufacture and sell the Monarch indestructible ammeter, and also all patent rights. In addition to marketing the Monarch ammeter, the new company is also placing on the market an indestructible voltmeter and an indestructible storage battery tester.

INDIANAPOLIS, IND., April 24—Cecil E. Gibson, president of the new $500,000 Madison Motors Co., Anderson, Ind., has appointed E. D. Hand, Detroit, Mich., who has been connected with the sales departments of two or three well-known automobile companies. W. E. Moore, at one time one of the production experts at the Ford Motor Co., has been selected as factory manager. G. S. Sarber will be assistant secretary and O. S. Beroth, formerly of the Hudson and Rutenber companies, will have charge of the service department.

DETROIT, MICH., April 27—Alfred Thompson, who for about 2 years was works manager for the Maxwell Motor Co., has become identified with the production department of the Hudson Motor Car Co. and will act in an advisory capacity as a machine expert. This move will not conflict with the efficent service of the Hudson company production management under W. J. McAneeny. Thompson first became identified with the automobile industry as general manager of the Pope-Toledo Mfg. Co. Since then he has been works manager of the Rutenber Motor Co., Marion, Ind. Geo. W. Smith is now works manager of the Maxwell company, having served as assistant to Thompson prior to the latter's change.

Timken Plants To Be Greatly Enlarged

DETROIT, MICH., April 24—Ground is about to be broken for a new forge shop and power plant for the Timken-Detroit Axle Co. This will double the present capacity of the concern for drop forgings, etc.

The site of the new buildings is approximately 1,000 feet long, facing the present plants and on the opposite side of the street, while it is about 500 feet deep, and it is probable that the entire space will be filled with the buildings.

Then too, Timken-David Brown facilities are to be increased to about double their present capacity on worm gear making when a building now under way and three stories in height of brick is completed. This was begun earlier and is in addition to the expansion already mentioned. The axle output is about 250 sets of standard Timken front and rear axles a day, and fifty sets of the Timken-David Brown worm type. The additions now under consideration involve $750,000.

At work on the Chicago speedway at Burnside, which is being built for the 500-mile race to be held June 19

Work Begins on Chicago Speedway

200 Feet of the 2-Mile Board Track Now Ready for Final Planking—Fourteen Entries

CHICAGO, ILL., April 24—After many weeks of uncertainty as to the fate of the Chicago Speedway and the 500-mile race set for June 19, it jumped from a project on paper to an actuality in the past 3 days. Active work on the construction of the track at Burnside, a suburb, began Tuesday. Two hundred feet of the 2-mile board track is now ready for the final top coat of 2 by 4 planking, which will be in place before Sunday. Preliminary grading for the four subways, one at each corner of the track, is under way and the building of roads is progressing.

250 men are at work. Next Monday work on the track will be continuous, as three 8-hour shifts will be at work so there will not be an hour's cessation, night or day, until June 5, at which date, Contest Director F. E. Edwards expects to have the track ready for practice.

The 230-acre tract is level as a floor, so that no grading is necessary, except for the four subways which will give access to the infield—there will be no crossing of the track. The construction of the latter is of wood throughout, except for the concrete footings. Upon these are set 12 by 18-inch sleepers lengthwise of the track. The sleepers carry 2 by 12-inch beams placed radially and the top surface is of 2 by 4-inch lumber lengthways of the track. The width is 56 feet on the straightaways, except the home-stretch, which is 66 feet, and 75 feet on the turns. The track is to be banked on the turns for speeds up to 95 miles an hour or better. The grandstands will seat between 45,000 and 50,000 spectators.

Starting of the work was delayed by financial difficulties and a disagreement with the original contractor. Both these difficulties have been overcome, the first by the negotiation this week of a $300,000 loan and the latter by arrangement with a new contractor who is pushing the work with remarkable speed, now that it is actually started.

Fourteen entries have been received for the June 19 meet of 500 miles for the purse of $54,000 offered by the speedway. These entries include two Sunbeams, two Duesenbergs, three Maxwells, Ralph DePalma in the Patterson Mercedes and John DePalma in the Delage, three Stutz, with Gil Anderson and Earl Cooper as two drivers, Barney Oldfield's Bugatti and Burman's Peugeot.

Oklahoma Winner Had Many Handicaps

OKLAHOMA CITY, OKLA, April 26—As reported in THE AUTOMOBILE last week, an Overland driven by Claude Foster won the 99-mile Oklahoma race on Tuesday, April 20, driving the car in the shape in which it left the factory, except for the fact that the fan was removed.

Foster made the 99 miles in 2:02:03 1-2. He made the run in spite of handicaps of the worst kind. The first accident to his car was when a bolt on his oil tank worked loose and was lost. This he overcame for a time by having his mechanic hold the tank on. Next the number four car in the race threw a tire, causing the Overland to slow down to 10 miles per hour, losing thereby the lead it had taken over other cars. Then the driver was forced to stop his car to take off the faulty oil tank and to put more oil in his engine, losing at least one lap in that way. The throttle stuck, causing a slow down, almost equal to a stop and then to cap the climax the foot throttle broke on the next lap, which forced Foster to use the hand throttle and to drive the car with one hand for the last five laps.

The radiator tank was not refilled during the race, and according to both Foster and his mechanician, the water was not boiling at the finish.

The winners of the 99-mile race, for the $1,000 purse, were as follows:

Car	Driver	Time
Overland	Claude Foster	2:02:03 1-2
Hupmobile	R. W. Thomas	2:02:34
Studebaker	C. Shaffstall	2:05:05
Buick	C. B. Chandler	Not taken

R. W. Thomas of Enid finished in second place just 30 minutes behind the winner. Throughout the entire race, he did not make a single stop. The Studebaker, driven by C. Shaffstall, was third and the fourth share of the $1,000 purse went to C. B. Chandler, who piloted a Buick. Of the nine cars which started in the race, all except two were running when the starter's flag closed the race. The Knox jumped the course, struck a tree and was wrecked at the Willard hook in the second lap. The Wallace special developed motor trouble in the third lap, limped to its pit and after seventeen laps while mechanics worked on it, started again, only to come to grief and go down for the count near the wreck of the Knox. Save for bruises to Mechan-

Claude Foster in the Overland which won the 99-mile race at Oklahoma City ician Haibe of the Knox, none of the four riders in the ill fated cars were injured.

Drawing the inside of the front rank at the start, Buick No. 2, piloted by J. H. Strickler of Enid spurted to the lead and gradually increased its margin up to the ninth lap when magneto trouble slowed it up and caused it to lay aside for six laps. Prior to this mishap, and for the twenty-six laps after the car got back into the race, Mechanician George Frey covered with his hand a leak in the gas tank.

On the fourth lap, Strickler made the best time for one lap in the race, covering the 2.409 miles course in 2 minutes, 33 1-3 seconds. When the Buick No. 2 went to the bad, M. J. Main, Jr., picked up the lead with his Mercer. In the fifteenth lap he was forced to lay out while the others gained a half dozen rounds, the Overland running in front.

The Overland surrendered the lead in the twenty-fifth lap when it stopped at the pit for 2 minutes, having lost an oil tank, and the Hupmobile claimed first honors. The Overland went into the lead again in the last few miles, increasing its advantages when both the Hupmobile and the Studebaker lost time on the curves.

Oklahoma Race for April 29

OKLAHOMA CITY, OKLA., April 26—Special Telegram—Owing to continued rains and the bad condition of the 4-mile road race course in this city the 200-mile race which was to have been run as a postponed date on Sunday, April 25, has again been postponed until Thursday, April 29.

17 Entries So Far for Indianapolis

INDIANAPOLIS, IND., April 26—Two Bergdoll cars have been added to the Indianapolis 500-mile race field of entries, making the total list to date amount to nineteen. Erwin Bergdoll of Philadelphia, Pa., is sponsor for the cars, one of which he expects to drive himself, with his brother Grover Bergdoll at the wheel of the other.

J. Porporato, a Spanish driver, has been named as alternate driver on the Sunbeam team in the event that either Louis Coatalen or Chassagne, the present candidates, are unable to get away.

Howdy Wilcox, runner-up in the recent Vanderbilt and Grand Prize races, in one of the new 300-inch Stutz cars, reeled off a lap in 1:36:4, or better than 93 miles an hour in a time trial at the Indianapolis Motor Speedway in Indianapolis this week.

Gil Anderson next took the same car and did 50 miles in 34:27, or 87.1 miles an hour, without a sign of trouble.

This performance has caused America's stock in the next 500-mile race to go up materially and for an early season performance it is regarded as remarkable by local automobile men. More trials will be held soon. Entries to date are as follows:

Car	Drivers	Probable Drivers
Maxwell	Carlson	
Maxwell		Rickenbacher
Maxwell		
Stutz		Anderson
Stutz		Wilcox
Stutz		Cooper
Sunbeam	Chassagne	
Sunbeam	Coatalen	
Peugeot	Resta	
Peugeot	Burman	
Peugeot		Duray
Delage	J. De Palma	
Mercedes	R. De Palma	
Duesenberg	Alley	
Duesenberg	O'Donnell	
Du Chesneau	Brown	
Cornelian	Chevrolet	
Bergdoll		E. Bergdoll
Bergdoll		G. Bergdoll
F.R.P. (Porter-Knights)		Hughes
F.R.P. (Porter-Knights)		Whalen
F.R.P. (Porter-Knights)		Keene
	Expected Entries	
Mercer		Pullen
Mercer		Ruckstell
Mercer		
Bugatti		Oldfield
Mulford		Mulford
King		A. Klein
Sunbeam		Grant
Cornelian		C. Klein
Ft. Worth		Clarke
Cino		McCord
Duesenberg		Thomas

May Combine Two Big Desert Races

LOS ANGELES, CAL., April 22—The 1915 Phoenix road race will be a 5-day desert dash for a $20,000 purse, if the plans of enthusiastic Los Angeles automobile men and sportsmen carry through. It is the intention of the desert race votaries, to combine the Los Angeles to Phoenix and the El Paso to Phoenix races.

Celebrating the completion of the board portion of the Tacoma speedway, built by the Tacoma Speedway Assn., Tacoma, Wash.

The proposed route is over the National Old Trails route, or the Santa Fe-Grand Canyon-Needles National highway, to Ash Fork Junction, then south through Prescott to Phoenix and over the Borderland route through Tucson, Tombstone, Bisbee, Douglas, Lordsburg and Deming to El Paso, Tex. There are to be four night controls; at Needles, Prescott, Phoenix and Tucson.

This proposed course would measure approximately 1,200 miles. The distance from Los Angeles to Phoenix, over the northern route, the course of the desert classic in 1914, is 671 miles and it is practically 525 miles from Phoenix to El Paso over the Borderland route. This would be the longest automobile race ever held and would come under the head of a semi-transcontinental event.

It is also proposed to hold the race at an earlier date than formerly. The first week in November has always been the time set for the desert classic but the supporters of the event claim that it should be moved up 3 weeks or a month.

The $20,000 purse is to be cut eight ways. The winner is to receive $8,000 according to the plans of the supporters of the race. The second place man is to receive $5,000, $3,000 is to go to third, $1,500 to fourth, fifth place is to net $1,000, $750 is to go to sixth place winner, $500 to the seventh man and $250 for the eighth place.

Entries for Tacoma Speedway Events

TACOMA, WASH., April 22—Although the running of Tacoma's 1915 speedway events is still 3 months off, the following entries are registered at the office of the Tacoma Speedway Assn.: Robert Burman, Peugeot; G. Ruckstell, Mercer; Eddie Pullen, Mercer; Dave Lewis, Stutz; Earl Cooper, Stutz; J. Parsons, Parsons Special; and Joe Thomas, Mercer.

The Montamarathon classic, the 250-mile event, will be run on Sunday afternoon, July 4, while the Inter-City century and the Potlatch trophy events will be run on Monday, July 5.

NEW YORK CITY, April 23—An intercollegiate transcontinental automobile race has been planned for next summer by the Eastern College Newspaper Assn., according to an announcement made at Columbia University yesterday. Cars from every college and university in the country will compete. The start is scheduled to be made about July 1 and stops will be made at the Panama-Pacific Fair.

The race is planned more as an endurance test for the college drivers and their cars rather than as a speed test. Any make of a car will be permitted.

Small Attendance at Exposition Exhibits

SAN FRANCISCO, CAL., April 18—Yesterday was one of the big attendance days at the Exposition here, but the attendance in the automobile exhibits was small, averaging less than three visitors per exhibit in the afternoon. In the British section the Rolls-Royce is exhibited. There are also displays by not a few American concerns such as Champion Spark Plug Co., Splitdorf Electrical Co., American Ever Ready Co., Wisconsin Motor Mfg. Co., Standard Oil Co., and a few others.

The exhibits of trucks is very small, but there is a motor truck building being erected at a stub-end of the grounds where it will be difficult for people to find it.

Want Light Trucks in Australia

Conditions in Automobile Industry Are Better — Many Fields Open

SYDNEY, AUSTRALIA, March 24—Automobile conditions are improving in this country. On December 31, 663 motor trucks were registered in New South Wales and 690 in Victoria, this showing a big improvement over one year ago. The light truck market is going to be a big one in Australia, and if dealers had hundreds of these trucks on hand today they could readily dispose of them. Quite recently business houses wanting light trucks were purchasing passenger touring car chassis and fitting them for light delivery work. While these have been successful in their light capacity something stronger has been wanting and the light truck is fulfilling this demand.

Owing to the British government commandeering the whole of the British output of trucks there is now a dearth in Australia of light motor trucks. No one has any on hand and no one can procure any from England. Importers are somewhat anxious and are hesitating whether to dabble in American light trucks or not; a few of them are now coming into the country and are beginning to sell. Light trucks up to 2-ton capacity are the type most of our business houses require.

Mail Service Offers Field

Another big field for the truck is the country mail service. Railroads are very scarce in Australia and from each railway town mail contracts are let to carrying firms, quite a few of whom already own motor cars for the heavy class of work. This service requires something stronger and slightly slower than the average passenger car and the light truck should fill these requirements.

The Australian postal department is very much in arrears in motor delivery. It has a few vehicles running between Melbourne and Adelaide, but the other cities are cared for by horses and the want of a light truck is staring them in the face today.

Other businesses such as piano houses, typewriter concerns, etc., are using motor trucks. Brewers are the greatest buyers today. Retail firms such as butchers and grocers are taking motor trucks very slowly.

In the big cities the catering business is controlled by a few large concerns who have depots all over the place. These depots are supplied from one huge factory located in a suitable district, and the question of delivery is the only thing that is troubling them today. In Sydney and Melbourne alone one concern is on the eve of placing the largest order yet placed in Australia for trucks, outside the government. This firm feeds more people than any other five concerns in Australia, and declares that inside a year it will not own a horse. If it had 100 trucks it would not have enough. At present it has five, but is launching out now in large numbers.

At the present time horses are scarce, owing to the war demands, and horse feed is very high in price through the drought and its consequences. These mail contractors are commencing to inquire into the utility of motor trucks, and a number of sales are expected in this direction.

Cattle is commanding record prices and so is wool. Wool has never been sold at higher prices than it has commanded lately; the demand comes from the seat of the war. With these prices it makes the automobile business very busy and very prosperous—the automobile only interests people with money, and it is monied people today that are making money. Unfortunately, the poorer classes are worse off than ever. War seems to be making extremes in this country and while the wealthy have plenty of money they will spend it in automobiles. Next year should be a record year, though the whole of the prosperity of Australasia depends on rain.

Nebraska Registrations Pour In—Sales Boom

OMAHA, NEB., April 27—Prosperity in this territory in the automobile business has been so great that dealers on every hand report such enormous increases in their trade that it is impossible for them to keep pace with the demand for their cars.

A year ago the total automobile registrations with the secretary of state at Lincoln reached 40,258. In 1913 the total registrations were only 25,616. Both were exclusive of motorcycles.

The registrations for the first quarter of 1915, under a new law which requires a change of motor tag number colors each year, have reached 15,000. Applications for license numbers are literally pouring into the office of the secretary of state. One morning's mail brought requests from 515 owners.

And still, it is believed, an old motor registration law, with its loose provisions, is working an injustice on the state. Licenses still are being used which were issued many years ago when no fee was required. They are obsolete, but their owners have not come up to scratch with the money for new numbers.

There is not a dealer in this city who doesn't report an increase in his business which varies from 60 to 100 per cent. The great trouble now is to supply the demand for machines. No sooner is one received on the salesroom floor, the dealers say, than it is grabbed up by some anxious purchaser.

If this sort of thing keeps up it is conceded that several millions of dollars in business will be handled through this point before the year is half over.

CHICAGO, ILL., April 23—The Inland Steel Co. has closed a contract with one of the largest gunpowder manufacturing concerns in the United States for its entire output of benzol for the next 2 years, which is expected to net the company a profit of about $2,000,000.

Prosperity Wave Hits Detroit Accessory Makers

(Continued from page 751)

some forty concerns on the company's books, and lots of business in sight. Expansion at the Long plants is the rule, for at this time they are building 5,000 feet more floorspace for enamelling ovens and general manufacturing.

The windshield branch of the trade is well represented in the present operations of the Vanguard Mfg. Co., which at this time is turning out over 1,000 windshields a day, with every manufacturer it is supplying increasing his specifications. Business is said to be fully one-third better than a year ago, and night and day shifts have been in vogue since some 5 or 6 weeks ago. Another means of comparison is in the fact that at this time there are about 300 men on the Vanguard payroll as against 165 in April of 1914. Here again, the statement was made that business looks better than it has for a year past.

Zenith 50 Per Cent. Gain

Last week the Zenith Carbureter Co. put on a night shift in an effort to keep pace with manufacturers' demands. This shift works 12 hours. Business has increased fully 50 per cent. in Zenith carbureters in the last half year. The Zenith factory is an example of modern factory construction, and was built large enough to take care of just such expansion as is now taking place. New machinery is being added in an effort to raise the output of 200 carbureters a day. Ninety men are now on the payroll.

The output of the Bower Roller Bearing Co. has been double that of last year, in order to fill its orders. Many departments are running overtime, and part of the production division is operating at night. The present number of employees is 125, which is about 40 per cent. more than the concern required at this time 1 year back. Bower bearings are now being supplied to seventy car makers.

The Massnick-Phipps Co., maker of the Perkins motors, has within the last year become one of Detroit's very active manufacturers. It foresaw the wave of popularity of the eight, and was quick to place one in the field. Now fully 75 per cent. of the daily output of thirty-two engines a day is of the eight-cylinder type. This production is 100 per cent. more than the concern enjoyed last year.

Not very long ago, Massnick-Phipps took over the plant formerly occupied by the Wahi Motor Car Co. which gives 25,000 square feet additional, making a total of 60,000 square feet. W. A. Perkins, of this concern, says that the company is swamped, and ought to be turning out at least fifty engines a day to keep up with orders. There are now 350 men on the payroll, which is a third more than ever before. Two 10-hour shifts are being used, and there is no let-up for Sundays.

Although the Hyatt Roller Bearing Co. is not strictly a Detroit concern, since its factory is in Newark, N. J., nevertheless the sales offices are here, and from it emanate reports of the biggest business in Hyatt history. Heavy specification increases have livened things up within a month, and the plant is running overtime, although prompt delivery is said to be possible due to large production facilities.

Naturally, there are many of Detroit's leaders on which nothing definite can be said due to the characteristic reticence, or conservativeness—call it what you like—of their officials. They believe in enjoying prosperity after the fashion of the ultra modest individual who prefers to hide his light under a bushel. Take Hoiley Bros., for instance. They are building an enormous number of carbureters each day, and are extremely busy, but do not care to be quoted.

Other Plants Rushed

Then there is the big Northway plant which is making well over 100 motors a day, and is working day and night shifts. Edmunds & Jones, specialists in lamp manufacture, are very busy, as are the body plants, such as Wilson, Fisher, Griswold, Briggs, etc. The Kelsey Wheel Co. is backward about talking, but is working to capacity. The McCord Mfg. Co. has all it can do to fill orders for its radiators and other automobile specialties, and the Sterling Motor Co. is very active.

Lansing, Mich., April 24—Because of rush orders which must be completed by May 1 for foreign shipment it has become necessary to work the plant of the Auto Body Co. to capacity. Several departments are being operated 24 hours a day, while other departments are being operated overtime. The company is employing more men this spring than formerly and is making use of added equipment, new buildings and new machinery.

Allegan, Mich., April 24—The Blood Brothers' Machine Co. is working 24 hours a day, 6 days a week, turning out parts for the new Corneiian car. Within a few days the company will be turning out the completed cars in larger quantities. Modern machinery has been installed in the plant and one of the features in making the car is the fact that the body enamel is baked in one operation.

Outline of System for Standard:zing Spring Suspension

(Continued from page 767)

has the advantage of making traction quite secure on slippery and other difficult ground and probably can take the place of 4-wheel-drive construction to a very considerable extent if not entirely, constituting a much simplified means for attaining the same ends that are sought to be accomplished by driving all the wheels. For motor ploughs it could also be seriously considered, as in fact it was designed for that purpose in the first place. Its most conspicuous drawback is that a sharp braking movement has the effect of raising the vehicle body for the moment. It is an application of the much derided wheel-within-a-wheel principle, which, however, apparently is the only principle by which secure traction can be obtained in a compact manner and without cumbersome accessories when friction fails.

In the applications of this principle which have been tried in the past the traction qualities have been demonstrated under the worst surface conditions but the wheels were not closely built and not fortified against end-thrusts or the hundreds of irregular movements to which a motor vehicle is subject. They were scarcely to be considered as wheels but rather as special devices for special conditions, on the order of the caterpillar traction system or of the huge traction blocks which are employed on the wheels of heavy artillery in the present scientific slaughter campaign of Europe.

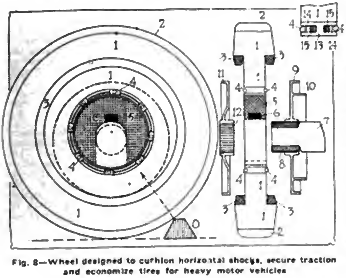


Fig. 8—Wheel designed to cushion horizontal shocks, secure traction and economize tires for heavy motor vehicles

A construction which should give the desired results is shown diagrammatically in its essential parts in Fig. 8. To the left is the central wheel 1 with the road tire 2, and the relatively small traction tires 3. It could be made of a non-vibrating fibrous material pressed in one piece, or it may be composed of many pieces of such material or of wood, or it could be a hollow steel casting—according to the specific purpose in each case. It could be made either with spokes or as a disk. It is mounted on a central steel ring containing the end-thrust bearings 4 and of such section as shown separately at 13. The balls project a little from the surface of 1 and roll—very slowly—on a slightly yielding backing, such as a steel ring 14 abutting against a ring of rubber compound 15 in the bottom of the groove containing the balls. The balls are caged.

Within ring 13 a thin metallic ring is free to revolve, exerting no pressure, so that graphite inserts for lubrication are sufficient. It contains block 5 made of cheap rubber compound or similar material, and this block holds an adjustment 6 serving to keep the wheel axle from bouncing at all when axle 7 is lowered by wear of traction tires 3.

Vehicle axle 7 with the flanged driving-wheel 9, on which brake drum 10 is cast and which is mounted on the fluted exterior of the bearing members 8, is inserted through the oblong opening in block 5, thereby bringing the driving-wheel 9 to rest upon traction tires 3, while the hub flange of 9 abuts against adjustment piece 6 above it. The weight of the vehicle bears down unrestrictedly upon the traction tires and continues to do so irrespective of wear. The other driving-wheel 11, whose hub 12 is also fluted internally, is now placed upon the outer end of bearing members 8 and is secured in its place, the two driving wheels abutting against the end-thrust bearings 4, and the wheel shaft is keyed to the hub of 11 in the usual manner. In case of chain-drive, brake drum 10 can be adapted to take the sprocket crown externally.

With reference to the subject in hand—the cushioning of the horizontal element of road shocks—it is evident that when the wheel strikes obstacle O the force is transmitted in the direction of the arrow and is decomposed at the interval between tires 3 and driving sheaves 9 and 11. The vehicle tends to climb the ascending curves of tires 3, thereby gradually absorbing the shock. Various considerations arise with regard to the action for one-sided shocks, but it is clear that the end-thrust bearings 4 will compel one wheel to follow the other to such an extent that the construction may be used for front wheels as well as for driving wheels.

Week's Summary in Detroit

First S. A. E. Standards Meeting in City a Success—Reports and Rumors in the Trade

DETROIT, MICH., April 27—It was Henry Souther who said recently in Detroit that the Society of Automobile Engineers is the periscope of automobiledom. In these war times that is a very appropriate metaphor, expressing as it does the sentiment of all who know anything at all about the great work which the society is doing for the industry. It is undoubtedly true that, like the submarine which depends upon the periscope for its existence, the industry could not well get along now without its engineers' organization.

The truth of this seemed more strikingly brought out last week here in Detroit than ever before, because the work of the standards committee S. A. E. was of a somewhat more popular nature than most of its previous labors, and it was thus brought home to the average man who is an automobilist. It made him realize that the engineering body stands ready to help not only in the design of cars, but in legislative matters, road matters, etc. This thought was expressed by several of those here at the session.

First Standards Meeting for City

This was the first time the quarterly meeting of the standards committee of the Society was ever held in Detroit, strange as that may seem. The principal reason for that is that the chairman was not a Detroiter. But with the election of K. W. Zimmershied to the honor, the meeting naturally was brought here.

A strong feeling of satisfaction permeated the little group of some fifty engineers, for they were not compelled to travel many miles to enter into the deliberations of the various divisions holding sessions, and into the general meeting last Thursday. They could give the benefit of their knowledge to the committees without staying too long from their duties at their factories, and had the meeting been held in some other city, it is doubtful if as many of the prominent engineers and authorities on the several subjects could have been on hand, for at this, the busiest time of the year for the factories in Detroit, it would have been next to impossible for some of them to have gone away from the city for the 3 or 4 days which the meeting necessitated.

Engineers Appreciate Opportunity

The Detroit engineers are fully aware of the advantages to the industry here of the work of the standards committee, as evidenced by the number of them who took part in the deliberations. One man was heard to say that he had not awakened to the vast amount of good that could come to himself and his company by taking an active interest in the work of the committee until after attending this meeting.

One other—it would be too bad to mention his name—he is too prominent—said he had awakened to its importance too late. It seems that in the deliberations of one of the divisions, he was invited to submit for the benefit of the committee certain special data bearing on the subject, and which he had obtained by exhaustive experiments. This he failed to do, through neglect or disinclination. Later the division made some recommendations to the Society which did not take into consideration the special needs of this certain company with the prominent but backward engineer. Had his special data been received, it might have helped his case. Now he takes an active part in the work

Several engineers who are really authorities on certain matters on which they have specialized took advantage of the meeting being in Detroit to attend the sessions and, though they were not members of these, they were welcomed into the deliberations. There is a growing spirit of co-operation, which was very evident at the Detroit meeting.

Several important changes have taken place in the trade here this week, Orlando Weber joining the Maxwell Motor Co. as assitant manager, S. H. Humphrey, factory manager of the Hupp company for the past 2 1-2 years, resigning to succeed H. H. Pinney third vice-president and works manager of the Chalmers organization and Alfred Thompson, for 2 years works manager with Maxwell, joining the production department of the Hudson factory.

Another development of the week was the formation of the Internal Gear Drive Assn., with the object of becoming a clearing house for information on this type of drive.

What has been assumed to be the new Packard has been seen on the road, and it certainly exhibits surprising speed and getaway. The jackrabbit seems to have nothing on the new job—if that is what it is. Anyway, J. G. Vincent, the Packard engineer who sits on the lid of the engineering department of the big company, has been driving a snappy affair on the roads of late, and rumor is rife. He has a habit of silently creeping up upon some innocent and unsuspecting car, and silently passing it at a remarkable clip before the surprised driver can speak to his mount and get started after the cloud of dust.

New Packard Raises Rumors

Persistently it has been said that Packard will have a twelve-cylinder machine for next year, but there are some motor seers who disclaim this statement and do not believe that it will have any more cylinders than the present models boast. There is no doubt, however, that the price will be lower than any previous Packard models—probably somewhere in the neighborhood of $2,500.

No less speculation is going the rounds about the new car which the General Motors Co. will bring out in the middle of the summer under its own name. That it is to be a six is certain, and parts makers have received invitations to bid on 30,000 parts for such a car. Northway will build its engine, and now that Cartercar is to be closed out, this plant in all probability will be used for the purpose. There are several light sixes at under a thousand dollars on the market, and it is but logical for the General Motors organization to enter this field in competition. None of its properties now operating is making a car of this type, and there is undoubtedly a big demand for such a machine. The General Motors officials are alert to the situation, hence long since color was lent to rumors which are now accepted facts.

Stewart-Warner's Ford Starter

Stewart-Warner is making a campaign just now on something new to come from their Chicago factories in the way of a starter for Ford cars. The belief of the writer is very strong that this is of the air variety, and supply men and manufacturers here are really very much interested to know just what the construction is. Of course, they may fool us and bring out an electric type, but we think not.

Eight-Cylinder Men on the Jump

Trade circles are agog over the surprising way the eight-cylinder fellows are getting along. Those who were skeptical of the popularity of the multi-cylinder engine are coming around in great shape, saying that they "told you so all the time." Some remember that they didn't, but then that is a part of the grim past. The grim past in Detroit was last fall and winter, when though the manufacturers were doing more than many in other lines, they did not look for the sunshine that spring and early summer have brought. It looks as if production figures in more than one plant will touch high levels, and with conditions just right everywhere in the country, there is great excuse for the striking optimism which they display, practically to a man.

S. A. E. To Shift Headquarters

NEW YORK CITY, April 28—After the close of the current week the headquarters of the Society of Automobile Engineers will be at the Engineering Societies Building, 29 West Thirty-ninth street, instead of at 1790 Broadway. The offices will be on the sixth floor and about the same number of rooms will be used as are now held in the Rubber building. The advantages of being close to the other engineering organizations besides the use of the library in connection with the building to be occupied have been among the chief attractions.

DETROIT, MICH., April 28—W. J. Murray was elected president and sales manager of the Splitdorf Electrical Co. of Detroit, at a directors' meeting held last week.

Developments in the Jitney Bus Field

San Diego Railway Interests Stop Development Till Jitney Is Curbed — People Want to Ride in Automobiles and Desert Trolleys for Buses — Reports from Other Sections

SAN DIEGO, CAL., April 17—One of the first sights for a visitor in this exposition city is a square block across from the Santa Fe station, filled with rows of rails and steel beams painted a vivid red and surmounted by this sign:

> TO THE CURIOUS
> What Is That Red Stuff?
> *That is the bridge steel for extensions of the San Diego Electric Railway. All extensions and construction work have been suspended or abandoned on account of the competition of the* unregulated *Jitney Bus.*
> *THAT'S WHY IT IS HERE*
> *San Diego Electric Railway Conductors' & Motormen's Conference Committee*

About 150 jitney buses are operating in San Diego spasmodically. A development in the situation came last week when a great many of the jitneys abandoned their routes between the rush hours—from 10 a. m. to 4.30 p. m. and after 7 p. m.—and pulled down their 5 cent cards, hanging new ones advertising "Auto Bus For Hire." They stationed themselves on downtown corners where they offer to drive visitors anywhere at rates which they are willing to discuss. They underbid the taxi and big bus lines.

The San Diego Railway Co. is bitter against the jitney and has publicly announced that not another spike will be driven until the jitney is curbed. This will result in the failure of suburban development plans. The railway also is spreading the information that the state is losing between $300,000 and $400,000 a year because of the shrinkage of gross receipts of street railway companies which the state taxes at the rate of 5 1-4 per cent.

The jitney men are hanging on half-heartedly. There is an anæmic association of operators known as the San Diego Auto Bus Assn. The association has close to 110 members, each paying $2.50 initiation fee and $1 a month dues.

The San Diego Electric Railway Co. has been investigating the jitney movement closely and has even stationed checkers to report on the earnings of jitneys. It is said that jitney operators, when they observed that they were being watched, pulled down their signs and drove away to garages.

The street railway has found that many jitneys collected as much as $8 a day for fares. Where owners do not drive, they pay drivers 25 per cent. of the gross earnings. Gasoline has sold for 12 cents a gallon for a long time here, but this cheapness is offset somewhat by the hilly nature of San Diego.

An interview with W. Clayton, vice president and managing director of the San Diego Electric Railway Co., elicited this information:

"In 1901 San Diego had a population of 17,500. Today we have about 85,000, exclusive of exposition visitors. A great many people come here to live because of the climate. They have money and own automobiles. With hard times in the east, these people have had their security incomes reduced and it is from this class that many of the jitneys are coming.

"We had jitneys first last July but did not feel the result in reduced street car fares until about October. Now we are suffering.

"The state of California will lose in taxes at the present rate between $300,000 and $400,000 a year, being 5 1-4 per cent. of the gross receipts the jitney takes away from the street railways. In other words, the street railway companies, which maintain regular schedules over long distances, day and night, pay 5 1-4 per cent. of their gross receipts in taxes to the state, while the jitney bus, which runs over short distances when it is in good repair and its driver is in the mood, is costing the state about a third of a million dollars a year in taxes without protecting its passengers or providing definite service or earning its operators a decent living wage.

"People ride in jitneys because of the novelty of riding in an automobile. In our investigation we find that many are willing to walk five or six blocks from a jitney terminus where they would regard a walk of three blocks from a street car line as an iniquitous oppression. You find people all over California willing to ride in jitneys and sit on strangers' laps. They never would do that in a street car.

"Jitneys will run nearly every street railway company on the coast to the wall unless they are regulated so that competition is equitable. A measure has passed the senate providing for a tax of $12.50 a seat for jitney buses. I do not believe this is half enough. When it comes to bonding a jitney bus, the surety companies are chary because with an irresponsible or discontented jitney driver many accidents might result. This should be taken care of by legislation.

"There is no question that in some places the jitneys have done a service to the people by punishing autocratic street railways companies. This is not the case in San Diego where our company has absolutely no watered stock, is controlled by the Spreckles brothers, and has always been more than willing to extend lines and assist in the development of San Diego into the large city that it some day is bound to become.

"But we won't drive another nail until we know where we stand. All line extension is stopped. We will forfeit franchises before we will expand our system with the present jitney bus competition protected by the state."

$500 Bond Per Seat in R. I.

PROVIDENCE, R. I., April 24—The Rhode Island legislature adjourned last night and in its closing hours the jitney bus bill was jammed through so that it provides for a bond of $500 for each passenger the vehicle in use can carry. As originally passed by the Senate it was $750 a passenger, but the lower branch knocked off $250. The cities and towns may make regulations governing the speed, streets used, etc.

Gotham Jitney Wins City Suit

NEW YORK CITY, April 26—The suit brought by the City of New York against the Peoples 5-cent Bus Corp., for demonstrating its electric buses on the city streets was dismissed by Justice W. Lynn in the Third District Municipal Court today.

The city brought suit to recover a penalty for a violation of section 41 of the city ordinances, which prohibits the use of trucks, vans or wagons in the Borough of Manhattan for advertising purposes.

The Peoples 5-cent Bus Corp., a subsidiary company of the Electro Coach Co., New York City, has been endeavoring to obtain a franchise from the Board of Estimate and Apportionment for the operation of a line of electric motor truck buses over certain specified routes in the Borough of Manhattan. The latter body has been very slow in passing upon the application for the franchise and in the meantime, the bus company ran several of the trucks up and down on the most important thoroughfares without carrying any passengers merely to bring them before the public eye.

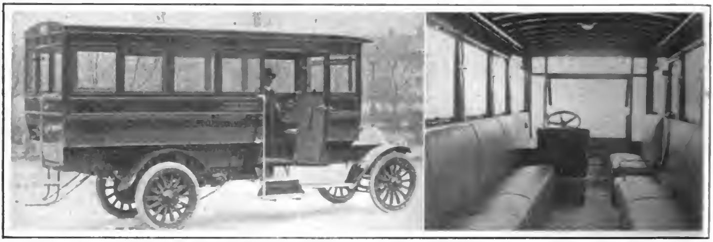
Two jitney taxicabs started running on Saturday, one machine going from Seventy-second street and Broadway and the other at Fifty-ninth street and Fifth avenue. The charge is 10 cents a mile. The machines used are seven-passenger touring cars.

Jitney Bus Bill Hits New York City

ALBANY, N. Y., April 22—By a last minute change made in the Thompson jitney bus bill, which was passed in the Senate and Assembly, New York City will be affected by its provisions.

At first the bill had a provision it should apply only to cities of the first class, with a population of 750,000 or under. It was changed to apply to any city.

By the terms of the bill any vehicle carrying passengers



Exterior and interior views of Stegeman twenty-passenger jitney bus mounted on the 1 1-2-ton standard truck chassis

for 15 cents or less must get a certificate of public convenience and necessity from the Public Service Commission and the consent of the local authorities before operating, if the latter demand it, and be subject generally to the terms of the railroad law, if in competition with any other common carrier.

Jitneys Reduce Trolley Revenue $2,000 Daily

WASHINGTON, D. C., April 24—After spending a month observing the operation of jitney bus lines in the south and west, Conrad Syme, corporation counsel of this city, has returned and is now making an elaborate report on his observations for the public utilities commission. He reports that the operation of jitney buses in New Orleans, Los Angeles, San Francisco, Kansas City and St. Louis is reducing the revenues of the street railway companies more than $2,000 a day in each of these cities.

Syme said that the jitney bus is not a fad or a mere transient thing, but that it has been called into service by demand for a more immediate and elastic form of transportation, particularly in the business parts of cities. The buses, he declares, are receiving strong popular support. He rode and talked, he said, with scores of jitney bus operators, all of whom claimed to be operating their cars at a profit, their average receipts being from $6 to $8 a day. The cost of operation, he was informed, is about $3.50 a day, which includes $1 a day laid aside for depreciation.

St. Louis Jitneys to Put Up Rates

ST. LOUIS, MO., April 24—Jitney owners in this city will soon raise their rates from 5 to 10 cents. A study of upkeep costs has convinced the owners that carrying passengers a distance of 4 miles for 5 cents each is a losing venture. It costs 7 1-4 cents a mile or 29 cents for the 4 miles according to estimates given by the manager of one of the jitney lines. It would be necessary to carry six passengers on each trip to cover the operating cost but this is seldom possible, because there are hours during the day when trips are made with three and four passengers, and during the rush hours of the morning return trips from downtown are often without a passenger.

$10 Per Seat Annually in Savannah

SAVANNAH, GA., April 22—An ordinance regulating the operation of jitney buses and putting a tax upon them has been passed by the city council. Every owner will be required to pay an annual tax of $10 a seat for every machine in operation. In addition they will be required to give an indemnity bond of $5,000. Buses will not be required to run on schedule, but will be required to operate along given routes and machines placed in service on one route will not be permitted to shift to another to get the benefit of an increased travel in that section.

Stegeman Jitney Bus Makes Appearance

MILWAUKEE, WIS., April 26—The first real jitney omnibus of the large-capacity type to make its appearance in Milwaukee is the 20-passenger car built for W. B. Hood by the Stegeman Motor Car Co., in collaboration with the Chas. Abresch Co., Milwaukee, body builder. Mr. Hood is making an experiment, which, if successful, will result in the purchase of additional buses. On the first day the new bus was in service, the total receipts were $25.50, running day and evening.

A standard 1 1-2-ton Stegeman truck chassis is used for the Hood bus. This employs a four-cylinder Continental-Stegeman motor with 3 3-4-inch bore and 5 1-4-inch stroke. The wheelbase is 127 inches. Final drive is by double chain from jackshaft. A Gray & Davis lighting equipment, but no starting equipment is used. For winter use, heating registers are placed in the floor of the car and connected with the exhaust manifold.

The body is 17 feet long, 6 feet high and 6 1-2 feet wide. The driver's seat is separate and at the left. All doors are operated by levers at the driver's right. The bus is of the pay-as-you enter type and the fare box is placed conveniently at the entrance in view of the driver, but out of his reach. Two dome lights in the ceiling illuminate the car. There is a push button above each seat. The seats run fore and aft. The rear door, for exit purposes, is placed in the center of the panel. Sheet metal is liberally used in the construction. The car is equipped with Motz cushion tires front and rear. Price, complete, is $2,700.

Jitney Bus Holds Sway in Grand Rapids

GRAND RAPIDS, MICH., April 26—The jitney situation still continues to hold the center of the stage in this city with the jitney men apparently having the best of the matter up to date, Mayor G. E. Ellis having announced that if the common council passes the drastic ordinance proposing large bonds, a higher license fee and prescribing difficult regulations, he will veto it.

The jitney owners have perfected their organization under the title of the Grand Rapids Jitney Bus Assn., with the following officers:

President, J. W. Sherwood; vice-president, F. P. Nichols; secretary, G. F. Barnes and treasurer, E. R. Thompson.

There are now nearly 200 jitneys in regular operation.

ATLANTIC CITY, April 27—After much discussion, the Atlantic City Council passed an ordinance for the regulation of jitney buses on Friday last. License was finally fixed as follows:

For five-passenger cars, $75; for seven-passenger cars, $100; for cars with more than seven and not more than ten passengers, $125, and for cars carrying more than ten, $150.

This is a reduction from the ordinance which was originally drawn which ranged from a $100 to $200 license fee.

Bond has to be given by the owner of each car operated at $5,000 for each car.

LOS ANGELES, CAL., April 23—The jitney bus operators of Los Angeles claim an overpayment on bus license fees to the amount of $27,000 and the city attorney is of the opinion that it lies entirely within the discretion of the City Council as to whether this amount shall be refunded or not.

The jitney men formerly paid a license fee of $15 per quarter. The city attorney ruled that they should be compelled to pay but $7.50 per quarter.

WATERBURY, CONN., April 24—Universal transfers, twenty-five tickets for $1, and operation of cars from 5:30 a. m. to 12:30 a. m. was announced today by the Waterbury Jitney Service, Inc. Operations will begin next week with thirty jitneys, and will be increased to 200 within 30 days.

Factory Miscellany

INTER-STATE Factory Busy—The Inter-State Motor Co., Muncie, Ind., this week sent out one of the largest single shipments of automobiles made this year by an Indiana manufacturer. The shipment consisted of twenty-one touring cars and nine roadsters, valued at $30,000, and was sent to the Fred C. Huffman Motor Car Co., Omaha, Neb. At the present time the daily output of the factory is between eighteen and twenty cars, but it is hoped that it will be increased to twenty-five by May 1. The factory is about 400 cars behind on its orders. On April 22 the Kanouse Automobile Co., Indianapolis, Ind., distributor, and the Inter-State company held the first "drive-away-day" ever held in that state. Fifty-six dealers and their friends from various points in that state and one from Ohio drove away from the factory in thirty-one new cars.

International Motors to Build—The International Motor Co., New York City, will build additions to its Saurer plant in Plainfield, N. J.

Mosler to Add—A. R. Mosler & Co., Mt. Vernon, N. Y., has completed plans for an addition to its factory on Wakefield and Webster avenues.

Hudson's New Storehouse—The Hudson Motor Car Co., Detroit, Mich., is taking bids on a structural steel storehouse, one story, 20 by 200 feet.

Packard's $20,000 Addition—The Packard Motor Car Co., Detroit, will spend $20,000 for a two-story, 52 by 40, addition to its plant located on Concord avenue.

Spokane Firestone Moves—The Firestone Tire & Rubber Co., Spokane, Wash., has moved to 127 West First avenue. The new quarters contain 10,000 feet of floor space.

Zinc Co. to Make Tires—The New Jersey Zinc Co. will shortly commence the erection of a rubber tire factory in connection with its plants at Palmerton and Millport, Pa. These tires are composed of 55 per cent. of zinc.

Kelsey Wheel's Second Addition—A two-story addition, 80 by 253 feet, costing $28,000, is to be started upon the plant of the Kelsey Wheel Co., manufacturer of automobils wheels in Detroit. This is the second addition to be announced by the company within the last 3 weeks.

Ford Buys Washington Land—Deeds were placed on record this week whereby the Ford Motor Co., Detroit, becomes the owner of the property at the northwest corner of Pennsylvania avenue and John Marshall Place. The ground is 150 by 200 feet, and it is understood a six-story assembly plant will be erected in the near future.

Owego Plant Sold for $2,000—Referee in Bankruptcy A. B. Kellogg, of 115 Broadway, New York City, sold on April 15 the office fixtures of the defunct Owego Car Co., Owego, N. Y., for $58.50 and the good will, stock and machinery, sold in a lump, brought $2,000. The successful bidder was William Wooster, representing the Automobile Surplus Stock and Supply Syndicate.

Harrison Radiator Co. Buys Plant—The Harrison Mfg. Co., Buffalo, N. Y., manufacturer of automobile radiators, on Saturday purchased for consideration said to be $23,500 the plant of the American District Steam Co. in Lockport, N. Y. The radiator concern for some time has occupied the building, and now that the company has purchased the structure an addition to the plant is being constructed to care for increasing business.

Sheboygan's Brass Goods Plant—Philipp Meyer of Port Washington, Wis., until recently associated with the engineering staff of the Falls Machine Co., Sheboygan Falls., Wis., has organized the Meyer Mfg. Co. and will establish a brass foundry and brass goods plant in Sheboygan Falls. The concern has leased the warehouse building opposite the C. & N. W. depot.

Savage Tire's New Addition—The Savage Tire Co., San Diego, Cal., is erecting an addition to its factory at Main and Sicard streets, which will double its facilities. The new building is 40 feet by 230 feet, and will cost $17,320. It is to be of cement. When the building is completed in 10 weeks, 250 additional employees will be engaged, adding $250,000 to the tire company's payroll. The roll of workers numbers 250 now.

Waukesha Working Full Time—The Waukesha Motor Co., Waukesha, Wis., has started work on adding twenty-four units to its plant to supplement four units recently added. The plant has been operating 24 hours a day for some weeks past and is obliged to maintain a record production indefinitely because of the unusual demand for Waukesha motors from automobile and truck builders, notably the Sternberg Motor Truck Co., Milwaukee, which is busy on large war orders.

N. Y. Spring Co. Buys—The E. R. Merrill Spring Co., New York City, manufacturer of automobile springs, located on the middle west side, has concluded negotiations for the purchase of two adjoining parcels for the enlargement of its plant. One parcel is located at 525 West Twenty-seventh street, a two-story building, and the other a three-story building at 531 West Twenty-seventh street. The company now occupies 525 and 529 on the same street, extending through to 526 to 532 West Twenty-eighth street, and with the new acquisitions controls a plot with frontages of 95 and 100 feet respectively.

The Automobile Calendar

April 30, May 1-2	Portland, Ore., Track Races; Northwest Automobile Assn.
May 1	Irvington, N. J., track meet; O. V. Matthews.
May 1	Philadelphia, Pa., Quaker City Motor Club, Eighth Annual Sociability Run to Atlantic City.
May 5-6	Detroit, Mich., Motor Truck Convention of the N. A. C. C., Hotel Statler.
May 8	Salem, Ore., Track Races; Northwest Automobile Assn.
May 15-16	Vancouver, Wash., Track Races, Northwest Automobile Assn.
May 15-18	Columbus, O., Track Race, Columbus Automobile Club.
May 17	Spokane, Wash., Show, Davenport Hotel.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 18-19	Boston, Mass., annual meeting of the American Automobile Assn.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
May 29	Philadelphia, Pa., Stone Harbor Memorial Day Run from Philadelphia.
May 29-30	Seattle, Wash., Track Races; Northwest Automobile Assn.
June 3	New York City, 11th Annual Automobile Outing for Orphans; Orphans' Auto. Day Assn. of N. Y.
June 9	Galesburg, Ill., 200-Mile Race, Galesburg District Fair Assn.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race, Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6.	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 13.	Oakland, Cal., Pan American Road Congress.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 1-2.	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show; Grand Central Palace.
Jan 22, 1916	Chicago, Ill., Show; Coliseum.

The Week in the Industry

Motor Men in New Roles

DORT Advertising Mgr.—R. B. Dort, formerly manager of foreign advertising for the Albany Knickerbocker Press, has been appointed advertising manager of the Dort Motor Car Co., Flint, Mich.

Whittemore Autocar Advertising Mgr.—H. L. Whittemore has been appointed advertising manager of the Autocar Co., Ardmore, Pa.

Beatty Goodyear Branch Mgr.—S. M. Beatty has been appointed manager of the Goodyear Tire & Rubber Co.'s branch in Providence, R. I.

Lawrie Makes a Change—G. H. Lawrie, for some time manager of the Boston branch of the Pennsylvania Tire Co., has resigned and bought an interest in the Mitchell & Smith Co., Boston.

Hunt Heads Philadelphia McNaull—The McNaull Tire Co., Toledo, O., has established a store and service station at 720 North Broad street, Philadelphia, Pa., with D. E. Hunt, manager.

Stimson Bowers Tire Mgr.—L. S. Stimson, formerly manager of the Batavia Tire & Rubber Co., has been appointed manager of the L. S. Bowers Tire Co., Philadelphia, Pa., 126 North Broad street.

Finger Sales Mgr.—F. J. Finger, has been appointed sales manager for the H. C. Skinner Co., Portland, Ore., distributor of Maxwell cars. Mr. Finger's territory will include all of Multnomah County.

Love's New Appointment—C. M. Love, formerly of the Atlanta (Ga.) branch of the Studebaker Corp., has been appointed special representative of the same corporation in Virginia and North and South Carolina.

Diers Increases Scope—C. L. Diers, formerly manager of the Indianapolis (Ind.) branch of the Goodyear Tire & Rubber Co., is now manager of the Indianapolis district, including the branches at Louisville, Cincinnati, Columbus and Dayton.

Federal Truck's New Sales Mgrs.—The Federal Motor Truck Co., Detroit, Mich., has appointed L. C. Long and E. D. Jones district sales managers. Long will look after eastern territory and Jones after Ohio.

Fry Detroit Empire Tire Mgr.—J. B. Fry, for 5 years rubber expert in the United States Navy, has been appointed manager of the Detroit (Mich.) branch of the Empire Rubber & Tire Co., 842 Woodward avenue.

Lees Oakland District Supervisor—R. C. Lees has been appointed district supervisor for the Oakland Motor Car Co., Pontiac, Mich., and will make his headquarters at Cleveland with the Adams-Oakland Co.

Crittenden Heads Regal Dept.—G. A. Crittenden, who was sales and advertising manager of the Krit Motor Car Co., Detroit, Mich., has become head of the sales promotion department of the Regal Motor Car Co., Detroit.

Slosson Firestone Rep.—Steward Slosson has been appointed Pacific Coast representative of the Firestone Tire & Rubber Co., whose duty it shall be to attend all speed events and interest drivers and motorcycle riders in the use of Firestone tires.

Ide Joins Simms—J. H. Ide, who for a long time has been connected with the Detroit branch of the New Departure Mfg. Co., Bristol, Conn., has received the appointment of western sales manager for the Simms Magneto Co., East Orange, N. J.

Eldredge Puritan Advertising Mgr.—F. M. Eldredge has been appointed advertising manager for the Puritan Machine Co., Detroit, Mich. L. A. Cuson has joined the company and is organizing a quick service department for repair parts for Krit cars.

Williams Lozier Traveling Representative—H. W. Williams, who has been in charge of the service department of the Lozier Motor Co., Detroit, Mich., has been made traveling sales representative for the Middle West. M. E. Gildersleeve has succeeded him.

Lubeck Joins Maxwell—E. M. Lubeck, former wholesale manager for the Studebaker Corp. in Chicago, Ill., and more recently with the Oakland dealer in that city, has joined the sales forces of the Maxwell Motor Co. as assistant to C. R. Newby, supervisior of Zone 3.

Weber Makes Change—H. E. Weber, who has been representing Stewart-Warner Speedometer Corp. throughout the West during the last 5 years, has resigned and is now in charge of the Stewart-Warner Speedometer Service Co., Milwaukee, Wis., at 188 Fifth street.

Gordon Heads Newcastle Rubber Co.—A. E. Gordon has taken charge as general manager of the Newcastle Rubber Co., Newcastle, Pa., recently incorporated with a capital stock of $500,000 to manufacture automobile tires. The plant will have a capacity of 1,000 tires and 1,500 tubes daily.

Blair Pennsylvania Tire Mgr.—George Blair has been appointed Philadelphia, Pa., branch manager of the Pennsylvania Rubber Co., Jeannette, Pa., 651 North Broad street. Increasing business has necessitated the securing of larger quarters and on May 1 the company will remove to 306 North Broad street.

Tverdahl Wiaton's Milwaukee Mgr.—O. M. Tverdahl has been appointed manager of the Milwaukee branch of the Winton Motor Car Co., Cleveland, O., to succeed J. I. Miller, who has been in charge since the establishment of a factory branch in this city. The branch is now located at 503-507 Broadway.

Rundell Oldsmobile Mgr.—C. C. Rundell has been appointed manager of the Oldsmobile sales for Marion County, Ind. He was formerly branch manager for the Peerless company and was connected with the sales department of the Premier for 5 years, where he took all the prizes offered by that organization for salesmanship.

Raymond in New Capacity—A. H. Raymond, who for the past 10 years has been continuously engaged in selling Packard cars, last week took charge of the truck department of Earle C. Anthony, Inc., Southern California, distributor for the Packard with headquarters at Los Angeles. Raymond was formerly connected with the Packard agency in San Francisco.

Woodin Hollier District Sales Mgr.—T. C. Woodin has been appointed district sales manager of the Lewis Spring & Axle Co., manufacturer of the Hollier Eight in Jackson, Mich. He will cover Missouri, Kansas, Nabraska and Oklahoma, with headquarters at Kansas City. A. J. Pray is manager of the Gate City Motor Co., Kansas City, recently appointed distributor of the Hollier car.

Hyman Cole Advertising Supervisor—H. R. Hyman has been appointed advertising supervisor of the Cole Motor Car Co., Indianapolis, Ind. He will have direct charge of all the advertising of the Cole company, and will assume his new duties the coming week. Mr. Hyman has been director of the publicity for the Bobbs-Merrill Co. for the last 3 years, and also has engaged in newspaper work.

Ivor McCulla Joins Knox—Ivor McCulla, brother of William R. McCulla, assistant chief engineer of the Knox Motors Co., Springfield, Mass., has been placed in charge of the experimental department of the Knox company. Mr. McCulla was connected with the Lozier Motor Co. and the Packard Motor Car companies in Detroit, and left recently to take up his new duties at Springfield.

Clarke Takes Over Business—W. J. Clarke has taken over the business of the Winsor-Clarke Co., Detroit, Mich., manufacturers' agents. He will continue to handle the products of the Auto Parts Co., Providence, R. I.; the Fitzgerald Mfg. Co., Torrington, Conn., makers of horns; the Spencer-Smith Machine Co., Howell, Mich., makers of pistons, and the Walden Mfg. Co., Worcester, Mass., makers of wrenches.

Fisher Heads Chicago Chase—R. M. Fisher will manage the new branch of the Chase Motor Truck Co., established in Chicago, Ill. C. E. Reynolds continues as division supervisor of agencies, covering Illinois, Iowa, Missouri and Minnesota. Headquarters will be in Chicago. C. E. Collard, formerly manager of the Mack-Sauer branch in Boston, has joined the Chase organization, with headquarters in New York City. He will be supervisor of agencies out of the Chase branch under the direction of F. B. Porter, of the New York City branch.

Miller Heads Milwaukee Wheel Co.—W. M. Swift Miller, for many years associated with the Allis-Chalmers, Westinghouse and Industrial Controller companies as publicity, advertising and sales manager, has purchased a large interest in the T. S. Wheel & Mfg. Co., Milwaukee, which recently began to market a new type of all-steel resilient wheel for motor cars and trucks after several years of experimentation and perfection. Mr. Miller has been elected president and general manager of the company. The present capacity of the plant is 2,000 wheels monthly.

V-Ray

MADE RIGHT here in the U. S. A.

"The Original Multiple-Electrode Plug"

Avoid Unscrupulous Imitations

The Most Dominant Quality Factor in the Motor Accessory Field Today.

ALL DEALERS

THE V-RAY CO.
Marshalltown, Ia.

ALL JOBBERS

Moline-Knight "40"

The First Light Weight, Low Priced, Knight Motored Car

Starting over a year ago, our engineers began to develop the new light weight Moline-Knight 40. They have created a remarkable car, weighing 2896 pounds when ready for the road—a light, snappy powerful car that holds the road at high speeds.

The new Moline-Knight 40 has created an instantaneous impression. Those who have seen it and ridden in it pronounce it an unusual value. It is one of the season's best sellers.

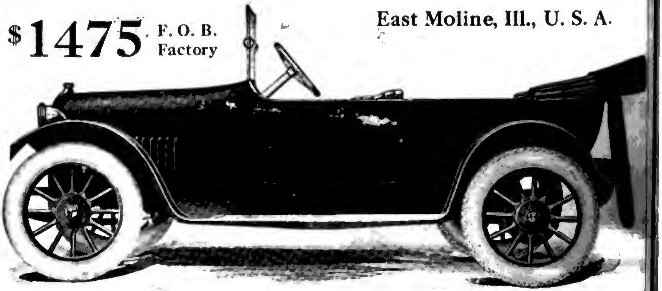
Dealers from coast to coast are rallying around the Moline-Knight 40. They see in this light weight sleeve valve motored car, one that will be a money maker for them, one that is destined to fill a long felt want on the part of buyers and one that will build a permanent trade, because a Moline-Knight owner never returns to the poppet valve motor.

Each week new dealers are added to the ever increasing Moline-Knight list of distributors. If you are located in territory not yet contracted for, write for complete information, or better still, come to the factory where you can see the car and our method of building. There are men in your territory, who will buy either a Moline-Knight 50 at $2500 or a Moline-Knight 40 at $1475.

Moline Automobile Company

East Moline, Ill., U. S. A.

$1475 F. O. B. Factory



Automotive Industries

5-8-15
amH

MAGAZINE LOAN COLLECTION

gl

The AUTOMOBILE

Vol. XXXII
No. 18

NEW YORK, MAY 6, 1915

Ten cents a copy
Three dollars a year

"Just Like a Mirror!"

Johnson's Prepare

is the standard polish f
body, hood and fender
It is quite different fro
the many liquid polish
on the market—most
which contain acid or o
and if they do not a
tually injure the finish
at least remain on th
surface sticky and tack
—gathering every bit
dust.

JOHNSON'S PRE

cleans, polishes and finishes
varnish and protects it from
cle

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

Does Not Gather Dust

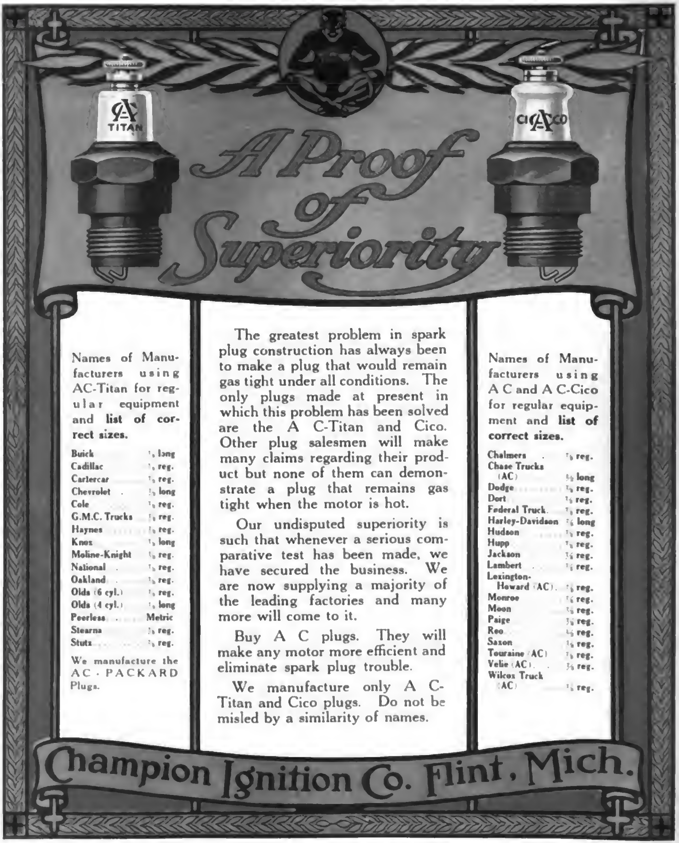
Johnson's Prepared Wax gives a perfectly hard, dry, glasslike finish that cannot collect dust. It forms a thin, protecting film over the varnish—prevents checking and cracking—and

"Sheds Water Like a Duck's Back"

1 pint by Parcel Post, 60c.—
enough for a season's use.
Agents wanted.

S. C. JOHNSON & SON
Dept. A
RACINE, WISCONSIN

COUPON A
I enclose 10c. for a can of Johnson's Prepared Wax—sufficient for one polish on a large car.
NAME ....
ADDRESS ....
CITY & STATE....................................
My accessory dealer is....................................



A Proof of Superiority

Names of Manufacturers using AC-Titan for regular equipment and **list of correct sizes.**

Buick	⅞ long
Cadillac	⅞ reg.
Cartercar	⅞ reg.
Chevrolet	⅞ long
Cole	⅞ reg.
G.M.C. Trucks	⅞ reg.
Haynes	⅞ reg.
Knox	⅞ long
Moline-Knight	⅞ reg.
National	⅞ reg.
Oakland	⅞ reg.
Olds (6 cyl.)	⅞ reg.
Olds (4 cyl.)	⅞ long
Peerless	Metric
Stearns	⅞ reg.
Stutz	⅞ reg.

We manufacture the AC-PACKARD Plugs.

The greatest problem in spark plug construction has always been to make a plug that would remain gas tight under all conditions. The only plugs made at present in which this problem has been solved are the A C-Titan and Cico. Other plug salesmen will make many claims regarding their product but none of them can demonstrate a plug that remains gas tight when the motor is hot.

Our undisputed superiority is such that whenever a serious comparative test has been made, we have secured the business. We are now supplying a majority of the leading factories and many more will come to it.

Buy A C plugs. They will make any motor more efficient and eliminate spark plug trouble.

We manufacture only A C-Titan and Cico plugs. Do not be misled by a similarity of names.

Names of Manufacturers using A C and A C-Cico for regular equipment and **list of correct sizes.**

Chalmers	⅞ reg.
Chase Trucks (AC)	½ long
Dodge	⅞ reg.
Dort	⅞ reg.
Federal Truck	⅞ reg.
Harley-Davidson	⅞ long
Hudson	⅞ reg.
Hupp	⅞ reg.
Jackson	½ reg.
Lambert	⅞ reg.
Lexington-Howard (AC)	⅞ reg.
Monroe	⅞ reg.
Moon	⅞ reg.
Paige	½ reg.
Reo	½ reg.
Saxon	⅞ reg.
Touraine (AC)	⅞ reg.
Velie (AC)	½ reg.
Wilcox Truck (AC)	⅞ reg.

Champion Ignition Co. Flint, Mich.

Vol. XXXII New York—Thursday, May 6, 1915—Chicago No. 18

The Automobile

Porter-Knight Speed Creations

High-Speed, Sleeve-Valve Motors, Alloy Steels, Light Weight and Simplified Construction Features

Front view of Porter-Knight speed creation. Note minimized wind resistance

NEW YORK CITY, May 1—The Porter-Knight racing cars which THE AUTOMOBILE announced last January were to be built by Finley R. Porter, long famed in racing circles through his previous connections with Mercer cars, are now practically completed and the first of the three that are entered for the Indianapolis 500-mile race has been given its first tryouts over the roads around Port Jefferson, L. I., where Mr. Porter has been manufacturing them. This week speeds of 100 miles per hour and higher have been shown with the motor but partially worked in.

First American Racing Knights

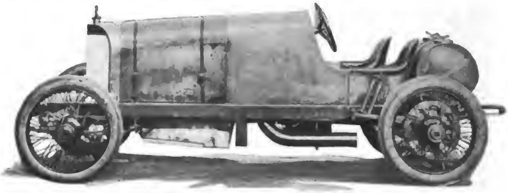
These Porter-Knight cars will be watched with more than usual interest during the coming racing season as they represent the first effort of an American manufacturer to develop a racing car using the Knight double-sleeve action in place of the conventional poppet valves. Although this is the first American effort, it is not the first time this type of motor has been used in speed contests. Two years ago a Mercedes-Knight competed at Indianapolis and its performance was one of the features of the meet, the car being a standard Mercedes model with a piston displacement too small to be considered a serious contender.

Last year in the Isle of Man road races in the British Isles a team of Minerva-Knights, built by the Minerva company in Belgium, proved the sensation of the meet, the team making the best performance of any.

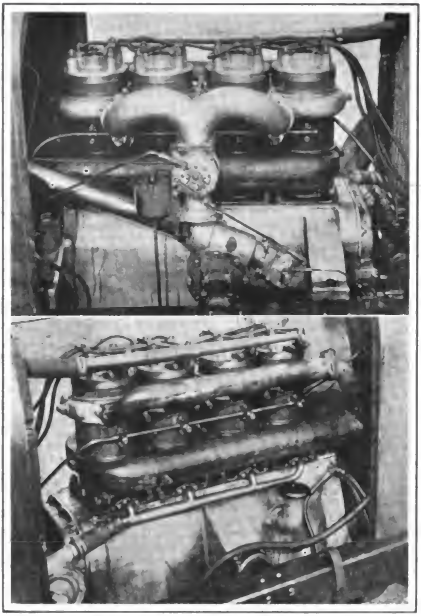
Although the time allotted Mr. Porter for developing the present Porter-Knight models has been only since February 1, he has succeeded in incorporating into these machines details heretofore not used in Knight-motored vehicles; he has endeavored to put into them much of the valuable experience gained in poppet-valve racing; and because of this America will have its first opportunity of observing the American sleeve-valve motor perform in a field which it has not heretofore invaded.

Design of Three Cars Identical

The three Porter-Knight racing cars are identical in every respect. Compared with the stock Knight motor used by American makers producing this type, the Porter-Knight racing motor varies in many important respects, in the same way that the racing poppet-valve motors used generally vary in many regards from standard designs. The two-sleeve prin-



Side view of Porter-Knight which makes 100 miles an hour



Upper—Intake side of Porter-Knight racing motor. Note high mounting of carbureter and large manifold. Lower—Exhaust side of same motor, showing simplicity and accessibility. Note how manifolds fit around cylinder castings instead of bolting to them, both intake and exhaust pipes fitting into grooves in the castings as a piston ring fits into groove in the piston

ciple is used, but instead of there being but one eccentric shaft —which corresponds with the camshaft in a poppet type— there are two, located on opposite sides, one reciprocating the inner sleeve and the other the outer sleeve.

Further: In the standard Knight design these sleeves have had intake and exhaust ports near their upper ends, but Mr. Porter has, in additionn, introduced lower exhaust ports close to the lower ends of the sleeves, this being a result of experience gained last year with the Minerva-Knight cars which used this lower exhaust in the Isle of Man races. The majority of the hot exhaust escapes through this lower port leaving the upper port to serve merely for scavenging the remaining gases.

But there are other respects in which these racing Knights vary from conventional design: The intake and exhaust ports are of practically double the area and the timing of the sleeves is different so that higher efficiencies and speeds are obtained, the motors turning up to 5,000 r.p.m. in the testing room, which is a high mark in crankshaft speed and which is largely due to the enormous port areas. Coupled with these larger areas, higher efficiency has been obtained by reciprocating the sleeves only .75 inch, instead of 1 1-8 inches, accomplishing in this way quicker port openings and longer dwells with the enlarged openings.

Improved Lubrication System

There are many other respects in which the conventional has been departed from, such as an improved system of motor lubrication; the use of timing gears being necessitated instead of silent chain drive for the eccentric shafts on account of employing two of the latter; and, naturally, the very general use of the highest quality of metals respectively suited to the different parts of the motor, as well as making these as light as possible.

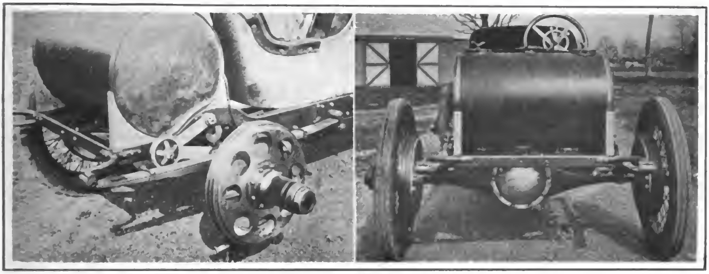
Apart from the motors, the remainder of the chassis is a result of Mr. Porter's long racing experience. In the design he has worked with three objects in mind: First comes maximum strength obtained by using only the best metals; second, minimum weight, made possible by the selection of materials; and, third, utmost simplicity of parts, largely achieved by a clear conception of design, rather than by trying to remake parts that previously existed in more or less involved forms.

122 H.P. at 3,950 R.P.M.

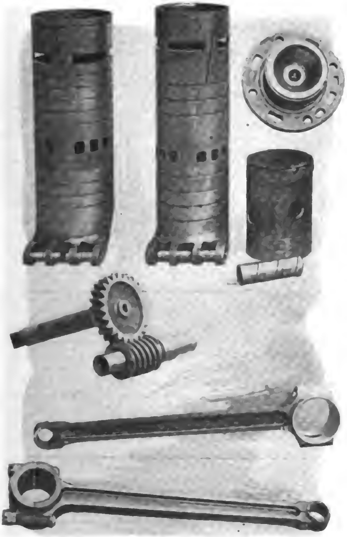
With these three objects in mind he has produced a racing creation weighing 1,910 pounds and having a four-cylinder motor 3.75 by 6.125 —3 3-4 by 6 1-8—inches, having a piston displacement of 270 cubic inches, or well under the 300-cubic inch limit of the Indianapolis race. With this motor he secures 122 horsepower at 3,950 r.p.m. With a 3 1-4 to 1 ratio on high the motor is rotating 2,650 at a speed of 85 miles per hour. At a car speed of 100 miles per hour the crankshaft speed is 3,250 r.p.m.; and at 60 miles per hour the motor speed is 1,986 r.p.m.

The chassis is built with a 110-inch wheelbase, 56-inch tread, 32 by 4 front tires and 33 by 4.5 rears. The combined gasoline and oil tank, 30 gallons of gasoline and 10 gallons of oil, is mounted transversely at the rear and no attempt is made at a streamline tail but in the general body design front-end wind area has been cut to the fifth place of decimals, metaphorically speaking. The body at its maximum measures but 30 inches overall width, yet there is ample room for the driver and mechanic who occupy staggered seats; and while the body is high, no special effort being made to keep it specially low, its lines are such as to entirely protect the driver and mechanic and eliminate any loss caused by the wind striking their heads or shoulders. The radiator is narrow and relatively high with the sides well bevelled. Wind resistance at 100 miles per hour approximates 50 pounds per square foot of front area, but Mr. Porter has in reality little or no really effective area in front. Coupled with this is the fact that the drawbar pull of the car is but 18 pounds on a level macadam road, this pull being sufficient to move the car. Mr. Porter has calculated that but 5 horsepower would be needed to propel the car at a speed of 100 miles per hour in a vacuum. On the road different conditions are met and here it is found that 98 horsepower is needed to drive the car 100 miles per hour and that 93 of this is needed to overcome wind resistance, the remaining 5 to propel the car.

Three metals are conspicuous in these machines: First comes chrome-vanadium steel which enters very generally into



Left—Rear construction, showing lightened brake drum, mounting of fuel tank, etc. Note spring horn at rear through which drive is taken instead of through front end of springs. Right—Rear view of the car, showing narrow body. Observe ribs on brake drums for strength and cooling. This view also gives an idea of the spring horn mounting



Parts of Porter-Knight racing car. Note additional ports at lower part of sleeves, a departure from usual practice. Light weight and strength characterize all the parts illustrated. In the center is the extra-strong worm and gear used in the steering mechanism. The length of the connecting-rods is about two and a half times the motor stroke

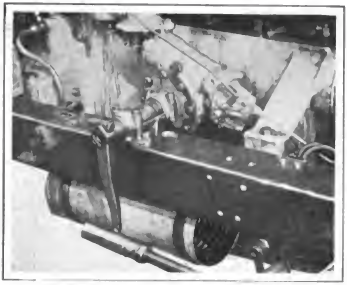
parts; second, air-hardened steel used for gears and where it is desired to get great hardness and yet avoid the dangers of warping in manufacture; and third magnalium with its strength factor combined with light weight. Chrome vanadium is used in the frame, front axle, crankshaft, eccentric shafts, shafts of gearbox, rear axle, propeller shaft, wristpins, etc. Air hardened steel, a metal very rarely used in this field, is employed in gears and a few other places. It is a government product used in projectile manufacture. Its chief merit for use in an automobile lies in the fact that it is very easy to heat treat and because of this avoids warping in the heat treatment of gears. With air-hardened steel in the heat treatment process you heat to 1,500 degrees F. or thereabouts, using only one treatment as compared with some alloy steels which are heated to 1,700 or 1,750 F. after which there is a reheat and a drawing accompanied by the possibility of warping. Air-hardened steel is in reality a tungsten alloy. Magnalium is used in several parts where strength is not the prime consideration, an example being the carrier for the differential, this carrier fitting into the pressed steel rear axle housing.

Metal Selection Saves Weight

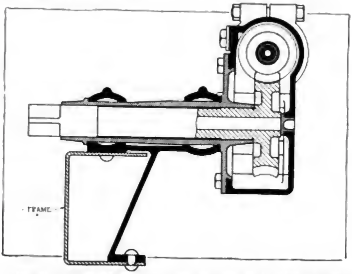
By the careful selection of metals much weight has been saved. In the differential alone there is a weight of 46 pounds as compared with the standard types. The total rear axle weight is but 180 pounds, this including brake drums and everything but the wheels and tires. The four-speed gearbox, including the brake drum on the rear of it, weighs 90 pounds. There is a saving of 9 pounds in the two universal joints in the propeller shaft. Added to these are many other examples of weight reduction accomplished by hollow propeller shaft, light connecting rods, pistons, etc.

Before taking up the detail questions of design involved in the motor, gearbox and other car parts, one other example of care in design crops out, and one which may have a bearing on future racing on speedways. Up to this time it has been considered that a two-speed gearbox is sufficient for speedway racing and that considerable weight could thus be saved. A four-speed set is used on the Porter-Knights, due primarily to the use of a very small motor, 270 cubic inches. European practice has been to increase the number of gearbox speeds as the motor displacement has been cut down. It is figured that better acceleration will be possible with a four-speed set and the motor kept in its range of most effective speeds. Some of the high-speed, high-efficiency European motors use five forward speeds.

The Porter-Knight motor uses four separate cylinder castings with the usual detachable heads and employs a spherical combustion chamber with a single spark plug located in the dome. Across the front is a transverse shaft carrying the



Extra-strong steering gear used on Porter-Knight racer. Note cooling coil for lubricating oil mounted under frame. This is part of the circulating system



Section through steering gear, showing method of rigidly bracing to frame. A Z-shaped piece of steel is riveted by a single rivet each to the top and bottom of the channel

Bosch ZR-4 magneto on one end and the water pump on the other, thus leaving both sides of the motor clear, except for the carbureter, which is positioned above the steering gear on the right side. The crankcase is an aluminum casting supported rather unusually at three points, two rigid arm supports to the frame on the right side and a central trunnion in the middle of the right side. This disposition of the three supporting points is preferred to using the trunnion at the forward end and the rigid points oppositely at the rear, as less strain is transmitted from the frame to the case and consequently to the crankshaft bearings.

Manifolds Not Bolted On

Most conspicuous about the motor is the attachment of the intake and exhaust manifolds, which, instead of bolting to their respective sides of the cylinder castings fit around the castings the same as a piston ring fits into its groove in the piston. Each cylinder casting has two grooves around its exterior, the bottom groove being for the main exhaust manifold and the top groove for the intake and scavenging exhaust manifolds. Into these grooves the manifolds fit and the airtight fit is by the castings bearing against the top and bottom of the groove just as a piston ring fits to prevent gas leakage. The large main exhaust manifold is in halves, one half on each side, and these are held together by transverse bolts extending from side to side between the cylinder castings and by shorter bolts at the ends. The combination top manifold is similarly secured.

The cylinder castings are a fine grade of gray iron, water-jacketed throughout their length and with a casting thickness of 3-32 inch outside the jacket and 1-4 inch between the jacket and the cylinder. The crankshaft is counterbalanced with crescent-shaped integral weights to counteract centrifugal force and thus impose less stress on the three bearings. These bearings are all 2 1-4 inches in diameter and have the folowing lengths: Front 3 1-4 inches, center 3 inches, and rear 4.5 inches. The bushings are bronze shells faced with a very thin layer of white brass, 1-32 inch thick, the aim being to have the white brass serve solely as an anti-friction film and, should it burn out, the damage to the shaft would be less than if a much thicker facing were used.

Connecting Rods Are Light

Connecting-rods are cut from solid billets of chrome-vanadium and when complete weighs 2 pounds, 3 ounces without the bushings but with cap and bolt. They measure 15 inches center to center, which is about two and a half times the piston stroke, this being a higher ratio than generally used.

Pistons are particularly thin steel castings carrying two rings in one groove near the top. The usual perforations to reduce weight are not used but the weight cut to 2 pounds 4 ounces by cutting the thickness of the plain part of the piston to 1-16 inch. The length is 4 3-4 inches, top clearance .025 inch and at the bottom .015 inch. The wristpin is a 1-inch chrome-vanadium tube which clamps into the top end of the connecting-rod.

The two reciprocating sleeves are domestic castings using iron with a high graphitic carbon. The inner sleeve is 5-32 inch thick and the outer one 1-8 inch.

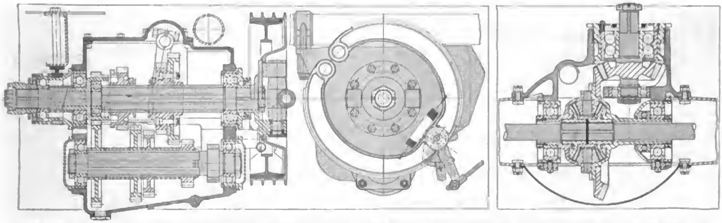
Port areas are prime essentials and these are large. The intake port for each cylinder has an available area of 3.14 square inches; the lower exhaust port area is 4.86 square inches; and the top exhaust port 1.17 square inches. The value of the large bottom exhaust port is better realized as it opens 70 degrees before bottom dead center, thus getting rid very early of the hot gases. The opening of this port is very abrupt, the sleeves having moved into the desired position so that the final opening is accomplished by the descending piston uncovering the ports.

The complete motor timing follows:

Exhaust port opens 70 degrees before bottom center.
Exhaust port closes 15 degrees past top center.
Intake port opens 5 degrees past top center.
Intake port closes 62 degrees past bottom center.

The opening of the intake port is rapid and is accomplished by the downward movement of the inner sleeve, the outer sleeve port being in position previously and waiting for the inner one. This, combined with the quick opening of the lower exhaust port, is given credit for much of the motor power.

A non-splash system of motor lubrication delivers oil under pressure to the three bearings of the crankshaft, to the lower connecting-rod bearings through the drilled crankshaft; and, lastly, direct against the piston wall by means of oil ducts leading into one side of the cylinder casting and other ducts leaving from the opposite side. The oil so entering the cylinder reaches the outer piston wall by passing through a series of oil ports in the sleeves, these ports in the two sleeves registering on the up stroke of the piston. When these ports in the sleeves are not in register the oil so fed into each cylinder finds its way around the outer sleeve to the opposite side where the exit oil duct attaches and oil so escaping from the cylinder is led onto the timing gears at the forward end and finally finds its way into the reservoir in the engine base.

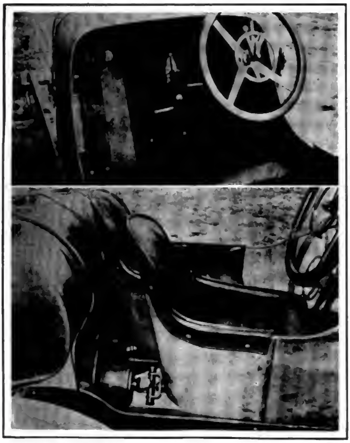


Left—Section through the clutch and gearbox of the Porter-Knight racing car. Center—Transmission brake in section. Right—Sectional view of the differential

To maintain such a system of motor lubrication two pump systems are in reality used. The primary pump system consists of a single plunger pump, operated by an eccentric, which draws the oil from the reservoir in the base through a strainer and next through an oil radiator, a cylindrical coil of .5-inch copper piping outside the crankcase. Here the oil is cooled as much as possible. Passing through this cooling coil, the oil is lifted into a secondary reservoir of 2 quarts capacity. In this reservoir is a five-plunger pump. Four of the plungers feed direct to the three crankshaft bearings and the fifth supplies the oil to the cylinder walls, already referred to. There is a separate pump for the two end crankshaft bearings and two for the center bearing.

The clutch is a cone type, the magnalium cone faced with Raybestos. The forged steel flywheel weighs 55 pounds and measures 18 3-8 inches in diameter.

The four-speed gearbox is an exceptionally compact design and is skillfully mounted at three points on two frame cross members. One end is suspended by metal straps from a tubular cross member and the other end is suspended centrally by a single stirrup from a conventional channel cross member. The gearset is a vertical design with the mainshaft directly above the secondary or layshaft. Air-hardening steel is used in the gears which are 3-4 inch face and six pitch. Direct drive is on fourth speed and the three highest ratios between the motor and rear axle are 3 1-4 to 1; 4 1-4 to 1; and 6 to 1.



Upper—Simple, clean layout of dash on the Porter-Knight racer. Lower—Staggered seats to allow the driver plenty of elbow room

Brake Behind Gearbox

Closely associated with rear axle design is that of the brakes, of which both sets are internal expanding, one located within ribbed drums on the rear wheels and the other within a similar drum on the rear of the gearbox and pedal applied. The rear wheel brake drums are 16 inches in diameter and the expanding shoes are semi-circular magnalium castings faced with short segments of cast iron presenting a 2-inch width against the drum. Expansion of the bands is by cam with a spring release. The brake construction in rear of the differential is identical.

Front axles call for much care in racing car construction and in this case a chrome-vanadium forging is used with the steering pivots inclined backwards at an angle of 8 degrees and with an inside camber of 2.5 degrees. This combination of angle and camber gives a castor effect which gives ease of steering and tends to keep the wheels moving in a straight line. With this arrangement should the tie rod break or either tie rod arm break the loose wheel will follow the other one and so an accident is in all probability avoided.

Running Gear Details

Running gear details have come in for as generous use of alloy steels and careful construction as other car parts. The frame is chrome-vanadium 1-8-inch stock and with 4 7-16 inches vertical section. Both sets of semi-elliptic springs are practically flat, there being a camber of .5 inch on the front set, which measures 36 by 2 inches. The rear set, 46 by 2 inches, is shackled at its forward end and bolted direct to the frame horn at the rear, the reverse of general practice. This is done so that the axle in reality pulls the car through the rear end of the spring rather than pushing it through the front end, which it would do if the shackle were in rear and the bolting direct to the frame at the front end. By this reversal of general practice a steadier running is claimed with less tendency to bounce on the track.

Steering is through a worm and complete gear mounted in a manganese bronze casting, this casting being supported direct on the frame side member, with the bracket so designed that the weight is distributed on the top and bottom sides of the channel and the vertical section is not pierced by supporting bolts. This mounting has the merit of rigidity as well as conspicuous accessibility.

Burman about to pass Oldfield on Rainbow Curve in Southwest Sweepstakes at Oklahoma City. Oldfield's car is No. 1

Burman's Peugeot Wins Oklahoma Race

Covers 199.5-Mile Course at 67.98 Miles Per Hour

By C. S. Moore

Result of 200-Mile Southwest Sweepstakes

Car	Driver	Time	M.P.H.
Peugeot	**Burman**	2:56 3-5	67.9
Stutz	Lewis	2:57:25 1-5	67.6
Case	Raimey	3:05:41	64.7
Case	Hearne	3:08:02	63.8

Bob Burman, winner of 200-mile race at Oklahoma City

OKLAHOMA CITY, OKLA., May 1—Like a flash of lightning on the straightaways and "Wild Bob" on the sharp and treacherous curves, Burman, driving a French Peugeot, won the $5,000 200-mile Southwest Sweepstakes automobile race here Thursday afternoon, after a most spectacular duel for thirty laps of the course with Dave Lewis of the Stutz team who finished second. Burman's time for the course, which is actually 199.532 miles, was 2 hours, 56 minutes and 3-5 seconds. His average was 67.98 miles an hour. His fastest lap, his seventieth, was made in 2 minutes flat, which is traveling at the rate of 72 miles an hour. This was the official announcement. Against this were the times obtained from a score of spectators, with stop watches, who declared that Burman made the lap in 1 minute and 59 seconds, and there were a few whose time pieces said the speed demon made it in 1 second less.

Battle Between Burman and Lewis

Burman, the favorite of the majority of spectators after the first few laps, drove a wonderful race, gradually closing in on Lewis after the thirtieth lap, gaining several seconds on each by taking the turns with great daring. He had lost almost an entire lap, 2.404 miles, when forced to change a tire in the eleventh lap, but took the lead from Lewis on the seventieth round, and his advantage was increased slightly three laps later when Lewis ran off the course at Willard Hook, losing nearly a 1-2 minute. Victory for Burman was made practically certain when Lewis eased into the pits after the seventy-seventh lap, with just six more laps to go, for a new tire.

A crowd estimated at between 12,000 and 15,000, saw the race, the first really big automobile race ever staged in this part of the country. The grand stand was packed, and the whole course was lined with spectators. Great throngs gathered at Willard Hook and Rainbow curve, the sharpest and most dangerous places on the curve.

Only two slight accidents marred the event. Scott's Tulsa car jumped the course and crashed into a tree in the very first lap. Scott was slightly cut on the top of his head, and his mechanician was scratched on several places about his face. Neither was hurt to any serious extent. Earl Cooper in a Stutz, in his twenty-eighth lap struck the inside bank on Rainbow curve while going at 65 miles an hour and his car was disabled. Both Scott and Cooper were forced out of the race. Cooper limped into the pit. Scott and mechanician deserted their car at Willard Hook, where the machine plunged into the tree going at a terrific speed. Spectators said the driver went too far toward the outer edge of the curve and that when his machine started to skid he had no control over it whatever.

Of the eleven cars starting just seven finished.

Here is the way the drivers were numbered when the race started:

1. Maxwell, Oldfield, driving; Goetz, mechanic.
2. Maxwell, Carlson, Frazen.
3. Simplex, Disbrow, Needham.
4. Case, Raimey, Moore.
5. Case, Hearne, Le Corq.
6. Peugeot, Burman, Haibe.
7. Stutz, Lewis, Devore.
8. Stutz, Cooper, Dutton.
9. Mercedes, Clark, Reese.
10. Stafford, Striegel, Day.
11. Tulsa, Scott, Combs.

The cars started in this order: 10 and 4; 3 and 8; 6 and 5; 7 and 2; 1 and 9; 11, all being paired except the Tulsa car. The starts were 20 seconds apart.

John Raimey in a Case was in the lead for the first few laps, but Billy Carlson in a Maxwell soon overtook him. Carlson well led the field during the first twenty-five laps, and even in the twenty-eighth when he went out of the race on account of a burned bearing, he was a few seconds in the lead. Louis Disbrow in a Simplex was second for a short distance, but soon fell behind.

Burman, running steadily and close up, was thrown back to eighth place after the eleventh lap when he stopped for a new tire. He had picked up a nail on Rainbow curve. According to the official timer, the change of tire took 31 2-5 seconds.

Earl Cooper was forcing rapidly to the front in the few laps just preceding the accident that left his car a hopeless wreck insofar as that race was concerned. But as he gave up the lead his teammate, Dave Lewis, came up from behind and was soon ahead of the field. Billy Carlson stayed at the front of the list until his oil supply became exhausted in the twenty-eighth lap and his bearings burned out.

Barney Oldfield dropped completely out of the running after three or four stops early in the race on account of trouble with his engine, but he refused to quit the race and was running at the finish.

Burman's Winning Spurt

The big white Stutz, driven by Dave Lewis, ran steadily in the lead from about the thirtieth lap, with Raimey, Disbrow, following, and Burman in his Peugeot taking things easy, until the forty-fifth. Then Burman passed all others except Lewis, and then he began pressing the leader. From the sixtieth lap on Burman drove at a tremendous gait until he caught and passed the flying Stutz on the straightaway on Sixteenth street, and the cheering was loud and prolonged. Lewis, perhaps a trifle excited, made victory easier for Burman when he left the course at Willard Hook on the seventy-first lap. Six laps later he was forced to the pits to change a tire, and lost nearly a full minute.

Running out of oil after going sixty-two laps, George Clark brought the old Mercedes into the pits for the first time. After the gas tank had been filled and the driver was ready to resume the race, oil that had been spilled under the car caught fire and the blaze enveloped the rear end of the machine. The conflagration was extinguished in a few moments, but the car was damaged so that either it could not be put back into the race, or Clark, realizing his hopeless chance to get inside the money, would not start again. Disbrow brought his Simplex in for a new tire after the Mercedes was out. Disbrow, noted for his daring on dirt tracks, took the turns far more easily than did several of the other drivers.

Dave Lewis, whose Stutz was second in Southwest Sweepstakes

No one realized what a handicap Burman drove under until after the race was over. When he stepped from his machine after completing the eighty-third and last lap he immediately asked for medical attention. He had driven from the seventh lap with a piece of glass lodged in his right eye, and nothing to protect the eye from the terrific pressure of the wind. The glass on the right side of Burman's goggles had been broken by a pebble hurled by the buzzing wheels of Eddie Hearne's car when Burman was passing Hearne on Rainbow curve. A peculiar feature was that when Burman's car had gone in front of Hearne's, a small stone dug out by the Peugeot's wheels flew back and broke one of the glasses in Hearne's goggles.

The $5,000 purse was officially divided by Referee Furlong, and turned over to the winners. Burman received $2,500, the winner's share; Lewis, $1,250; Raimey, $750, and Hearne, $500.

Stafford Only Non-Stop Car

Albert Striegel in a Stafford was the only one of the eleven who made the entire distance of the race without a single stop.

Beside winning the second portion of the purse, Dave Lewis won the $100 offered by the Harwell Jewelry Co. for making the fastest time for the first 100 miles. Lewis was leading Raimey by a few seconds at 100 miles. His time for the distance was 1:29:16, an average of a little more than 67 miles an hour.

Burman's peugeot, Lewis' Stutz and the two Cases which took third and fourth place, respectively, used Bosch magnetos. Burman's car was fitted with Nassau tires.

Raimey's Case on Willard Hook. Raimey took third place

Eddie Hearne on Willard Hook. His Case was fourth

Steel—

Its Pathology

Part IV

Specification and Price Determine Car Makers' Selection

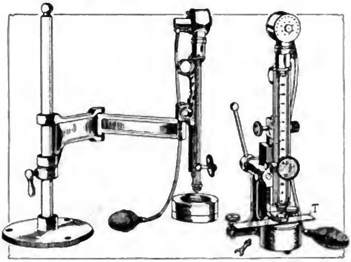
By J. Edward Schipper

THE patient has been cured. After the doctor has prescribed the proper treatment and the patient has fully recuperated and reached a state of perfect health, he goes forth to join the ranks of his fellow men and to seek employment. When this man, together with all the others in the same condition, is examined with a view towards taking a position, there are just two questions determining whether or not he will be employed. First, are his qualifications correct for the particular work in hand? And secondly, is the amount of payment he exacts commensurate with the work he can perform?

Directly parallel is the chain of events which occurs upon the discharge of a steel from the metallurgist's hospital ward. The steel has been properly treated from the medicinal standpoint by having its impurities removed and definite qualities imparted to it by the use of alloying substances. It has been rendered uniform in structure and of the proper degree of hardness by heat treatment. It is now in the position of the patient whom the doctor has discharged. It is seeking a job and, like the man, must have the two necessary qualifications before it can find one: It must possess certain definite qualities which render it suitable for the particular work, and the price must be commensurate with the work it can perform.

Two Factors—Specification and Price

In steel two requisites alone determine its selection by the automobile manufacturer; specification and price. When a man buys a steel he cares only in a secondary manner for its chemical specifications. What he wants to know is, what are its physical properties and what is its cost as compared with other metals of different specifications? If there were two metals with exactly the same physical qualities, the cheaper would be just as good as the more expensive. If a certain set of specifications will completely fill the bill of requirements for a certain definite job there is no necessity of going to a greater expense to buy a steel which will be much stronger and much better than that originally selected. We do not use gold for electric light fixtures, headlights and various other fittings and decorations—we use brass. Gold would be a more decorative material but it costs too much. Similarly there are many metals that are used throughout the automobile that fill the bill perfectly but are neither the most costly nor the strongest.



Shore scleroscope for measuring hardness

All that is required in any structural material is that it be sufficiently strong with a reasonable margin of safety, the margin of safety being the ultimate strength of the material divided by its required strength. For example: If a certain beam sustained a weight of 1,000 pounds and were capable of bearing a weight of 10,000 pounds before failure, it would have a factor of safety of 10. Factors of safety as high as this are not necessary in many automobile parts; in fact, where it is desired to cut weight to the lowest limit, as in automobile practice, factors of safety must suffer and therefore the material must be reliable.

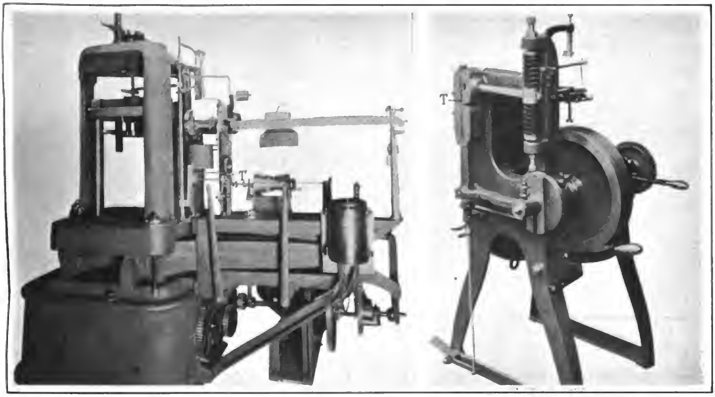
The engineer calculates the stresses which will fall upon definite parts, multiplies them by what he considers to be the proper factor of safety and then sets out to seek the cheapest material that will fill his specifications. He is like the man who seeks to hire a person for a responsible position; he knows the actual daily requirements which this man will have to meet, but in determining upon the employee, he goes further and seeks a man whose knowledge is not only confined to the narrow limit of the particular job, but who has a sufficient factor of safety in knowledge and health to assure him that emergencies will be adequately met.

Qualifications Determine Life's Work

A man may have great administrative ability, he may have a great mind for detail work, he may have a great knowledge of a particular field and be well suited for consulting work, or, on the other hand, he may be of great physical strength and well suited for physical labor. These are qualities which would enter into the choice of this man for a particular job.

In the choice of a steel there are five primary qualities ordinarily desired either singly or together. These are hardness, toughness, malleability, ability to resist shock and the ability to resist heat.

Other than these there are secondary requirements for certain definite purposes, such as, for example, retentivity of magnetism, small co-efficients of expansion, friction, heat, etc.



Left—Tinius Olsen testing machine for tensile strength. Right—Olsen testing machine for resistance to fatigue. T shows test pieces

The alloying substances and the heat-treatment whose principles have been explained, have determined these qualities, and it is now time to settle upon the particular metal desired.

In positions of ordinary stress the particular specifications desired can be reached by simply varying the carbon content of an unalloyed simple steel. For a part where ductility is required, the carbon content will be quite low, possibly around .10 per cent. At the other extremity of the scale is the part where great hardness is desired. Here the carbon content will be high, possibly .8 per cent. These are the limits for structural use and higher carbon contents are only used for special tools, etc. Where the greatest possible hardness and toughness are desired without an undesirable amount of brittleness, we might expect the carbon content to approach .40 per cent. Thus by varying the carbon content alone of a simple steel, ordinary conditions can be met.

Often, however, alloy steels will be necessary. In parts where hardness is required and yet where it is essential that absolutely no chances of fracture through brittleness will occur, it is necessary to use alloys such as chromium or tungsten. Where great endurance and strength are necessary, nickel and chromium will be found, and so on through the gamut of special steels. The duties which a part has to fulfill in taking up its post of responsibility on the car, determine the stresses that it must endure and these in turn are the factors in the selection of the steel. It will be interesting to trace how these problems are met in the transmission of power from the cylinder of a car to the rear wheels.

In an automobile, each part which is made of steel has its own peculiar stresses to bear and which therefore determine the physical characteristics that the metal must have. Following through the transmission of power from the moment the charge is exploded, the impulse is first transmitted through the piston, then to the wristpin, then to the connecting-rod, the crankshaft, the clutch, the gearset, the driveshaft, the rear axle gears, differential, axle shafts, and finally through the wheel. Each of these parts receives the impulse in its own definite manner.

The piston receives the thrust of the exploded charge on its head and must be strong enough to bear this thrust and at the same time have the peculiar quality of being able to slide freely in the cylinder. Since the area upon which the thrust is received is comparatively large—a 4-inch piston has an area of 12.566 square inches—cast iron will do. The thrust upon each unit area of the piston is not so great.

On the other hand all this thrust is concentrated upon the much lesser area of the wristpin and thus this pin, the first steel part to be met in the drive in the conventional car, must have strength to withstand the continuous hammer of the exploding gas upon the piston.

Wristpin Is a Simple Beam

The wristpin is technically referred to as a beam supported at two points. It is one of the peculiarities of this type of beam that it must resist bending stresses. Steel tubing of medium carbon content is frequently chosen for this work. The medium carbon somewhere in the neighborhood of .30 per cent. gives the necessary hardness and the tubular section gives great resistance to bending stresses. The wear of the upper connecting-rod bearing on the wristpin is guarded against by case-hardening the pin in most designs, thus giving the hard highly-carboned shell which resists abrasion.

The next step in the power transmission, the connecting-rod, has entirely different duties to perform. Here a comparatively long rod must stand great thrusts along its length. Stiffness is its great factor and there are many ways by which manufacturers of motors reach the desired end. Few use an alloy steel. Most manufacturers secure the stiffness in the ordinary carbon steel, which has between .25 and .35 per cent. carbon, by the heat-treatment. The tensile strength of the connecting-rod does not have to be remarkably high and prominent makers use a steel which does not run over 70,000 pounds per square inch. In a steel of this kind the carbon content is about .30 per cent., the manganese .65, the phosphorus not above .045 and the sulphur not above .05 per cent.

To secure the stiffness the heat-treatment is such that a good, close grain structure is provided, and in addition, the shape of the section is such as to offer the greatest resistance to bending in the direction which the bending stresses take in imparting the thrust upon the piston to the crankshaft.

Crankshaft Is Important

The crankshaft is the next important unit. Perhaps beyond all others, it is where the study of the qualifications of the material is of the greatest importance. The crankshaft must be stiff or the motor will vibrate. It must have the power to transmit the great impulses of the cylinders through the rest of the transmission system without distorting, and hence stiffness is the great factor desired above all others. It is not necessary for its tensile strength to be remarkably high, as the greatest stresses upon it do not tend to pull the metal apart, but it must have every possible means of resistance against being thrown out of line either by the forces it transmits or by its great enemy, centrifugal force.

Alloy steels are not generally employed in crankshafts, although many makers believe in their use. The general method is to use the highest possible carbon content without running the danger of brittleness and then by careful heat-treatment, to thoroughly unify the structure.

Crankshaft steels have generally a carbon percentage as high as .40. Some go as high as .50 per cent. but this is approaching the danger line of brittleness and none is found above this mark. The tensile strength of such a steel is rarely found to be above 90,000 pounds per square inch, but after careful heat-treating, great rigidity is imparted to the finished shaft.

The use of high-carbon steel, unalloyed, for crankshafts, although far in the majority, is not universal. Alloy steels have been making their way into this field within the last 2 or 3 years. One concern uses chrome-nickel, another chrome-vanadium, and the reasons they advance for this bring us directly back to the qualities of these alloys as explained in the previous parts of this series. Chromium is found in both these examples and, as has been explained, it is the bone-builder. It enables great shocks to be withstood and hence, in a crankshaft, it would impart the strength necessary to withstand violent knocks, backfires and other stresses which would tend to break the shaft. Nickel, the muscle-builder, would tend to make the steel shaft stronger and permit a smaller shaft to impart the same turning effort that a larger one of carbon steel would be able to do. But, on the other hand, chrome-nickel steel is much more expensive than carbon-steel and the question is whether or not it is worth while to go to the expense of an alloy steel when such great satisfaction is being obtained from the carbon-steel.

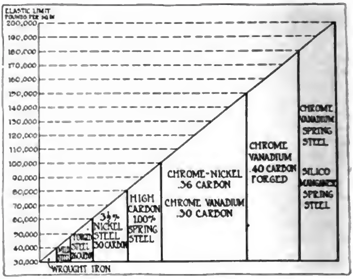
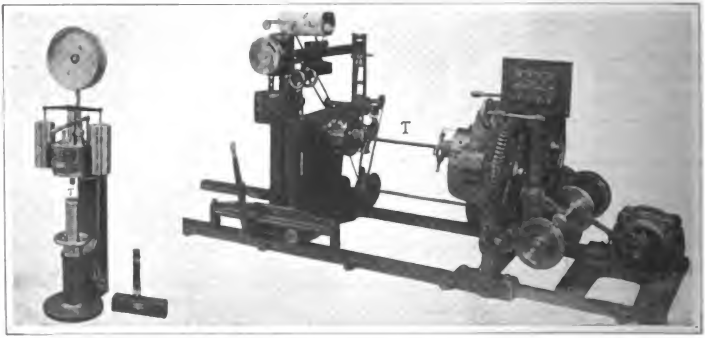


Chart showing range of elastic limit of some of the representative steels in common use

Vanadium Used to Promote Endurance

The same may be said of the chrome-vanadium crankshaft. Vanadium, the great promoter of endurance, especially when in connection with chromium, would give a shaft whose life would be longer than that of simple carbon-steel. Chrome-vanadium steel is expensive as compared with carbon-steel, but some makers believe that the expense is justified while others believe that equally satisfactory results can be obtained from the less expensive material. With some, there has been an effort to bring the shaft down to a smaller diameter with the same strength in order to decrease the bearing speeds. The further away from the center of the crankshaft, the greater the linear speed of travel around the bearing and hence the smaller in diameter the shaft, the less wear on the bearing. This, then, is one of the great factors in choosing the steel for the crankshaft. Not tensile strength,



Left—Brinnell hardness machine, T shows position of test piece. Right—Olsen torsion testing machine but stiffness and great endurance without too great a diameter are the big qualities for this work.

The next step in the transmission of power is through the blades of the clutch. If it is a multiple-disk clutch the steel plates are called upon to transmit the entire power of the motor, but since the plates are of great diameter, relatively speaking, no great strength is necessary here. Thus, alloy steel would not be expected, neither would great tensile strength. Hardness might be in some designs, but not in all, and therefore, although it is universal to use a simple carbon steel, for clutch disks the carbon content varies greatly with the design of the clutch and upon the hardness necessary. In one clutch plate, the carbon percentage is .85, in another .10. Both of these are from representative cars and show the great variety in hardness of the clutch plates. Where the low carbon is used, case-hardening is often resorted to and in that case the carbon percentage of the shell about the metal will be very high.

Driveshaft Under Torsion Stress

The next step of importance in the drive is in the change-speed gears. Here a great variety of stresses must be borne. Great torque must be transmitted through small teeth; great wearing stresses must be met due to the constant abrasion of tooth upon tooth; great shocks must be borne in sudden starting and stopping; therefore, it is not surprising that the use of alloy steel is practically universal at this point. Representative makers use chrome-nickel, chrome-vanadium, and nickel steels. Here the qualities of hardness and great tensile strength must be found, hence the alloys nickel and chromium. Great endurance is needed, hence some turn towards vanadium. Great toughness is desired, hence heat-treatments, which will produce great tensile strength, are required. One maker using a .50 per cent. carbon chrome-nickel open-hearth steel, hardened and oil tempered, has gears which show a tensile strength of 223,000 pounds to the square inch.

Chromium in the Gears

The use of the chromium in these gears enables the hard steel to withstand the shocks of gearshifting without chipping. Gears of this steel defy the sledge hammer in the hands of a man of more than ordinary strength and cannot be chipped or battered. The nickel promotes the toughness and this is the factor which produces the great tensile strength.

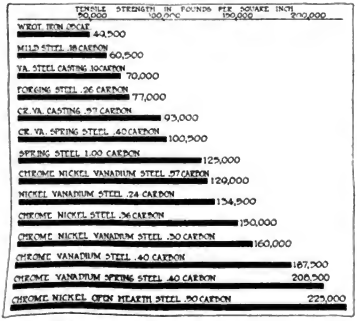
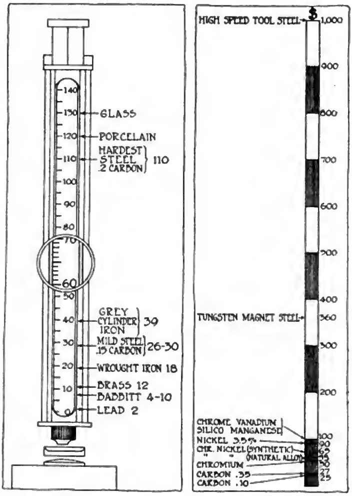


Chart showing tensile strengths of representative steels in common use in automobile practice



Hardness of different materials as measured on the Shore scleroscope. Right—Chart of prices of automobile steels. These prices are average quotations based on an order of 100 tons of 2-inch round annealed bar. They include S. A. E. specifications numbers 1,010, 1,035, 2,330, 3,130, 5,165, 6,135 and 9,250. Also high-speed tool steel and magnet steel. The prices are for a 2,000-pound ton

The vanadium is a helper towards endurance. Not all makers, however, use these expensive materials but here again carbon-steel is sometimes employed with the reliance placed upon careful heat-treating and hardening. But this is not so to the same extent that it is in crankshaft work, where it can properly be stated that only a minority use alloy steel.

The Driveshaft Problem

The next step, the driveshaft, presents a different problem. Here is a long straight shaft through which the entire drive must be taken. It must resist torsional strains, and therefore, in order to do this, it must be tough. Nickel is the great toughener and nickel is found in practically all driveshafts, with the exceptions being very few. The merits of 3 1-2 per cent. nickel-steel for transmitting the drive are universally recognized. Others go a step further and introduce chromium with their nickel to harden the steel and to help it in withstanding bending stresses. The chrome-nickel, therefore, and nickel-steel are the great driveshafts steels.

Alloys for Emergencies in Drive

The problems of the remaining drive parts are similar to those considered. The gears in the rear axle have to meet the same problem as those of the gearboxes, and consequently are composed of much the same material. Similarly the rear axle shafts perform the same duties as the main driveshafts and consequently the material in these is very much the same as in the main driveshafts. Thus the alloys are introduced into the steels in the drive to meet the emergencies, where greater toughness, hardness and strength are needed than in ordinary circumstances.

Static Strains Are Factors

Dynamic stresses alone have so far been considered. The steels in the drive are under motion but yet there are many other steel parts about the car which have to bear static strains. The frame, for instance, and the front axle are good examples of these. As pointed out, it is desired to make the car as light as possible and these stationary parts are the ones which suffer frequently, their specifications being shaved to the limit. One of the great means at the disposal of the designer to lighten these parts, and yet keep them as strong as possible, is in the use of alloy-steels, but the cost of these is so far above carbon-steels that it is only in the most expensive cars that it is possible to use them profitably.

Low-Carbon Steel for Frames

By far the greatest majority of automobile makers use a low-carbon-steel for frames. They are low in carbon so that the frames can be worked cold, most of the channel sections employed being cold-rolled stock having a carbon percentage of .20. With this steel the channel must be much deeper and much heavier than would be the case with a high-priced nickel-steel for instance, but it is cheaper and hence most commonly employed, giving a sufficiency of strength while the difference in weight is not to be considered in any degree disastrous. The front axle offers a similar condition. Here the carbon steel is also most employed because it is cheaper, although a certain car of low price uses a vanadium steel in order to gain lightness and strength. The percentage of makers who use alloy-steels in the front axle is much greater than those using alloy-steels in the frame, but, nevertheless, the carbon-steels are greatly in the ascendency.

Cost the All-Important Factor

These examples considered give an idea of the stresses to be met in examples throughout the car. Each represents a job for the steel to perform and, like the man who started out to seek employment, the steel must meet these requirements and at the same time be economical. The great question is, "What does it cost?" and the answer is a variable one for steels owing to the fluctuations in market price and the law of supply and demand. Certain facts hold good though, as regards the prices of the different steels, and a summary of what has been paid for the different steels considered will answer to a large extent the question of why a given steel was picked out for a given purpose. This, in connection with the tabulation of strengths of the different steels, forms the answer to each problem which presents itself.

The Question of Price

As in most other products on the open market, the price of steel will vary to a large extent with the amount ordered. It will also vary in the alloy steels very substantially with the rises and falls in the prices of the alloying substances. For instance, chromium and other substances are now rather hard to secure, owing to the war conditions, and therefore the prices of the alloy steels which involve their use have risen. An idea of the prices on the steels, however, may be given, not as a practical market quotation, but as a guide on the relative prices for the different steels.

Ordinary low-carbon steel with a specification of carbon at .10, phosphorus .045, sulphur .05, may be expected to sell for around 1.25 cents per pound, or $25 per ton. It may be quoted less than this or at times more. But this is a fair value. If the formula is kept the same but the carbon raised to .35 per cent., the price would be perhaps 1.35 cents per pound or $27 per ton.

Nickel-steel is perhaps the most expensive of all the commonly used steels for automobile structural work. A common price for it is 4.5 cents per pound. This corresponds to the price which is quoted at times for S. A. E. specification 2,330 which has a .30 percentage of carbon, a .65 percentage of manganese, .04 phosphorus, .045 sulphur, and 3.5 per cent nickel. This steel would sell at $90 per ton at this rate.

Standardize Heat-Treatment

The physical qualities of the different steels will vary greatly with the heat-treatment, and in order to obtain uniform results, manufacturers are now aiding to standardize certain heat-treatment for definite composition. The Society of Automobile Engineers has gone into this work thoroughly and it will not be long before the Standards Committee of this society will publish a list of physical specifications for each of the S. A. E. steels.

Thus we have come finally to the factors in the selection of the steel. It has been shown how the metallurgist, like the doctor of medicine, analyzes the structure of the substances with which he is dealing and then, by carefully manipulating his prescriptions, surgical operations and physical exercise, brings the patient to a state of health where he is qualified to go out and meet the requirements of labor. So the steel has had its impurities removed, it has had health-giving elements added to it and finally, by the bath of flame, has been rendered fit for arduous duty. It is now in a position to prove that, by reason of its strength, and by reason of its relative price, it is the fitting material to be given a definite duty in the structure of the automobile.

Silico-Manganese Used for Springs

One steel which is often quoted for automobile use in springs is silico-manganese. This frequently sells for about 5 cents per pound, or $100 per ton. The steel in question is the S. A. E. No. 9,250, and has from .45 to .55 carbon, .70 manganese, .045 sulphur, .045 phosphorus and 1.95 per cent silicon. This is the one steel which is used in actual automobile parts which exceeds the 3.5 per cent. nickel in price. It is not the highest price steel by any means, as some of the special tool steels sell for as high as $1 per pound. These are special combinations of chromium and tungsten and are highly refined.

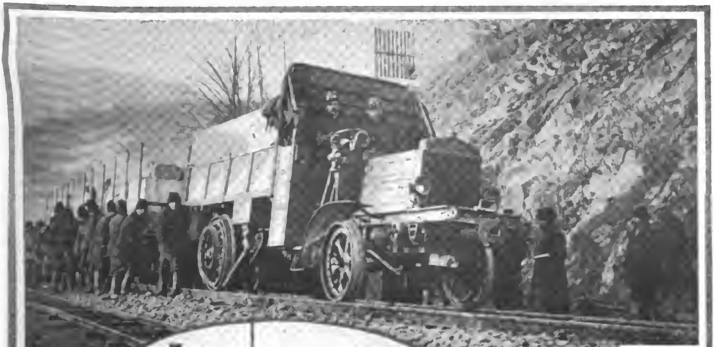
Silico-Manganese Used for Springs

Some of the chrome-nickel steels sell for sums in the neighborhood of 2.75 cents per pound or $55 a ton. Plain chrome steels will sell for $50 per ton, the difference in price being due to the expensive nickel. Chrome-vanadium steels are high priced, selling for 4.25 cents per pound or $83 a ton. These quotations would be for S. A. E. specifications No. 3,135 for the chrome-nickel, 5,140 for the chrome and 6,130 for the chrome-vanadium. The chemical specifications for these are as follows:

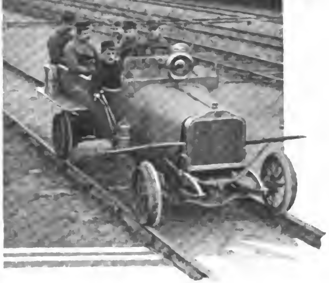
Nickel - Chromium Steel	3,135.
Carbon	.35
Manganese	.65
Phosphorus	.04
Sulphur	.045
Nickel	1.25
Chromium	.60
Chrome - Vanadium Steel	6,130.
Carbon	.30
Manganese	.65
Phosphorus	.04
Sulphur	.04
Chromium	.95
Vanadium	.18
Chromium Steel	5,140.
Carbon	.40
Manganese	.35
Phosphorus	.04
Sulphur	.045
Chromium	.75

This is the concluding article of a series of four dealing with steel. The first part dealt with the impurities and the constituents which are always found in any steel. The second dealt with the alloying substances added to give special qualities. The third, with the heat treatment and the fourth with the practical selection of the steel.—Editor.

Cars and Trucks Under War Conditions



Above — Austrian Army transport truck photographed in one of the defiles of the Carpathians, the battleground of the Russian and Austrian forces. Note how the wheels are flanged to run on the railway tracks



Above—Rough seas flooding the road in the north of France. The Tommy Atkins is trying to crank the English Daimler truck, stalled in the water, but the magneto has had a bath and refuses to spark so, in spite of priming the cylinders and other methods of coaxing the motor to start, Tommy finally gives up the task, having only a ducking in the icy water for his pains.

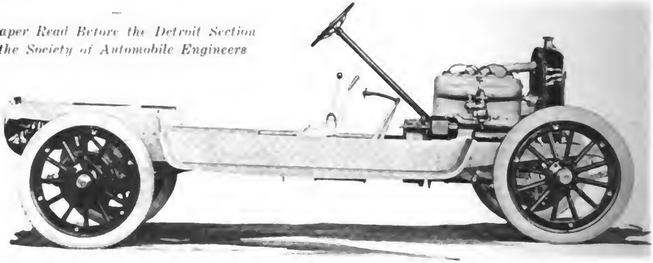
Right—Owing to the tremendous artillery fire to which large sections of country in northern France have been subjected, as well as to the constant pounding of heavy and practically continuous traffic, roads in these regions are frequently well-nigh impassable. The illustration shows a touring car which has been altered to meet these conditions, the wheels being fitted with flanges to permit of driving the car on railway lines.

Photographs on this page are copyrighted by International News Service, New York City.

Brush Advocates Scientific Chassis

New System of Layout Based on Structural Demands Said to Increase Strength and Cut Weight

A Paper Read Before the Detroit Section of the Society of Automobile Engineers



Chassis designed according to the Brush method in which the stresses on each part alone are considered in determining the dimensions and shape

DETROIT, MICH., April 29—Before the largest attendance of the year A. P. Brush, consulting engineer, outlined new principles in automobile frame construction that proved one of the most interesting topics since the discussion on eight-cylinder motors, at the monthly meeting of the Detroit section Society of Automobile Engineers. Mr. Brush's plan of chassis construction briefly does away with the conventional running board, running board apron, step hangers and body cross section, and widens and deepens the frame so as to bring it out flush with the body sides, and using the frame itself as a substitute for the aprons. While this gives practically an identical outward appearance as compared with the standard design, it was pointed out that practically every bit of metal used is of structural value, whereas it was contended that much of the material used in the conventional chassis has no structural value whatever. That is, running board brackets, aprons, and the like, are of no use structurally. The paper follows:

I am keenly aware of the fact that it is an honor, as well as a privilege, for any man to be permitted to address a gathering of the members of the Society of Automobile Engineers.

It is a pleasure to me to know that what I have to submit for your consideration, criticism and discussion has by severe and practical tests, justified the indulgence with which you honor me this evening.

At least the older of my brother engineers can remember when they sold automobiles with the front end like a toboggan, fenders were an extra and "get-a-horse" was the latest thing in slang.

We have all heard about the fickleness of the automobile-buying public, but as I review in my mind's eye the development from those early machines to the modern streamline motor car, I am impressed by a singular consistency. It has constantly and invariably set the seal of its approval upon progress in reliability, better performance, increased comfort to the passenger and operator, and more rational—or shall I say more artistic—appearance?

Fenders became a part of the car. The old carriage step was displaced by the running board. Wheelbase began to lengthen and the single rear entrance tonneau was replaced by the double side entrance. The wheelbase continued to grow. The center of gravity was lowered. Passengers were given more leg room, more seat width, and doors were provided for the front seat.

In the main essentials, the modern car had arrived, but what a hodge-podge it was in appearance with its exposed frame and running board supports; with the seat lines and the door pillars conspicuous on the sides of the body; with the old horse-drawn vehicle's dash still in evidence, lacking only the whip socket.

The automobile-buying public may be fickle about some things, but there has been no uncertainty about its approval of the cleaning up of the exterior appearance. The running board apron, or dust shield, covering the frame and the running board supports, the flush sided body and the streamline, give a simplicity and harmony of appearance that is as inherently a part of the modern motor car as is the motor itself.

All of this progress in comfort and appearance which I have outlined, together with many other contributing details, such as shaft drive, electric lighting and starting, and increased power in proportion to the total vehicle and load weight, has not been secured without sacrifice.

Weight Increase Has Occurred

In spite of better materials and in spite of better knowledge and experience in the proportioning of parts, the development of the motor vehicle has been accompanied by an increase in the weight of that vehicle.

This increase in weight, while partly due to increased size and power, is also partly due to the fact that the main structural elements of the chassis have remained substantially without change for the past 12 years, and the profound change in appearance and equipment which has taken place during that period has been secured largely by the addition and elaboration of parts which, structurally speaking, are so much junk.

There may be legitimate differences of opinion as to types of motors, as to lengths of wheelbase, and there may be legitimate differences of opinion on a thousand and one other details of motor car construction and proportion, but I believe there is no difference of opinion to be found anywhere as to the advantages to be secured by a reduction in the weight of a vehicle, provided such weight reduction can be secured without increasing the cost of the vehicle and without sacrificing any of the qualities which appeal to the user.

In outlining for your consideration a method of reducing the weight of this so-called pleasure vehicle, I realize fully that the suggestions would be of little or no value if they involved any considerable increase in cost; if they involved any weakening of the structure or if they involved any increase in what may be characterized as the road noises of the vehicle.

On the contrary, I feel justified in the unqualified assertion that the suggestions which I wish to present to you are advantageous at every point to the car builder and to the car user.

It is a matter of approximately 3 years since it began to be borne in upon me that the trend in the appearance of the motor car was toward a final form which would enable the structural elements of the car to be so made that a distinct gain in strength could be secured, accompanied by the elimination of a considerable amount of material, which, in conventional construction, has no structural or strength value, its only use being to secure the required appearance.

I have refrained from presenting this plan for an improved type of construction to the society until I could speak with certainty as to its proven value.

I have had prepared a number of drawings which illustrate the principles involved, and to some extent to make plain the latitude which these principles of construction allow the individual engineer in working out his own particular problem. You will agree with me that these charts illustrate a more scientific arrangement of the material used in securing in a car structure that combination of strength necessary to make a durable vehicle and that clean simplicity of appearance which is so essentially a part of the modern and future motor car.

Design Has Been Tested

In considering this proposed type of chassis construction, I want you to bear in mind that it has been worked out and tested in actual service by two engineers other than myself. Both of these engineers are men of recognized standing and ability in the automobile industry and it is their experience quite as much as my own which makes me feel confident that I am presenting material for a substantial advance in the science of motor car construction.

If you will, in imagination, open the door of a representative car of today and cut through one side of that car, you will at once realize that about half of the material cut through has no structural value whatsoever. If, for example, the material used in a modern long span bridge, were as unscientifically arranged, that structure could not support itself.

Fig. 1, page 804, shows such a section of a car, and with it a similar section with the materials arranged so that while the appearance is substantially identical, practically every bit of the material used is of structural value. The section on the right, of a conventional car structure, represents what I believe to be about the best that can be accomplished along the old conventional line, and is therefore, in my judgment, beyond criticism as a work-out where the engineer has been confined to the type of construction used. If what I have to say sounda like criticism, I trust you will bear in mind that I am only endeavoring to compare types of construction and not to find fault with the work of any engineer, or the product of any organization. It is merely desired to bring out certain well-defined points by comparison.

Finished car mounted on a Brush chassis showing little difference from ordinary design

Weaknesses in Car Design

My purpose is to try to convince you that if engineers and producing organizations will free themselves from their habit of thought in chassis construction and consider this problem with an open mind, they will realize that their own interests and the interests of the ultimate consumer can, and will, be better served by this new and more scientific use of the materials which enter into the car structure. Let me briefly point out what I believe to be some of the weaknesses that are inherent in the conventional structure.

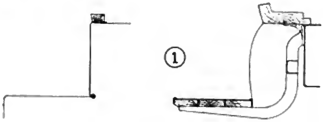
Many of you are familiar with the destructive effect of carrying touring equipment upon the running board; a practice by no means uncommon on long trips. Can you imagine a more improper way to load a U-section, pressed steel member than by the strains transmitted through the running board hangers. A 200-pound passenger standing upon the outer edge of the running board over one of these hangers applies locally approximately 3,400 inch-pounds of bending stress upon the vertical web of the frame, and a considerable amount of yield is inevitable. If anything like the equivalent weight is strapped to the running board, these strains are repeated and intensified indefinitely over a rough road, and the integrity of the whole structure is necessarily threatened. The only answer is either ultimate disintegration in the hands of the user, or, because of the incorrect application of stresses, a needlessly heavy structure.

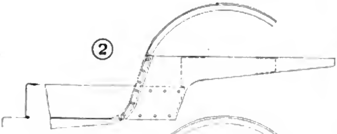
Now, comparing this same problem in stresses with the alternative construction shown, it is at once apparent that load at any point on the running board results in downward stress well distributed upon the vertical web of the frame. The torsion effect, as will be shown in the other layouts, is applied to the frame only at the ends of the running board where proper and adequate provision for withstanding them can readily be made.

In these two sections, the cross sectional areas of the pressed steel frame members have been kept equal, but the application of the pressed steel running board eliminates the need of any considerable amount of lower flange throughout the length of the running board. This enables us to secure a deeper vertical frame web, which, in itself, guarantees greater rigidity for the same amount of material used, and this difference in vertical strength is further increased by the reinforcement which the running board itself forms, so it is obvious that the simpler, and as a whole, lighter alternative section is very much stronger than the heavier and more complicated conventional section.

Absolute Rigidity Impossible

We all know that absolute rigidity under varying strains cannot be secured by any structure. Considering for a moment the heavier, weaker and more complicated conventional structure, some interesting and obvious defects are





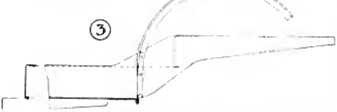


Fig. 1—Section of the conventional car and a similar section with the materials arranged to be of structural value

Fig. 2—Rear end of the running board may be used to form a bracket to avoid twisting strains on the frame

Fig. 3—Showing the possibility of using a single piece side member

apparent. The frame is bound to deflect appreciably under driving conditions. The running board apron, not being subjected to any of the road stresses, and having, because of its form, considerable vertical rigidity, is bound to move slightly with respect to the parts with which it is associated, and sooner or later, squeaks and rattles begin to make their appearance. The same thing is true of the body frame.

Again: Considering the proposed alternative structure, it is apparent that practically every bit of the material used helps to resist these fluctuating road stresses and the rigid association of the parts, together with the greatly increased strength has proved itself in actual service singularly free from this aging action which is so inherent in the conventional structure. By forming the chassis frame so that its vertical web is directly under the outer edge of the body, and because of the great increase in rigidity which is secured, there is no longer any need for the body frame or sill, and the light weight sectional body becomes a proper and advantageous structure.

I do not mean to say that the one-piece body cannot be used, but that it ceases to be a necessary or advantageous form of construction for the open touring car.

While for purposes of comparison I have shown a frame section identical in area with that found necessary with the conventional construction, a frame section less than .1 inch in thickness has been used in connection with a wheelbase of approximately 135 inches. On this test car the sectional body construction was used. The door fit was exceptionally close, and yet, after severe tests over the rough going of Arizona, not the slightest change in the fit of the doors could be detected. During this test, an unusually heavy touring equipment was carried on the running board. No supplemental running board supports were added, and yet no suggestion of body or frame squeaks or rattles was developed.

Fig. 2 shows how the rear end of the running board may be used to form a bracket to hold the running board in plane without local twisting strain upon the frame. It also forms a very rigid and conveniently located support for the rear tonneau door pillar. The rear fender is simplified; the rear seat heel board becomes naturally a valuable structural element of the chassis construction, and the tonneau itself becomes only a side and rear wall for carrying upholstering, the rear seat cushion practically resting upon the frame itself.

You will notice that just as wide a range of location of the rear seat and heel board is secured with this construction as with the conventional construction, but with the advantage that the rear heel board becomes a structurally useful instead of a structurally useless part. I presume the practice of making a two-piece side member will be questioned by some of you, but as I will presently show you, this is not a necessary phase of this type of construction, still I can assure you that it has no structural weakness, and because of the more economical use of the frame stock and the simpler body fitting, this detail of construction probably makes for some cost reduction. Fig. 2 approximates the dimensions used on a 118-inch wheelbase, five-passenger car, the frame material used being 12 gauge.

Fig. 3 illustrates the possibility of using the more conventional single piece side member, and the more conventional square corner between the rear end of the running board and the rear fender. The body fitting in this construction would not be quite so simple as with the two-piece frame, and the support for the rear tonneau door pillar, while undoubtedly ample, would not be quite so simple or quite so rigid as with the other construction.

Construction Has Adaptability

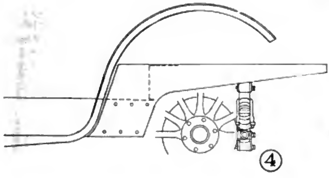
The following illustrations have been drawn for the purpose of illustrating the adaptability of this type of construction to a few of the various rear spring suspensions now in use. Figs. 4 and 5 show a form of rear spring suspension, which, while somewhat unusual, has a number of pronounced advantages, and in practice has given exceptional results. Fig. 5 is a rear view and I will use it to call your attention to peculiar advantages of this type of suspension. This is, as you see, a semi-elliptic suspension where the springs act in series instead of in multiple, that is, each spring deflects only half of the total spring action. A wide loading both on the axle and on the frame is secured, and the entire mass of the springs themselves is spring borne by the lower spring.

Shackling only one end of the spring, the ride is vertical, the same as when longitudinal springs are used, and unlike the single cross spring, there is no possibility of shackle sway of the vehicle.

Fig. 6 shows the conventional semi-elliptic spring suspension and you will notice that because in this frame construction the frame side members are kept as wide as will give proper clearance inside of tires, and because the lower flange of the frame has been substantially eliminated, the spring may lie entirely within the vertical section of the frame, the front end of the spring being bracketed advantageously into the angle formed by the top flange and vertical section of the frame. I hardly think the conventional semi-elliptic spring suspension in connection with this chassis construction needs further comment.

Fig. 7 will aid in considering the problems of cantilever suspension. This spring suspension, while favored by many engineers, taxes the rigidity of the frame more than any other, and for this reason I believe this extraordinarily rigid construction will be found to have exceptional advantages where this type of spring suspension is desired. The wide frame and the narrow lower flange permitting the spring to lie inside of the vertical web of the frame and close to that web, brackets being reinforced by the upper flange of the frame immediately over them.

This vertical flange, as you have no doubt realized, not only has exceptional strength because of its unusual depth, but is rigidly supported against torsional displacement by the running board, by the use of the rear seat heel board as a cross member, by its wide upper flange and by the tieing of



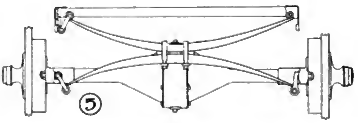


Fig. 4—Left—Form of rear spring suspension claimed to have advantages. Fig. 5—Right—Rear view of same suspension

the two upper flanges together, either by the use of a steel tonneau floor or by the use of the supports at the front and back of a wood floor.

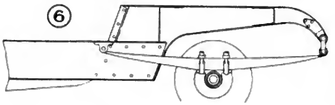
Running Board Problem Double-Ended

I have not shown or discussed the support of the front end of the running board since this is obviously like the problem of the rear end. The front end of the running board may either be upturned to form its own bracket or a supplemental triangular bracket may be used immediately under the front fender. This front end support for the running board is naturally adjacent to the rear engine support which takes strains due to running board load off the vertical web of the side members. In cars using this type of chassis construction, it has been the practice to increase the width of the bottom flange of the frame members at the front end to conventional dimensions, letting this wider lower flange extend back to a point past the front end of the running board.

A type of construction, like a producing organization, is relatively efficient or inefficient, depending upon the amount of service rendered by each bit of material used. With this fact in your minds, I want you to let me turn again to Fig. 1. I trust you will all agree with me that what I have brought to you for consideration is a method of securing more service from every bit of material used in those elements of chassis construction which we have been considering. This arrangement of material has, in the hands of each of three engineers, shown decisive superiority in cost, weight and strength over their best handling of the conventional arrangement of material, and I am confident that in the hands of still other engineers, it will continue to show itself superior to the conventional type of structure.

It has occurred or will occur to some of you, that there is room for further development and refinement along this line. I should be surprised if this were not true, for this construction has, since its inception, received perhaps a total of four or five years of engineering consideration. The conventional structure has, without doubt, received within the last 10 years 10 centuries of engineering thought and study.

I have not tried to even approximately cover the field of discussion suggested by my topic. Front and rear axle construction and the arrangement and construction of the various other chassis units are still fertile ground for the exercise of engineering ability. I have confined myself to those phases of what I believe to be more scientific chassis construction, which seem to me to need the most drastic treatment and promise most decisive improvement in the car as a whole.



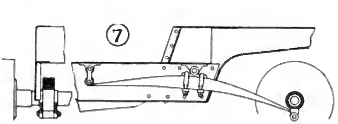


Fig. 6—Conventional semi-elliptic spring suspension, showing wide frame side members

Fig. 7—Extraordinarily rigid frame structure necessary with cantilever rear springs

The discussion brought no weaknesses to light. Pictures of a car actually built and in successful operation with this form of construction were conclusive evidence that Mr. Brush knew what he was talking about.

Discussion Revealed No Weaknesses

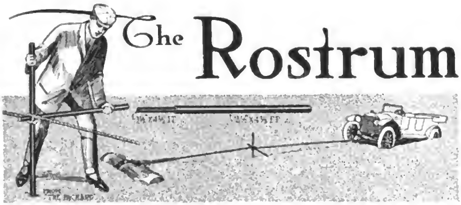
J. G. Vincent, Packard engineer, questioned Mr. Brush as to the difficulty of narrowing the wider chassis at the front end so as to give a small turning radius. It was explained that the construction followed the bottle-neck form, and that it narrowed just as any other frame does, giving average clearance for front wheel turning. G. W. Dunham, consulting engineer, thought that the greater width at the rear might affect the wheel house and clearance, but it was stated that though the frame is wider, there is ample clearance, even with a 5-inch tire.

Russel Huff, consulting engineer of Packard company, claimed that the running boards depend upon the fenders for their support, but Mr. Brush explained that the fenders do not act in this capacity at all, since the running boards are riveted to the lower web of the frame throughout their length, and then at the ends are bent upward and again attached to the frame. It was explained also that, whereas the conventional running board bracket acts as a lever to exert considerable bending force on the upper part of the frame, the new construction cannot put any bending stress on the frame, but only a vertical downward stress distributed along the vertical web.

The matter of finish was questioned by C. C. Hinckley, Chalmer's engineer, who also asked as to the section over the front springs, and whether or not it would allow for plenty of spring action. As to finish, it was held that proper care in applying enamel would take care of it, whereas, it would be easy enough to apply a linoleum covering to the running board metal. As regards the section at front, this was explained to be brought down in depth to about the same amount as any conventional frame, allowing similar spring radius.

A comment was made that damage to fender and running board might affect the frame, making a repair difficult. To this Mr. Brush replied they were bringing up the same objection as has often been heard in the past on the block cylinder casting. If you damage one cylinder, all have to be replaced.

L. C. Weinberg gave a lecture on the development of vacuum or suction in fuel feeding systems. Using the blackboard, he sketched the elements of a number of different patents, and showed how different men had attacked the subject from different points of view. He stated his opinion to be that good as was the vacuum feed today it still was not in a final stage of development, and he expected to see great improvement take place within the next few years. The principal fault of the systems in use is said to be the liability for the feed tank to run dry if the motor is run at high speed with wide open throttle for a long time, this being more noticeable on some motors than on others since it depends upon the depression at which the carbureter will operate. The author was sure this could be overcome and sketched some methods for reaserch which might be followed. In dealing with his own experiments he indicated the detail troubles which could be encountered with apparently perfect systems, and laid emphasis on the fact that the suction feed was so good that it would of a certainty be developed into something still better, neater and yet more efficient.



Spanish Windlass

¶ *A simple device for the extraction of an automobile from deep sand or mud is illustrated herewith. A large tree or railroad tie sunk in the earth or some other solid, immovable object is used as a base of operation. To this is tied a rope and at the other end the rope is fastened to the car. About half way between the immovable object and the car, a 4.5-foot wrought iron pipe is sunk vertically into the ground. A connection is made around another pipe of the same length as shown in the illustration herewith and, by means of the long fulcrum thus produced, is used in winding the rope around the drum formed by the pipe which is sunk into the ground. For convenience in carrying, the two pipes may be telescoped together as illustrated.*

Formula for Two-Cycle Horsepower

EDITOR THE AUTOMOBILE:—What formula would you recommend for calculating the actual horsepower of a two-cycle, three-port engine?

2—What formula would you recommend for calculating the actual horsepower of a two-cycle engine having differential pistons?

As I understand it, a two-cycle engine having differential pistons will develop about twice the horsepower that a four-cycle engine of the same cylinder size will.

Rutherford, N. J. WM. C. DAVIDS.

—A formula often advanced for a two-cycle engine is the following:

$$P_b = \frac{d^2pln}{600,000}$$

In this d is the diameter of the cylinder in inches; l, the length of the stroke in inches; n the revolutions per minute; p, the mean effective pressure and P_b, the brake horsepower.

For a two-cycle three-port engine it would be safe to assume the mean effective pressure as 60 pounds to the square inch. This would give you then for brake horsepower the following formula:

$$P_b = \frac{d^2 ln}{10,000}$$

For N cylinders the final result would be N P_b.

2—It will be quite safe to use the formula $\frac{d^2n}{1.25}$ for two-cycle engine with differential pistons. In this formula d equals the diameter in inches and n the number of cylinders. The constant 1.25 includes the stroke in calculating the piston speed as 1,000 feet per minute and the mean effective pressure as 90 pounds to the square inch.

Reboring Ford Cylinders with Special Reamer

Editor THE AUTOMOBILE:—Would Ford cylinders rebored with a spiral fluted reamer and finished by lapping make a satisfactory job?

2—Which would you recommend, the rose shell or spiral fluted reamer, the rose shell to be spiral also?

3—What should be the size of reamer to fit Ford piston No. 3020-D, which is .03125 inch oversize?

4—What metal, other than platinum, that can be procured anywhere is best for repointing master vibrators? This, of course, means for a temporary repair to enable a car to reach a place where new parts for vibrator may be secured.

Briscoe, N. C. C. B. AUMAN.

—There is no reason why a spiral cutting reamer that would be adjustable would not work as well as the straight cutters. They would be hard to sharpen and adjust and more expensive to install.

2—This is answered under question 1.

3—The Ford company does not lap cylinders after reboring, but fit the oversized pistons, which in most cases are .001 inch or more oversize. The cylinders are bored .0025 inch larger than the piston. At a good many of the Ford company's branches the cylinder block will be rebored, rebabbitted and oversized pistons fitted for $3 and for this reason it would not be advisable for an agent to go to the expense of installing a boring machine and tools.

4—For a temporary repair German silver, silver or a piece of tungsten steel can be made to suffice.

Shunt Field Seems to Be Open

Editor THE AUTOMOBILE:—An Apple dynamo has been used for lighting on a Buick car with storage batteries. The dynamo does not deliver a current now and on taking it out for testing, I can find no fault in the wiring and the dynamo runs as well as a motor on current from dry cells at 9 volts and 30 amperes. Why does it not generate?

E. Brookfield, Mass. F. H. DRAKE.

—From the data you furnish it appears that the shunt field is open. To determine this, lift the brushes off the commutator and test to see if you get a current through the shunt field.

Oversize for Cyclecar Rims

Editor THE AUTOMOBILE:—Is it possible, and if so, would it be advisable to put a 3-inch automobile tire on a 2 1-2-inch rim? I have in mind a clincher tire. The wheels are cyclecar wheels 28 by 2 1-2 and I wish to use a 28 by 3-inch tire.

Plantersville, Miss. W. I. S.

—If you are using the latest type or CC rim you can put a 28 by 3-inch tire on the rim. If you have the old type rim you will not be able to do so but you can apply the regular oversize for the 28 by 2 1-2, which is the 29 by 2 3-4.

Cannot Find Maker of Eberman Pump

Editor THE AUTOMOBILE:—Can you inform me where the Eberman power tire pump is made?

I have a small one-cylinder affair and I do not know where I may send it for repairs.

2—I am also having a great deal of trouble with my Everett six in regard to grease working out of the rear axle upon wheels and brake drums, etc. I have had the wheels taken off, axles repacked, and have also had the axles out, but with no result.

The felt packing seems to permit the grease to come through it or around it so that it gives me a great deal of trouble. How can I have same packed and what kind of packing can I use?

3—Can you tell me how I can plate my horn with nickel? I have same off and would possibly have all necessary articles if I knew the process, formula and what voltage current to use.

West Salem, O. R. C. Wallace.

—The Automobile is unable to locate the makers of this tire pump but it is possible that one of our subscribers reading this will communicate with you giving you the desired information.

2—The best method would be to secure an oversized felt packing and probably use two felt washers in place of one, packing them slightly into the space between the axle shaft and housing. If this does not suffice a grease trap in the shape of a disk fixed to the shaft which will throw the oil by centrifugal force to the housing where it will drain back to the differential gearcase can be fitted. This should not be necessary, however.

3—The cheapest method for you to nickel-plate your horn would be to use a liquid preparation which will give the desired deposit of nickel on the horn. This can be secured from any large hardware concern. It would be cheaper and more satisfactory if you desire to electro-plate the horn to send it out, but if not you can nickel-plate it yourself by making up a nickel-plating bath and following the directions for nickel-plating which you can secure from any book on electro-metallurgy. The instructions are too lengthy to be given here on account of lack of space.

Location of North East Cut-Out

Editor The Automobile:—Kindly explain by sketch the location of the regulator on the North East motor generator?

N. Y. C. Joseph Daly.

—The location of the regulator on the North East motor generator is shown in the accompanying illustration, Fig. 1. As will be noted, the regulator is contained within the main housing.

Camphor Not a Carbon Remover

Editor The Automobile:—Will you kindly advise me whether there is any efficacy in using a small amount of gum camphor placed in each cylinder when the engine is hot to remove carbon, and if so, what the theory is and just how the camphor should be used?

2—Can you recommend anything to remove carbon from the cylinders? G. W. B.

Shelburne Falls, Mass.

—It would not be advisable to place a small amount of gum camphor in each cylinder when the engine is hot to remove carbon. When camphor burns carbon is released and gum camphor cannot be considered efficacious for removing carbon.

2—Carbon can be burned out with oxygen, scraped out or dissolved by some of the better carbon removers. There are some liquid removers on the market which have stood the test of time and which have many adherents.

Instruction in Horsepower Calculation

Editor The Automobile:—Can you tell me whether The Automobile intends to publish an article on how to calculate the horsepower by the bore and stroke? Also showing the difference between a magneto and a Genemotor?

Beaver Springs, Pa. W. C. Baker.

—The Automobile has frequently published references to different formulas by means of which the different horsepowers can be calculated from the bore and stroke. The most frequently used of these is the S. A. E. formula $\frac{D^2N}{2.5}$ in which D is the bore of the motor in inches and N the number of cylinders. This formula will give you approximately the brake horsepower of the motor and is very simple. You need not include the stroke in the calculation as this is already included in the 2.5 figure as it assumes a piston speed of 1,000 feet per minute and this depends directly on the stroke.

Regarding your question on the difference between a magneto and a Genemotor, the Genemotor is the trade name for a given make of motor-generator. A magneto is a simple type of generator which provides electric current for ignition. As it supplies an alternating current this current cannot be stored in a storage battery and hence it is necessary in starting and lighting systems to provide a direct current generator. An electric motor is required to crank the gasoline engine. This in some cars is a separate device but in others is combined with the generator, the combination being known as a motor-generator. It will thus be seen that the difference between the magneto and the motor-generator is a wide one.

Gear Ratios of Eight American Cars

Editor The Automobile:—What are the gear ratios of the following touring cars: Hudson light six-40; Davis 38, model B; Buick, model C-25; Overland, model 80-T; Dodge Brothers touring car; Herff-Brooks, 4-40; Chandler six-35; Saxon six.

Carver, Minn. E. H.

—The gear ratios of the cars referred to are as follows: Hudson 6-40, 3 10-13 to 1; Davis 38, 4 to 1; Buick, model C, 4 to 1; Overland, model 80, 3.75 to 1; Dodge 3.615 to 1; Herff-Brooks, 4-40, 4 to 1 with an option of 3.5 to 1 if desired; Chandler 4.4 to 1; Saxon 4.6 to 1.

Horsepower Calculated by Formula

Editor The Automobile:—What is the horsepower according to the S. A. E. rating and brake power; size 3 3-4 by 5 1-4? Also size 3 3-4 by 4, number of cylinders four, for both?

2—How can I figure the horsepower with both bore and stroke of an engine? Give example for guide.

Beaver Springs, Pa. W. C. Baker.

—The horsepower rating according to the S. A. E. formula for a four-cylinder 3.75-inch motor with a 5.25-inch stroke is 22.5. The S. A. E. rating for the 3.75 by 4-inch motor will be the same, since the only variable factor in the formula is the bore. It is impossible to give you the actual horsepower

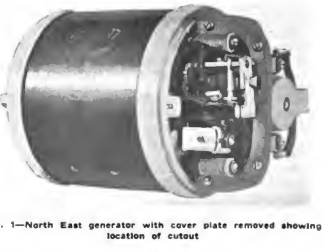


Fig. 1—North East generator with cover plate removed showing location of cutout

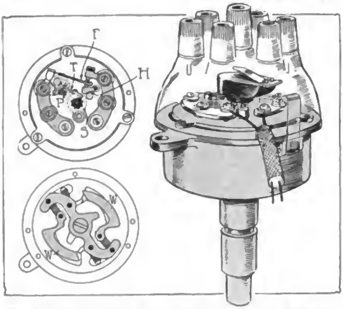


Fig. 2—Working parts of the Atwater Kent timer-distributing mechanism

without an actual dynamometer test of your motor but it will closely approach that given by the S. A. E. formula.

2—A formula which takes in both the bore and stroke of the motor is that of E. P. Roberts which is $\frac{D^2LRN}{18{,}000}$ equals horsepower.

In this formula D is the diameter of cylinders in inches, L the length of the stroke in inches, R the revolutions per minute of the crankshaft and N the number of cylinders. Thus, in a given example if the bore is 3 inches, the stroke 4 inches, the revolutions per minute 1000, and the number of cylinders 4, the horsepower according to this formula would be 8 horsepower.

E.M.F. Used Continental Demountable Rims

Editor The Automobile:—What type of Schebler, also what type of Stromberg, carbureter is best adapted for a 1912 E. M. F. model 30?

2—What make of demountable rim is used on the 1912 E. M. F. 30 and where can they be obtained and at what price?

3—What is the cause of gasoline running out of the bottom of a Rayfield carbureter on a 1913 Mitchell six, just as soon as the motor stops? The carbureter is set so that the car runs well.

4—What causes grease to come from the left side wheel end of the rear axle of a Ford car when it will not come out at the right side end, and how can it best be cured?

Hull, Iowa. H. J. H.

—The Schebler company recommends the use of the model L 1.25-inch size carbureter for this car. The Stromberg recommends the model K 1 inch.

2—The Continental demountable rim is used on the 1912 E. M. F. 30. These can be obtained from any of the Studebaker stock rooms or service stations at a cost of $3.40. The official part number of this in the Studebaker lists is A-4060. A few of these cars use the Gilbert rim, which is no longer obtainable.

3—The probable cause of the gasoline running is that the heavy fuel which is in the manifold condenses after the car has stopped running and will run back into the carbureter and drip out. By putting a full hot air attachment on the motor so that all the air is heated by passing through a muff surrounding the exhaust manifold, the dripping will probably be stopped. It is not a serious trouble, however, and if your motor runs well, the change would not do other than perhaps give you a slightly greater fuel economy.

4—The packing on the left side of the axle has evidently become worn out and this can be cured by securing felt washers for this purpose from the Ford company.

Battery Ignition vs. High-Tension Magneto

Editor The Automobile:—Which is the best ignition for a car? High-tension magneto or storage battery, and which is most complicated and most expensive? Which will give the least trouble? I have had experience with magneto ignition only.

2—Please explain the Atwater Kent ignition and if possible give an illustration.

3—Is the speedometer on the Grant-six geared from transmission or front wheel?

4—Is it harder to detect motor trouble in a six than in a four?

5—Has any of the three companies, Saxon, Grant or Metz sold out? Do they wish to do so?

Shippee, Neb. Ira McComb.

—If the figures on American practice be taken into consideration, the adherents of both magneto and battery ignition would find plenty of ground upon which to base their arguments. Important concerns use both and hence it is impossible to say that one is better than the other because if this were the case a great majority would be using that type. An article entitled Magneto vs. Battery Coil appeared in The Automobile for January 7, page 20.

2—Atwater Kent ignition system is illustrated in Fig. 2 as regards the timing distributer mechanism, which is the heart of the entire system. Primarily, the Atwater Kent system comprises a coil and a combined breaker and distributer mechanism with a switch for the control of these units. It is in the circuit breaker that the design is distinctive, the great feature being that it is impossible for the two points of the breaker mechanism to remain in contact while the switch is on and the motor is not running. Referring to the illustration, the shaft S, which is the rotating portion of the breaker distributer mechanism, has four, six or eight notches equally spaced peripherally according to the number of cylinders. The trigger T catches in these notches and is drawn around with the shaft a minute distance. When it escapes from the notch it rides slightly up on the round surface of the shaft and then returns to its normal position by the tension in the coil spring P. As the trigger T jumps back under the influence of the coil spring, it strikes the hammer H, which in turn transmits the blow to the flat spring F, bringing the contact points together for a very small period of time. This gives the contact and breaks it in such a short space of time that the eye cannot follow the opening and closing of the points.

3—The speedometer of the Grant car is geared from the front wheel.

4—It is not harder to detect motor trouble in a six than in a four for one who is accustomed to both motors. The difference in complication is very slight.

5—The three companies which you mention are in excellent condition and are selling their outputs without trouble.

Why Dry Disk Clutch Drags

Editor The Automobile:—We have a dry disk clutch which is giving us trouble. It will grab and will not slide.

2—Where is the best place to look for a knock?

3—Would it be possible for a young man about 17 years of age to have a state license as a driver, if he has had 2 years experience as a driver and repairman?

Logansport, Ind. A Reader.

—The place to look for trouble on a dry disk clutch is in the facing. There is probably some roughness or some stickiness in the surface which gives rise to the grabbing. There is another possibility in that the trouble is that the spring is adjusted too tightly which does not permit of an easy engagement.

2—All moving joints are susceptible to knocks. Tracing through the transmission of power from the cylinder to the rear axle, we find that at each point of engagement one or more moving parts with other parts there is a chance for a knock. Starting with the piston, if this is too loose, there will be a distinct slapping sound. It can only be cured by the use of an oversized piston. The next point is at the wrist-pin which might have a knock due to looseness in the upper connecting-rod bearing. The third point is at the lower bearing of the connecting-rod. The fourth point is in the main bearings in the crankshaft. Fifth, at the connection between the crankshaft and clutch then in the universal joints and the gearbox bearings and between the teeth of the different gears. Loose valve tappets, timing gears, Oldham couplings, etc., are also fruitful sources of knocks.

3—Consult Indiana state motor vehicle law.

Changing Direction of Magneto Rotation

Editor THE AUTOMOBILE:—Please publish in THE AUTOMOBILE whether or not a Bosch high-tension magneto can be run in both directions by changing the gears, as they are marked to run both ways, and if they will throw as strong a spark one way as they will the other?

Loudonville, O. F. A. Y.

—The Bosch magneto cannot be run in both directions, but must be run in its designed direction. The magneto, however, can be changed over at a cost of about $2 at any one of the Bosch service stations. The work requires the substitution of another breaker box mechanism for that on the magneto. The charge will be increased if it is found that the mechanism already on the magneto is in poor condition, as the cost of repairs on the old one is charged against the amount allowed for the used mechanism.

The design of the keyway on the breaker shaft is such that it cannot be used for a magneto which will run in either direction and consequently in ordering a Bosch magneto it is always necessary to specify whether the instrument should run clockwise or anti-clockwise when looking at the instrument from the shaft end. The direction in which the magneto rotates will have an influence on the system of wiring and upon this and the order of firing in the cylinders will depend the method or system by which the wires from the distributer are attached to the spark plugs. Referring to the accompanying illustration, Figs. 3 and 4, the wiring scheme for clockwise and counter-clockwise magnetos will be seen.

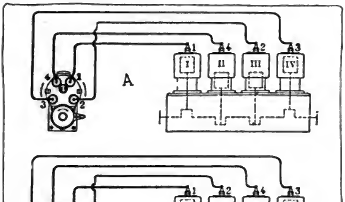


Fig. 3—Diagrams of connections with a magneto which runs clockwise

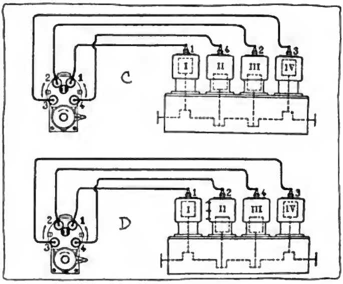


Fig. 4—Connections shown by diagram for a magneto which runs anti-clockwise

Special Franklin Holds Economy Record

Editor THE AUTOMOBILE:—Kindly let me know through the Rostrum what the world's economy record per mile is for automobiles, including steamers, and also by whom this record was made, where and when.

Greenwich, Conn. E. C.

—The record for fuel economy is held by a specially-constructed Franklin car which on June 21, 1913, ran a distance of 83.5 miles over Long Island roads on 1 gallon of gasoline. This car was a special car in every way and cannot in any way be understood as a stock design. The body was a sheet aluminum design in the form of a two-seated roadster with torpedo lines. The weight of the empty car was 1,695 pounds and its total weight with driver and passenger at time of the test was 1,995 pounds. The driver was S. G. Averill, the owner of the car, who was accompanied by an official of the Automobile Club of America, who acted as official observer.

Lightness Big Factor

Everything on this car was done to reduce the coasting resistance. The rear axle was placed on ball bearings and the drive was taken through only one real wheel, the other running free. Plain clincher tires were fitted, 34 by 3.5 inch in size and inflated to a pressure of 35 pounds. The country passed through on the test was fairly level, with an occasional 2 or 3 per cent. grade. The test lasted 6 hours and the average speed over the entire distance was 14.5 miles per hour or about average touring speed. The driver would open his throttle until he had attained a speed of close to 20 miles per hour and then would stop the motor and coast until the car had almost stopped.

Distances per gallon of gasoline traveled by different vehicles vary greatly. A motorcycle has traveled 190 miles on 1 gallon and 10 ounces. This was done by S. A. Baker in 1907. The average accomplishments of stock models equipped with regular bodies fall far below this record. The average gasoline automobile travels from 15 to 25 miles on a gallon, although some touring cars go as low as 4 miles to a gallon and others as far as 30. The average steam automobile goes 10 miles to the gallon, and the average aeroplane 10 miles to the gallon with its fuel mixed with lubricating oil.

Discussion of
"The Improvement
of
Spring Systems"

Springing to Relieve Driver's Fatigue on Rough Roads

Tire Qualities Demanded If Air Tires Were Discarded—Steering and Skidding Considered

TWO contributions on the subject of horizontal springing for ordinary automobiles are presented in the following and indicate the wide interest which would be taken in any adequate constructive solution of the problem. The first one, from an engineer who does a good deal of rough country driving, calls attention to the important question of driver's fatigue and mental tension, to which traffic accidents are often indirectly due, and incidentally suggests the remark that nearly all the main viewpoints emphasized in the M. C. K. articles relate chiefly to driving under worse than normal road conditions or driving at speeds which make even the normal road conditions trying; also that the requirements for commercial vehicles have been kept fully as much in mind as those of the pleasure vehicles, in most of which the loads vary only between narrow limits and for which, therefore, springs in combination with air tires can be made to answer the principal purposes fairly well.

An Engineer's Driving Experience

Editor THE AUTOMOBILE:

In connection with the series of articles you are publishing on the subject of Spring Systems, I note the comment by W. M. E. in your issue of April 1, as to the effect that might be produced by introducing springs to take up horizontal as well as vertical shocks and the effect on roadability of the resulting horizontal movements of the axles.

It occurs to me that this horizontal movement would have another important effect on the steering. On a perfectly smooth road almost any kind of a steering gear is good enough but on a rough road the reaction of the front wheels about their steering spindles would make steering very troublesome unless a self-locking or "irreversible" form of steering gear is used. This is of course the chief reason for the general use of worm steering gears and eighteen inch steering wheels notched or ridged to make them less liable to be jerked out of the hands by a hard shock. Anyone who has ever run over a dog or struck any large obstruction at fair speed with one front wheel only, will realize why irreversible steering gears and large notched wheels are necessary. Of course the vertical effect or component of a blow or shock received on the wheel does not affect the steering or tend to turn the front wheel but the horizontal component does.

Calculations made in these articles show, in actual figures just why and how much these horizontal components are, for instance the case mentioned in THE AUTOMOBILE of Dec. 31, 1914, of a 3,000-pound car under stated conditions, where the horizontal component of a jolt was figured to be 8.524 foot-pounds with a forty inch wheel. For a 34 inch wheel which is more common for a car of that weight, this horizontal component would become 9,200 foot-pounds. This is for both front wheels striking equally and at same time, in which case there is little effect on the steering as the turning effect on the two wheels is opposed in direction so that the jerk is taken up in the tie rod. If however only one front wheel strikes the obstruction, only part of the weight of the front end of the car is raised, though the kinetic energy of the entire car helps to force it over the obstruction. In this case the horizontal component will be something less than 9,200 foot-pounds, but with an obstacle larger than three inches the horizontal shock on one front wheel might easily be as much or even more than this figure.

Such a shock on only one front wheel will give a very large turning effect to the front wheel, and without any counteracting effect from the other wheel through the tie rod, the steering gear itself has to stand this great shock, and in spite of the so-called irreversible gear, the steering wheel will get a vigorous jerk, and that is where the large size wheel with the notches comes in.

And it is not only when the wheel is being held that the shocks have a bad effect on the ease of steering, but also when the wheel is being turned. Should the driver try to turn the wheel at just the instant when one of these great shocks is being transmitted to the steering gear, the movement would be retarded for at least the length of time that the shock is in effect, and it might even happen that the wheel would be jerked slightly backward.

Cushioning these heavy shocks on the steering gear by permitting horizontal movement of the axle would certainly reduce greatly these jerks on the steering wheel, make it easier to turn the wheel during the time in which a shock is being received, and, in general, steering over rough roads would be much less of a trial than it is under present conditions. On a long drive it is not the simple turning of the wheel to keep the car in the right direction, that becomes so tiresome, but the constant tension and readiness for instant action, for readjustment of the wheel after each severe shock and bracing up for the next shock.

So it seems if these shocks to the steering wheel which come only from the horizontal effect of road shocks, can be eliminated or reduced by horizontal springing, a very large part of the strain of driving, at least country driving, would be removed. I do not know just how this will all work out in practice, but on paper it looks as if it should be one of the important benefits of horizontal springing.

New York, April 23, 1915. C. A. D.

It might be added that springing always taking effect in the direction of the shock, if this be possible to encompass, should afford the same relief.

With reference to the opening words of the following letter, M. C. K. would like to say—to obviate all misunderstanding—that in his opinion pneumatic tires, far from being a curse or even a necessary evil, have so far been a blessing for the automobile industry and its patrons, easing construction work immensely, and one not to be lightly discarded. So far as pleasure automobiles are concerned, he sees the advantages from the perfecting of horizontal springing rather in a better chance for saving wear and deterioration of the air tires, through reduction of the worst shocks and the practicability of keeping them fully inflated and otherwise protected, than in any change to tires of a different type and material. Rightly read, he thinks, the letter by O. W. H. stands for the same view for the present time, the difference being in terms of expression only.

Substitutes for Pneumatic Tires

Editor THE AUTOMOBILE:

I have been very much interested in the recent articles in your publication on Spring Systems, especially those in which there are given indications that a system of horizontal springing may be used as a substitute for pneumatic tires. It seems to me that the opportunity to do away with the curse of pneumatic tires is one of the greatest things that could happen to the automobile industry.

If it is true, at speeds exceeding 35 miles per hour, that obstacles three inches or more in height produce horizontal shocks which are of greater magnitude and which cause more damage than the vertical shocks resulting from the same obstacle, it is obvious that cushioning these shocks is of primary importance. However, would not the possibility of using solid tires be of more value than the saving of the car from these shocks? From the viewpoint of the manufacturer the most important detail is to build a car which will withstand rough usage for the greatest length of time, but from the standpoint of the user, I believe that the tire question is of more interest.

I believe that it should not be a difficult matter to construct a car in which the axles would move horizontally a distance equivalent to the horizontal component of the "give" of the pneumatic tire under identical conditions.

In Fig. 15 of the issue of February 18 the tire gives to a point *a*, which is approximately half of its thickness; the horizontal component is about two-thirds of the entire radial movement. In the case of a 3 inch tire this would be equivalent to a radial movement of 1 1-2 inch and a horizontal movement of about 1 inch. It is doubtful if tires which were properly inflated could give to this extent, except in unusual circumstances, and the life of the tire would be greatly cut down. It should not be difficult to design a system of horizontal springing which would require the same force to push the axle back 1 inch as to dent the tire an equivalent distance. In that case, as far as the horizontal shocks are concerned, the results should approximate those with pneumatic tires.

If this is ever accomplished, and solid rubber tires come into extensive use on pleasure cars, I believe that it will become necessary to develop some special type of solid rubber tire.

With a system of horizontal springing a soft tire should not be necessary for comfort, although it would be necessary to have a tire that would flatten out sufficiently to obtain good traction and safe steering. No explanation is necessary as far as traction is concerned, but it may be well to say a few words as to the steering part as related to the contact area.

At speeds over 25 to 30 miles per hour it is a difficult matter to steer a car equipped with solid rubber tires. This is because of the fact that they act so quickly that small bumps keep them off the ground a greater portion of the time than in the case where pneumatics are used. Then, when they come down, the time of contact is so short that they often fail to follow a change in steering. This partly explains the matter, but there is a further factor which enters into the matter.

The pneumatic tire, in flattening out, leaves on the ground a long elliptical contact surface, the long axis of which is in the plane of the wheel. On the other hand, the solid rubber tire flattens out little and leaves a contact surface that is nearly square. The elliptical contact of the pneumatic tire is so long that the wheel tends to follow any change in its direction almost immediately. The square contact of the solid rubber tire is so short along the plane of the wheel that the wheel responds to a change in direction much more slowly.

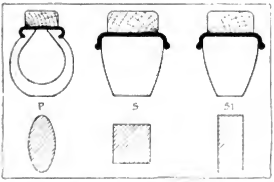


Illustration of road contact areas and shapes produced by different types of tires: S1 being the proposed special not yet materialized

On curves where the side thrust is great, the tendency to skid in the case of the solid rubber tire is greater than with the pneumatic tire. This is due to the smaller area in contact with the ground, and also to the fact that the solid tire is on the ground a smaller portion of the time.

If we had a solid rubber tire with a rectangular contact area instead of a square contact of the same area, and if this rectangular area were very long in the plane of the wheel, then this tire would respond to changes in the course very readily—nearly as well as a pneumatic tire. On curves, however, due to smaller contact area, the skidding would be as bad as with a "square" tire. It is the length of the contact on the ground that governs the quick response to steering changes.

Therefore, we may see that, even though a soft tire is not necessary for comfort when a system of horizontal springing is used, something better than the present solid tires is necessary for safety at high speeds.

Some years ago I read an article concerning the use of a cork filler for tires, and have since wondered why it was that this did not come out on the market. The other tire fillers all have their drawbacks; some of them are affected by heat and others by cold; most of them take a permanent set when left standing for any length of time, and they are all entirely too heavy. It seems to me that ground cork, impregnated with rubber and pressed in a form until all superfluous rubber has been squeezed out, should make a light and resilient filler, not affected by temperature changes. It should not flatten out appreciably or take a permanent set if left with the weight on it for a length of time. Such a tire would flatten out on the road with a sufficiently long contact for good steering, and would yet stay down over bumps better than a solid rubber tire.

It may be, however, that there is some very good reason why such an apparently perfect filler is impracticable. With an air-filled tire, struck at a point *a* by an obstacle, the most damage on the exterior is sustained by the tire at *a*, and within it the change in pressure is distributed uniformly over the entire surface. That is, the whole tire withstands the increase in pressure due to the shock. With a filler, however, there is no tendency to distribute the shock to all parts of the tire internally. Therefore, not only must the tire at the point *a* stand the external shock, but the region surrounding *a* must withstand the bulging due to the compression of the filler at the point struck. It may be that this is the reason for the poor success of all fillers, thus far, and possibly the same would be the case even with the cork filler.

It might be possible, however, to make this composition of rubber and cork into a solid tire, eliminating entirely all points of similarity to a pneumatic tire, and dispensing with the shoe. Its lightness would allow its use in about the same sizes now used in pneumatics without an excessive increase in weight, and this large size would allow the filled tire to approach the pneumatic tire in results.

Some such tire, combined with horizontal springing to take up the horizontal shock ordinarily taken by the pneumatic tire, would prove to be the greatest possible boon to the automobile public.

April 24, 1915. O. W. H.

It would be interesting to hear from others who have an extensive driving experience on some of the points raised by O. W. H., notably as to whether skidding is really more likely to occur when the contact area is small, without regard to its shape, and whether a pneumatic tire really remains more steadily in contact with the road than a solid tire if it is strongly inflated. The prevailing opinion seems to be that the pneumatic tire has this particular advantage mainly at high speed—which of course is very important—but otherwise only if its flexibility is markedly superior to the flexibility of the vehicle springs. It may be a question if a solid tire made of a material whose resilient reaction were as slow as that of a cushion stuffed with horsehair—a material not yet invented so far as tires are concerned—would not have similar advantages at all speeds, with regard to the steering and the skidding.

The possibilities in this connection are as yet unexplored. It seems to have been taken for granted that, inasmuch as the prompt resiliency of pneumatic tires APPEARS to be a desirable feature, an equally prompt resiliency must be an advantage in solid tires, though necessarily of smaller range. In reality, as the same spot of the tire does not strike again till, say, 120 inches farther on in the road, a very much retarded resiliency might serve better. There seems to be a field for experiment and invention on this line of thought for ALL TYPES of TIRES.—M. C. K.

The Engineering Digest

Movement for the Wider Manufacture of Small Motor Ploughs

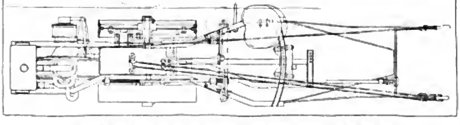
EUROPEAN MARKET TO FACILITATE DEVELOPMENTS

WITH several millions of men and horses removed from the ranks of workers, the European nations will after the war experience a very urgent need of motor ploughs and other agricultural motor machinery, and they will draw as heavily as possible on American supplies in these lines, even to the extent of placing their farm mortgages largely in the hands of American investors. As the demand for self-propelling machinery up to July 1914 was limited only by the shortcomings in construction which made it suitable and profitable only for very large estates, and favorable soil and surface conditions, the attention of designers has been turned strongly to the small working unit, and a large number of motor ploughs supposed to meet the requirements of the farmer of moderate means have made their appearance, but with regard to none of them have decisively favorable results in practice been recorded. No firmly organized co-operation of constructive and agricultural insight seems to have been effected anywhere to solve the knotty mechanical and economical problems involved, each designer apparently fancying that he can strike a happy solution alone with a few picked-up bits of information with regard to the many different things which the average farmer must be able to do with the machinery in order to make it pay, while the farmers usually imagine that they ought to be enabled to farm with machinery on just the same plan which they have always followed.

The tendency toward the small unit is illustrated in the new Wyles plough shown in the accompanying cut. It is propelled by a single-cylinder gasoline motor of 8 1-2 hp. with a two-speed gearbox. The drive is by chain to a jackshaft and from it by sliding gears to the wheel shafts. Clutches on the latter permit either wheel to overrun the other for steering purposes, or to drive either wheel alone when the other is raised. The controls for these movements are under the left and right plough handles when the operator is walking. To make one wheel run in the furrow and the other on top of the land, each wheel is mounted on a radial arm capable of movement around the driving pinion.

The right wheel is guided by means of a handwheel and screw-and-nut steering gear. When turning around at the end of a furrow the whole frame of the machine must be lifted on the left side in order to prevent the two ploughshares from sticking into the ground while the turn is made, and for this purpose a special lifting arrangement has been devised. It consists of a double set of ratchet teeth on an extension of the radial arm carrying the left traction wheel. Two pawls are operated by a single lever on the plan that when one pawl is engaged the other is released. When the upper pawl is released the frame falls by gravity to the required position, the depth of the plowing being set by the handwheel and screw also used for guiding the right traction wheel. At the end of the furrow the lever is thrown over, disengaging the upper pawl, and the pressure of the teeth of the pinion engaging with the gear ring of the traction wheel is sufficient to raise the frame, the driving pinion climbing around the gear ring, while the movement of the lever in removing the upper pawl permits the lower one to fall into place and retain the frame in its elevated position. Thus the ploughshares are lifted to the surface of the ground without stopping the machine, and then, by driving one wheel alone, the plough is swung around one wheel as a pivot.

The addition of a seat and duplicate controls for the ploughman is an improvement devised for the latest model of this plough, which is made by Wyles Motor Ploughs, Ltd., at Leeds, England.—From *The Engineer*, April 16.



Side and plan views of recently improved small motor plough

Chemical Principles in the Protection of Iron Against Rust

TWO series of experiments to determine the chemical influences affecting the corrosion of iron are recorded in the Swiss *Bazeitung* for March 13 and 20 and establish the possibility for improving the ordinary oils and paints employed for rust protection considerably by the addition of certain chemicals. Among the facts which were found to bear on the subject were the following:

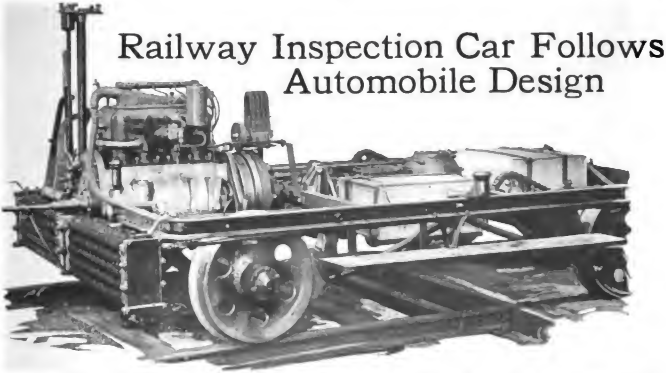
The contact of iron with other metals, especially copper and nickel, has the effect of hastening and increasing the rust formation every time these metals cause a difference in the electrical potential by contact with a liquid.

Distilled water causes rust much more readily than water charged with carbonic acid or sea water.

All solutions of metallic salts have one or more degrees of strength at which the tendency to rust formation by contact with it reaches maximum and another degree beyond which this influence is more and more reduced.

(*Continued on page* 830)

Railway Inspection Car Follows Automobile Design



Chassis of special railway car for inspection work, transportation of labor, pay car, etc., which follows automobile practice in many points of design. Note the radiator, the four-cylinder Continental M power plant, arrangement of tanks, jackshaft, running board, etc.

UNDER the stock name of No. 35 Railway Inspection car a very interesting use of the automobile engine is concealed. This is a motor-driven car with wheels designed to run upon the standard gauge rails to take the place of the locomotive for special work such as inspection, pay car, transportation of laborers, etc.

4 to 50 Miles per Hour

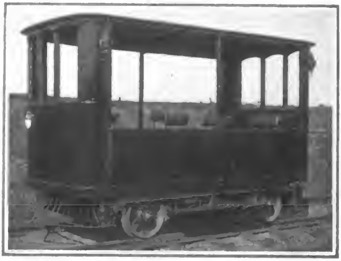
Speeds of from 4 to 50 miles per hour can be made with this car and, although in general construction and appearance this is strictly a railway car and not an automobile, in many respects the design follows automobile practice. Continental motors supply the power, the model M with the 30-horsepower rating being used. The motor drives through a single-plate clutch and a three-speed gearbox to a jackshaft by means of bevel gears. From the jackshaft the drive is taken by chain to each of the rear wheels, these being mounted on high-duty Hyatt roller bearings on the dead axle. No differential is required in work of this kind and by means of a double bevel gear arrangement, all speeds can be obtained in either direction and the car operated equally well either way.

Control of Automobile Type

As far as the control is concerned it is the same as an automobile. It is superior in spring suspension to the usual railway car, having a much easier riding ability, thus overcoming the fatigue generally resulting from long trips in other cars used for this same purpose. As regards the body, it is an all-weather proposition but for use in warm days can be left open, giving a pleasant relief from the stuffiness of the usual observation car. It has a full standing roof and closed ends with drop windows which are very low to allow a clear view of the track. The sides are semi-inclosed and with the side curtains pulled down an entirely closed body for winter travel is provided. There are two doors on each side, and eight seats each independent and swiveled so that they can be swung in any direction permitting observation on all sides of the car and facilitating conversation.

The utility and economy of this type of car can be appreciated when it is considered that such trips are usually made by special trains or at least in a special car attached to a regular train. Under such circumstances the officials are not free to stop at any or all points where they might desire and so are kept from getting into close touch with the different problems on their roads. This type permits them to run between trains and to stop at bridges for inspection. In fact, its usefulness is unlimited in this respect as starting and stopping does not interfere with the regular schedule of any train.

The field which is now open for this type of car should be good in view of the tendency of the railroads at the present time to have their officials get as closely in touch as possible with the details of the different lines, to say nothing of the other uses for the machine.



Railway inspection and work car complete. Note the side doors, of which there are two on each side, and fender in front. The car is designed for speeds of 4 to 50 miles per hour, having a regular automobile type three-speed gearbox. The eight seats are independent and swiveled, permitting them to face in any direction. Side curtains make it possible to completely inclose the car

ACCESSORIES

Superior Ford Radiator

A V-TYPE RADIATOR suitable for Ford cars is shown in the accompanying illustration. This is guaranteed for 1 year and is claimed by the maker to give double cooling efficiency, to prevent boiling over, to save fuel and oil and to increase power. With extending starting crank included this radiator sells for $34.70 in brass finish and for $38 in German silver. In conjunction with this radiator is offered the Ford streamline hood shown in the same illustration which tapers to the top of the wood dashboard and also tapers at both sides. It has a separate hood rest ready to screw on the dash. There are no exposed hinges on top, preventing rain from penetrating the hood. The four hood hooks on the wood ledge hold the new hood tightly in place. There are seven louvres or ventilator gills on each side, allowing the heated air to escape from the motor. This hood can be used in combination with the standard Ford radiator or with the V type already described. It sells for $8.—Superior Lamp Mfg. Co., New York City.

Noxal Shock Absorber

Acting on the principle that a shock absorber must have a guide at the top and bottom of the shaft, the Noxal, shown in the accompanying illustration, has a bottom guide, or bearing of bronze and dry graphite, 1 inch long and 3-4 inch in diameter, while the top, or plunger, guide is 3-4 inch high and 2 3-4 inches in diameter. These bearings are designed to insure long wear and a straight spring action at all times, eliminating side pull, rub or tipping. The springs used in the device are stiff enough for a heavy load, at the same time sensitive to the least vibration from road irregularities. Springs are of vanadium steel, while the yoke coupling and plunger rod are forgings. The plunger rod itself is 3-4-inch in diameter. The case or cover of the absorber is of steel 3-32 inch thick, the entire device being 2 3-4 inches in diameter and 5 inches long. Each pair is packed with fittings for cars with springs from 1 3-4 to 2 1-4 inches wide and shackle bolts from 1-2- to 5-8-inch in diameter. No filing, fitting or machine work is required in applying the device, which is designed for cars weighing from 2,600 to 3,800 pounds. This type sells for $10 per pair.

The Noxal absorber for Ford cars is different in design from that already described but the same materials and workmanship are employed. Like the larger type these are finished in two coats of hard black enamel. The Ford type sells for $8 per set of four.—The Noxal Co., Chicago, Ill.

Heinze Magneto Horn for Fords

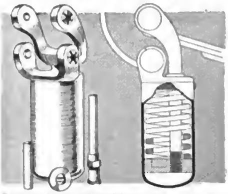
An electric horn which operates on the current generated by a Ford flywheel magneto is shown, not the least of its interesting features being the low price at which it is sold. It is of the vibrator type, the diaphragm being set in motion by the action of an armature moved by electro magnets, designed especially for the Ford magneto current. The vibrator points are of tempered tool steel.

A peculiarity of the horn is that the diaphragm is of aluminum, which offers advantages in that it is light and permits extremely rapid vibration, and is proof against rust. The bell is of brass.

An extremely convenient arrangement is the adjustment by means of which the horn is regulated to give the best results with the particular magneto from which it derives its current. The adjustment operates on the vibrator and is controlled by a milled head at the rear of the casing inclosing the mechanism. By slightly turning this milled head one way or the other while the engine is running and the horn button is pressed the tone can be regulated until it is at its best.

The outfit consists of the horn, button and flexible cord for carrying the current. The method of installation is simple, the horn being mounted where desired, the button clipped to the steering column or wheel, one wire attached to the magneto terminal at the top of the transmission case and the other grounded to any part of the frame or under a nut on the side of the transmission case. The horn sells for $3.50.—Heinze Electric Co., Lowell, Mass.

Heinze magneto horn for Ford cars



Exterior and section of Noxal shock absorber. A special type is also made for Fords

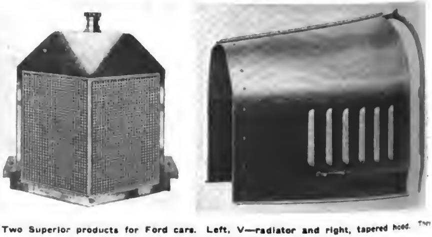
Improved type of Fisher generator

Improvements in Fisher Generator

The latest Fisher generator is not different in principle from the type made by the producers for over 3 years past but it has a variety of small changes in detail that make for convenience. For instance, much weight has been saved, the generator now being only 21 pounds, and the brushes are placed so that they can be taken out and replaced with great ease. The complete lighting outfit now costs $37.50. Also the output has been increased being now 10 amperes. The Fisher machine is of the inherent regulation type and strongly constructed, while its manufacturers specialize on the production of outfits to attach to standard cars of old patterns. From stock can be obtained lighting sets to fit Overland, Ford, Cadillac, Hupmobile and R. C. H. cars of sundry models.—Fisher Electrical Works, Detroit, Mich.

Portable Hand Lamp

This is a very simple form of hand lantern that derives its supply of current from any ordinary type of dry cell and will clip on the top of a number six cell of any make. It is of no importance what form of end the central carbon pole of the cell may have, as the lantern is



Two Superior products for Ford cars. Left, V—radiator and right, tapered hood. They may be used in conjunction or separately

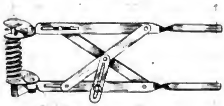
Meteor portable hand lamp

adjustable to suit any sort. For use in the garage an electric torch is, of course, much to be preferred to an oil lamp and this—known as the "Meteor"—seems to be ideally simple. The advantage of being able to use any kind of cell instead of a special sort is obvious.—Stewart-Skinner Co., Worcester, Mass.

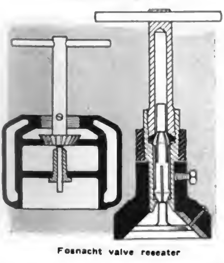
Several Paro Products

The accompanying cut of the Illinois valve remover shows it in action and gives an excellent idea of its simplicity and ease of operation. This device can be operated with one hand and the two adjustable jaws enable the worker to remove valves from the most inaccessible location. It compresses and retains the valve spring in position until the valve is replaced. Two features which will appeal to the car owner are that its action is not only easy and quick but it prevents soiling the hands. It sells for $1.

Another product of the Paro company is the Fosnacht valve reseater which is designed to cut a new seating surface on the old valve and its seat just as was done when the motor was machined at the factory. The chief advantages in the use of the instrument are said to be the preservation of the true angle and the unusual rapidity of operation, it being stated that a new seat can be given the valve by three turns of the tool. Reamers sell at $4 and $6 and special sets for repair shops are offered at $30, these being designed to provide a tool for every type and size of engine that may come into the shop.



Illinois valve remover

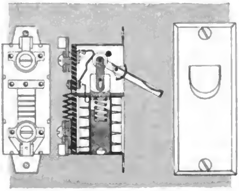


Fosnacht valve reseater

Klearglow, also produced by the Paro concern, is a one-piece all-glass device for diffusing the light of the headlamp, the surfaces of which it is composed are corrugated and arranged so that the light is softened and clarified and the dangerous glare is eliminated. The device is said to eliminate the glare without in any way reducing the volume of light cast by the lamp.—H. G. Paro, Chicago, Ill.

Automatic Safety Switch

Fuses in an automobile lighting circuit are always a possible source of trouble, though they happen very seldom. Their purpose is to prevent the wires in the circuit from being overloaded and they are a great safeguard. The trouble comes when some accident causes a short circuit, a rush of current and a "blow." It is then necessary to replace the fuse by a new one, after locating and curing the fault. Thus spare fuses have to be carried, as it is extremely dangerous to cut out a fuse by wiring it up with a bit of copper as is often done in emergency when no spare fuse is available. The Hartman automatic switch is a simple mechanical device which automatically switches off any circuit if the current in it exceeds the safe amount. It is operated by a small electro-magnet that pulls the contacts apart directly the current becomes too strong. Thus it is as effective as the fuse, while no part of it burns out to give the break in the circuit. All sorts of units are made from a single switch to gang switches that can control every circuit on a car and the prices naturally vary a good deal. A single unit costs $1.50 with face plate for attaching it, and a four switch plate costs $5.50. Automatic starter switches and ignition switches are also made by the same firm.—Hartman Electrical Mfg. Co., Mansfield, O.



Hartman automatic safety switch

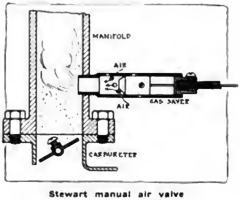
Safety Hand Lantern

The feature of the Federal electric hand lantern is that it casts no shadow on the ground beneath it. Instead of having the lamp at the top with a solid base beneath, it has an open foot consisting of a ring and four legs, so that the light is strong immediately under the hand of the person carrying it as well as spread all around. It is fed with current from a special dry cell that is easy to replace, and clips are supplied to fasten the lamp to the running board of the car. It is very compact when folded and the lamp bulb is well protected, while there is a space inside the dry cell where a spare bulb can be put. The price of the lantern is $4.50. A vertical pattern of hand lamp with a conical reflector top and both swinging and fixed handles is sold for $2.—Federal Sign System, Chicago, Ill.

Federal safety hand lantern which casts no shadow on the ground beneath it

Manual Air Valve

The Stewart gasoline saver is a simple little fitting for attachment directly to the intake manifold. As can be seen from the drawing, it is a length of tube threaded at one end and drilled with a series of small holes. Inside there is a piston which motor suction tends to draw down to the bottom of the tube, so closing all the little holes, but a wire control carried to the steering post allows the piston to be drawn back, so uncovering one or more holes and letting air into the manifold. The device is the extreme of simplicity and could not fail to prove its ability to save fuel if used by the driver in an intelligent way. A manual device is preferred by most experts to an automatic, because they enjoy using it, but this is so simple that it should appeal to the least expert, too, as there is nothing to be learned or understood about it. The price is $5 for the small size and $6 for a larger pattern.—Alfred C. Stewart Machine Works, Los Angeles, Cal.



Stewart manual air valve

American-Made Chassis Lead in Australian Trade

United States' Share of Commonwealth's 1914 Imports $2,154,420—Gain of $468,350 Over 1913—United Kingdom's Share $2,152,330, or Only $2,090 Less Than That of U. S.

IMPORTS of American-made automobiles and trucks into the Commonwealth of Australia are yearly making great strides and have gradually caught up to and passed those of their rival, the United Kingdom, which, on account of the war, has curtailed its shipments into that country and has thus lowered its export figures there. The latest statistics show large increases in all departments for the United States, the most marked being those in chassis. This country in 1914 exported to the Commonwealth chassis amounting in value to $2,154,420, an increase of $468,350 over 1913. The United Kingdom exported chassis amounting in value to $2,152,330, just $2,090 lower than the figures from the United States. Incidentally, this is the first time that the United States chassis exports have been greater than those of the United Kingdom.

U. S. Chassis Gain

Imports of chassis into the six states of the Commonwealth from the United States, showed gains in each for 1914. New South Wales led with $797,675 with Queensland second with $470,620. From latest reports it is shown that 79 per cent. of the cars sold in those states have gone into the country districts where farming and pasturage constitute the chief occupations. With this class of population purchasing practically 80 per cent. of the cars, it is not surprising that the low-powered and medium-priced cars should lead.

New South Wales also led in chassis imports from the rest of the world, the amount being $2 449,625, over one-third of the total, which amounted to $6,748,925 compared with $6,667,750 in 1913. This state also led in body imports, which amounted to $192,620, compared with $170,725 in 1913. Victoria was second in point of chassis and bodies, her chassis imports amounting to $2,148,540 and her body imports to $106,965. Queensland was third, chassis imports amounting to $871,640 and body imports to $215,600.

Queensland showed the largest increase in imports of American-made automobiles and trucks with New South Wales second. The 1914 increase of Queensland was $161,130 and that of New South Wales, $133,915.

All of the states, with the exception of Victoria, showed large increases in their total chassis imports. New South Wales led with a gain of $183,810 over 1913 and Queensland came second with a gain of $101,845. Victoria's drop was $235,125.

Canada Well to the Front

Though the United States showed the largest exports to the Commonwealth and also the largest gains, Canada was a close second in the latter. It might be added, however, that the Canadian imports were principally made up of Fords from the Walkerville factory. The United Kingdom, which was second in value of imports, fell way below its 1913 imports, just $278,980. This was due to the concentration of all its truck manufacturing for war purposes. The manufacture of automobiles has also been turned to war purposes.

A Fifty-Fold Increase Since 1909

American automobile and truck imports into Australia since 1909 have amounted to more than $10,000,000. From the figure of $50,625 in 1908, this value has risen to $2,707,780 in 1914, or nearly fifty times its magnitude. This country as an automobile buying territory, has made most astonishing headway in the last 5 years. Agriculture, mining and a variety of industries make that country a territory of considerable buying power. That the automobile industry is getting its share is manifested in the importation of $7,930,465 worth of chassis and bodies in 1914.

Automobile and Motor Truck Chassis and Bodies and Motorcycles Imported into Australia in 1914

CHASSIS FOR AUTOMOBILES AND TRUCKS

Country of Origin	N. S. W.	Vic.	Queensland	S. Aus.	W. Aus.	Tas.	Total
United Kingdom	$801,875	$704,360	$185,645	$304,255	$88,325	$67,870	$2,152,330
Canada	338,480	295,520	160,125	173,255	50,310	44,910	1,062,600
India	......	4,115	....	....	....	....	4,115
New Zealand	50	2,425	....	....	....	....	2,475
Austria	1,210	1,560	1,780	....	....	....	4,550
Belgium	58,185	58,300	11,895	3,755	30	....	132,165
France	184,790	297,505	27,590	52,390	13,595	10,665	586,535
Germany	156,785	187,065	10,990	13,445	195	4,265	372,745
Italy	110,575	129,675	2,995	20,610	6,635	....	270,490
Netherlands	......	475	....	....	....	....	475
Switzerland	......	5,625	....	400	....	....	6,025
U. S. America	797,675	466,915	470,620	254,620	133,855	35,735	2,154,420
Total	$2,449,625	$2,148,540	$871,640	$822,730	$292,945	$165,445	$6,748,925

BODIES FOR AUTOMOBILES AND TRUCKS

Country of Origin	N. S. W.	Vic.	Queensland	S. Aus.	W. Aus.	Tas.	Total
United Kingdom	$147,415	$76,180	$34,820	$44,050	$21,760	$13,335	$337,560
Canada	75,660	51,485	40,870	38,015	12,540	10,390	228,960
India	....	440	....	....	....	....	440
New Zealand	225	570	....	....	....	....	795
Austria	....	380	....	....	....	....	380
Belgium	1,135	2,585	580	....	....	....	4,300
France	6,950	8,060	1,920	2,410	1,055	60	20,455
Germany	11,955	3,110	575	1,320	....	280	17,240
Italy	8,245	5,510	....	1,885	2,230	....	17,870
Netherlands	....	180	....	....	....	....	180
U. S. America	192,620	106,965	136,835	74,145	35,580	7,165	553,310
Total	$444,205	$255,465	$215,600	$161,875	$73,165	$31,230	$1,181,540

MOTORCYCLES, ETC.

Country of Origin	N. S. W.	Vic.	Queensland	S. Aus.	W. Aus.	Tas.	Total
United Kingdom	$277,670	$230,020	$26,465	$89,560	$57,475	$29,905	$711,045
New Zealand	....	495	....	....	....	....	495
Canada	....	6,390	....	....	....	....	6,390
Belgium	9,605	....	3,125	....	....	....	12,730
France	265	115	770	1,235	1,105	....	3,490
Germany	2,165	630	....	280	5	....	3,080
Netherlands	75	...	....	....	....	....	75
Switzerland	2,385	655	....	....	....	....	3,040
U. S. America	6,920	132,600	3,410	5,000	2,725	455	151,110
Total	$299,085	$370,905	$33,720	$96,075	$61,310	$30,360	$891,455

The AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, May 6, 1915 No. 18

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico -One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - -One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft. Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Chassis Construction

IS the structural chassis design of today a scientific solution of the problem of stress on the various component parts, or is it a development which still shows traces of an ancestral horse vehicle? If it is the latter, there is hardly any doubt but what a scientific solution of the chassis problem will make important changes in practice. If the automobile chassis is merely a descendent from the frame work of the horse-drawn vehicle it would be beyond the realm of possibility that its structure would be the same were it approached by a bridge-designer, for instance, who had never seen the working drawing of either a horse-drawn vehicle or an automobile.

Very few, if any, automobile engineers have seen an actual stress sheet such as is common in bridge practice worked out for an automobile. Yet, certainly as regards its static loads and many of the dynamic stresses, the bending moments, sheering stresses, etc., are well within the possibility of calculation. The question is if the disposition of the material is the same in present design as it would be were it worked out to meet the conditions of a carefully worked-out stress sheet.

If the material which is added for the sake of beautifying the chassis can be utilized in such a way as to be a part of its structure the result is almost bound to be a lighter vehicle than when the beautifying material is added after the structure has been completed. Furthermore, if this could be done it would eliminate to a large extent the use of the lighter sheet metal parts and consequently eliminate one of the big factors for producing noise in a car which has seen a limited amount of service. It is not altogether possible that the methods used in bridge design could be transferred immediately to automobile practice, because there are certain demands which must be met in the way of the location of the center of gravity and in appearance. There are, however, parts where bridge practice could probably be employed to great advantage by permitting a scientifically disposed mass of material to perform duties which would be beyond the strength of material not so carefully arranged. For example, considering pure sagging stresses, the modulus of a section through the car frame would be the deciding factor. Therefore in deciding the bending moment this naturally would depend to a large extent on the material furthest removed from the center of the car. The location and arrangement of bends in the frame members and cross members are factors which have an all-important bearing on weight and strength.

1916 Motors

THOUGH the motor manufacturers are keeping information regarding their plans for 1916 very much in the background, enough leaks out now and then to show that the promise of the 1915 designs is likely to be fulfilled. That is to say the maximum crankshaft speeds will be higher than ever and the engines will be set so that the highest horsepower is attained at greater crankshaft speeds than heretofore.

Just at present it is to be observed in the conversation of engineers at informal gatherings such as always follow S.A.E. meetings and the like, that the high-speed four, the high-speed eight and the twelve are all expectations. That is to say 1916 is expected to produce many small fours of fairly high power and low gearing. Eights are expected to increase in numbers, and twelves to make their bow, while it is beyond all doubt that at least one of the largest firms of motor makers has a twelve practically ready for whoever may want it.

Apart from this, however, which is more or less common gossip, there is a good number of men who consider that the light, high-speed six has never had a proper chance to show its capabilities, and when many of the engineers are agreed on a point like this it is safe to argue that several makers at least will come along with a six of high volumetric efficiency. There seems general agreement that the day of the large, slow-speed six, giving its full power at 1,200 to 1,500 revolutions is doomed, that the motors with more than six cylinders, or the light high-speed six will oust it from the position it has held so long. This means that every motor manufacturer is working up the power per cubic inch and this will undoubtedly lead to considerable changes in detail design. This fall will surely see the introduction of a great many interesting developments in the internal economy of American automobile engines.

Forty-One Cars Will Start in Indianapolis Trial Heats

Two of Four Sunbeams Entered Only Ones with Six-Cylinder Engines—Ten Foreign Entries—Prizes Total $52,300—Bugatti Only Car with 300-Inch Displacement

INDIANAPOLIS, IND., May 4—Entries for the next Indianapolis 500-mile race on May 29 have closed with forty-one cars registered. The name of René Thomas will not be found among the starters. Thomas, after cabling his entry to the speedway management early in the spring, found it impossible to interest the Delage factory in loaning him a car, because of the war, and finally, though he tried until the last minute, failed to raise enough capital to buy the machine.

Looking over the list of entries, marked variations in motor sizes, etc., are seen; for instance, the Cornelian, which will be driven by Chevrolet, has a piston displacement of only 103 inches, the smallest car in the race, both in the latter respect and also in weight, this being only 1,000 pounds. The other extreme in respect to piston displacement is Oldfield's Bugatti with 300 inches. The heaviest car in the race is Cino, driven by McNay, with a weight of 2,450 pounds.

Despite the size of the entry list, some slight disappointment comes with the knowledge that no name of a previous winner appears. Harroun, who finished first in 1911; Dawson, 1912 winner; Goux, 1913 hero; and Thomas, who came in first last year, all are missing.

Ten Foreign Entries

There are ten foreign entries, representing five manufacturers. Four of these are Sunbeams; three are Peugeots; one a Bugatti; one a Mercedes; and one a Delage. America is even better represented. In the list, there are the products of half a dozen American factories. Also, there is the usual number of more or less mysterious American entries, the list this year revealing twelve makes that have been kept under cover until the last minute.

Just which of the forty-one entries actually will start in the race is problematical and will not be known until after the speed trials on May 20, 21 and 22. On these days the cars will be put through their paces in the inverse order of their entry and to be eligible to start they must show a speed of 80 miles an hour for one complete lap of the 2 1-2-mile course. As if more than three cars of any one make are entered only the fastest three can start, one of the Sunbeams surely will go. Only thirty-three cars will be permitted to start. The cars are to be numbered according to the speed they show in the preliminary trials, the fastest car receiving No. 1 and starting next the pole.

In order to make identification easy, each car is to be painted according to the International method. That is, German cars will be white; Belgian, yellow; French, blue; English, green; Italian, red; and American, red and white. The make of car and not the nationality of the driver will determine the colors.

As compared with previous 500-mile races, this year's race is at present on a par with the first event staged in 1911. For that race there were forty-one starters, the largest in the history of 500-mile races. The following year, twenty-four cars came to the line, this being the smallest number to start. In 1913 there were twenty-seven starters and last year thirty drivers faced the starter.

Many Well-Known Names

Even though there are no previous winners entered, the entry list contains many names which have become well-known to racing enthusiasts. For example, there is DePalma and his Mercedes; neither Carlson nor Rickenbacher of the Maxwell team need any introduction to racing fans; Chassagne and Coatalen, the Sunbeam team, are new to American racing, but both have enviable records abroad; Chevrolet has not been seen at the wheel of a racing car since his last appearance in a Vanderbilt race on Long Island, though his name and his prowess nevertheless are familiar; everyone knows Pullen, Mercer pilot, for who could forget his memorable and record-smashing Grand Prize victory? Resta, too, has carried off a Grand Prize, to say nothing of a Vanderbilt and foreign trophies too numerous to mention; and there are the Bergdoll brothers; Nikrent, the veteran Barney Oldfield, Hughie Hughes, Neil Whalen, Grant, twice Vanderbilt Cup hero, Burman and Chas. Keene, all of whom have made names for themselves.

Of the American cars, probably the three Porter-Knights' which are described and illustrated in this issue, will attract as much attention as any for this is the first time that a team of specially-built, Knight-motored cars has entered on American soil. These cars are wonderful creations, as is revealed by their horsepower curves—122 horsepower at nearly 4,000 r.p.m.—and their speed on the road; one has made over 100 miles an hour in practice. Then there are the Maxwells, a doughty team; the Stutz cars, the Duesenbergs, and the Mercers.

The speed that will be made is highly problematical though there is reason to believe that old records may go by the board despite the fact that the piston displacement this year has been set at 300 cubic inches. In 1911, Ray Harroun, in a Marmon, won the first race at an average speed of 74.8 miles an hour. Dawson averaged 78.72 miles an hour the next year with a National; and in 1913

List of Entries for Indianapolis 500-Mile Race

Car	Driver	Cylinders	Bore & Stroke	Displacement	Nation	Entrants
Maxwell	Carlson	4	3.8 x 6.8	298	America	Maxwell Motor Sales Corp.
Maxwell	Rickenbacher	4	3.8 x 6.8	298	America	Maxwell Motor Sales Corp.
Maxwell	——	4	3.8 x 6.8	298	America	Maxwell Motor Sales Corp.
Mercedes	De Palma	4	——	—	Germany	E. C. Patterson
Sunbeam	Coatalen	4	3.7 x 6.3	270.9	England	Louis Coatalen
Sunbeam	Chassagne	4	3.7 x 6.3	270.9	England	Louis Coatalen
Du Chesneau	Brown	4	3.3 x 5.5	183	America	C. A. Du Chesneau
Duesenberg	Alley	4	4 x 6	299	America	F. S. Duesenberg
Duesenberg	O'Donnell	4	4 x 6	299	America	F. S. Duesenberg
Duesenberg	——	4	4 x 6	299	America	F. S. Duesenberg
Cornelian	Chevrolet	4	2.9 x 4	103	America	Blood Bros. Machine Co.
Delage	J. De Palma	4	4 x 6	299	France	J. E. Wilson
Stutz	——	4	3.8 x 6.5	296	America	Stutz Motor Car Co.
Stutz	——	4	3.8 x 6.5	296	America	Stutz Motoe Car Co.
Stutz	——	4	3.8 x 6.5	296	America	Stutz Motoe Car Co.
Peugeot	Resta	4	3.7 x 6.9	274	France	Peugeot Auto Import Co.
Peugeot	——	4	3.1 x 6.1	183	France	Peugeot Auto Import Co.
Peugeot	——	4	3.1 x 6.1	183	France	Peugeot Auto Import Co.
Bergdoll	E. Bergdoll	4	4 x 5.9	299	America	G. C. Bergdoll
Bergdoll	J. Bergdoll	4	4 x 5.9	299	America	G. C. Bergdoll
Mercer	Pullen	4	3.8 x 6.8	298	America	Mercer Automobile Co.
Mercer	Ruckstell	4	3.8 x 6.8	298	America	Mercer Automobile Co.
Mercer	Nikrent	4	3.8 x 6.8	298	America	Mercer Automobile Co.
Bugatti	Oldfield	4	3.9 x 5.9	300	Germany	C. W. Fuller
Bergdoll	Haupt	4	4 x 5.9	299	America	G. C. Bergdoll
Emden	——	4	4.3 x 5.3	298	America	R. E. Donaldson
Porter-Knight	Hughes	4	3.8 x 6.1	270	America	F. R. Porter
Porter-Knight	Keene	4	3.8 x 6.1	270	America	F. R. Porter
Porter-Knight	Whalen	4	3.8 x 6.1	270	America	F. R. Porter
Sebring	——	4	4 x 6	299	America	E. E. Miles and J. W. Gwin
Sunbeam	Grant	6	3.2 x 5.9	278	England	Fortuna Racing Team, Inc.
Sunbeam	Limberg	6	3.2 x 5.9	278	England	Fortuna Racing Team, Inc.
Cino-Purcell	Cox	4	4.4 x 5	299	America	W. R. Purcell
Burman	Burman	4	3.6 x 7.1	298	America	Bob Burman
Harroun	Orr	4	3.8 x 6.8	298	America	Ray Harroun
Mulford	Mulford	4	3.7 x 7	299	America	Luther Brown
Cino	McNay	4	4.4 x 5	299	America	E. D. McNay
Kleinart	Klein	4	5 x 6	299.5	America	E. E. Klein
Mxis	Mais	4	——	—	America	J. A. Mxis
Shambaugh Spec.	Shambaugh	4	——	—	America	Charles Shambaugh
Bals Special	Hill	4	4.5 x 4.5	286.3	America	N. B. Bals

Jules Goux, with a Peugeot, averaged 75.92 miles an hour. In the last event, René Thomas, at the wheel of a Delage, turned the 500 miles at an average rate of 82.47 miles an hour.

Prizes Over $52,000

There will be $50,000 in cash prizes from the Indianapolis Speedway management to be divided up in ten portions as follows: first, $20,000; second, $10,000; third, $5,000; fourth, $3,500; fifth, $3000; sixth, $2,200; seventh, $1,800; eighth, $1,600; ninth, $1,500, and tenth, $1,400.

The Bosch Magneto Co., New York City, follows its custom of past years, offering cash prizes. It will award $1,000 in prizes to cars using its magneto and $300 to cars using Bosch plugs and magneto as well. The winner using the Bosch magneto, will receive $500, second will receive $300 and third, $200. The first three winners using both Bosch plugs and magnetos, will each receive $100.

The Emil Grossman Mfg. Co., New York City, is offering a cash prize of $1,000 to the winner of the race. The award is conditional on Red Head spark plugs being used exclusively.

Slade to Judge Automobile Exhibits at Exposition

NEW YORK CITY, May 4—A. J. Slade, consulting engineer of this city, has been selected as one of the committee to pass on the automobile exhibits at the Panama-Pacific Exposition and left for the Pacific Coast last week.

Saxon Travels 4,642 Miles in 30 Days

NEW YORK CITY, May 5—A Saxon roadster has completed its 30-day run between New York City and Albany, covering a distance of 4,642 miles in that time. Each day it made a one-way trip, covering over 154 miles. The car was a stock model and averaged better than 31 miles to the gallon of gasoline; 75 miles to the pint of oil. The operating cost was 1-2 cent a mile. The car used one set of Firestone all-weather tires throughout the run.

Galbraith Appointed Savidge Steering Eastern Representative

INDIANAPOLIS, IND., April 30—A. C. Galbraith, well known in the accessory trade, has just been appointed eastern representative for the Savidge Steering Device Co., this city.

Hess-Bright to Increase Plant

PHILADELPHIA, PA., May 4—The Hess-Bright Mfg. Co., of this city, will soon complete an addition to its present bearing factory which will materially increase its capacity. The new building is a brick structure conforming in style to the original factory.

Cleveland Police and Offending Automobilists Start Anew May 1

Offenses After That Date Considered as First—$25 a Car for Bond on Second—Headlight Rule Strict—Studebaker Declares First 5% Common Stock Dividend

CLEVELAND, O., April 30—Cleveland officials at conference April 27 decided to deal with speed and traffic violators along revolutionary lines. For some time conditions in this county, where there are more than 20,000 licensed automobiles, have been chaotic, owing to changes in laws governing motorists. Scores of cases have been brought to police court, fifty-two automobile cases alone having been disposed of by small fines in police court April 27.

The Cleveland police and prosecuting officials now propose to grant a general amnesty to all unpunished offenders, to wipe the slate clean, giving every one an immunity both for all past offenses and grievances May 1. On that date the police and automobilists will start on an equal footing.

After May 1 all offenders against any laws relating to motor traffic will be treated as first offenders. A set of the laws has been printed and copies are being distributed broadcast. The new policy will be not to make an arrest for first offenders, but they will be taken to the nearest police station, where they will be registered and all the details concerning their alleged infraction of the laws listed. The information will be forwarded to a central bureau at police headquarters for reference.

When a registered first offender is detected in a second offense he will be arrested and taken to the police station, where his record of the first offense will be consulted. Automobilists will not be detained in a cell at the station, but will be permitted under the new state law to deposit $25 cash bond or leave their machines at the precinct police station and then personally go to the central station to obtain bail. The money deposit or machine will be returned when he presents regular bail bond.

In the matter of headlight violations the procedure is exceptional. In such a case a second offense violator will be compelled to remain at the station under arrest until bail is brought to him, the same as any other misdemeanant. The reason for this is that the state law providing for putting up the car or cash as security for bail does not include headlight violators.

Studebaker Common Pays Initial Dividend of 5 Per Cent.

NEW YORK CITY, May 5—The directors of the Studebaker Corp. declared yesterday an initial dividend of 1 1-4 per cent. for the current quarter on the common stock. Payment will be made June 1 to shareholders of record May 20. The usual quarterly disbursement of 1 3-4 per cent. on the preferred was ordered.

Anderson Joins Sales Force of Fisk Rubber Co.

CHICOPEE FALLS, MASS., May 3—Justus D. Anderson, formerly president of the Hartford Rubber Works Co. and later sales manager of the merged companies doing business under the name of the United States Tire Co., has joined the sales department of the Fisk Rubber Co. here, and will assume his new duties May 3.

Westinghouse Co. To Buy Stevens Duryea Plant

NEW YORK CITY, May 5—The Westinghouse Electric & Mfg. Co. has taken options on several manufacturing plants in New England, including the J. Stevens Arms & Tool Co., Chicopee Falls, Mass. The Stevens-Duryea Automobile Co.'s plant, controlled by the arms company, is included in the arrangements.

These plants, it is said, will be used to fill rifle orders, recently received from a foreign government.

Bodman, of London, in Detroit

DETROIT, MICH., May 4—W. L. Bodman, general manager of Peters & Sons, London, Eng., representatives of the Scripps-Booth passenger car and the signal truck, is in Detroit this week in the interest of shipments of these machines.

Findeisen Calls on Detroit

DETROIT, MICH., May 1—Walter Findeisen, sales manager of the Findeisen & Kropf Mfg. Co., Chicago, manufacturer of Rayfield carbureters, reached this city Friday to call upon the manufacturers.

Rice Leaves for 2-Weeks' Trip in South

INDIANAPOLIS, IND., May 1—H. H. Rice, sales manager of the Nordyke & Marmon Co., left Wednesday for a 2 weeks' trip through the south. He will visit Memphis, Birmingham, New Orleans, Atlanta, Knoxville, Chattanooga and Louisville, calling on Marmon dealers.

137 Franklin Dealers Average 32.1 M. P. G. in Fuel Economy Test

Highest Average Is 55 Miles Per Gallon and Lowest 18.3—All Sorts of Weather Encountered—Results Better Than Last Year

SYRACUSE, N. Y., May 3—Traveling over roads of every condition in practically every state in the Union and under all sorts of weather conditions, 137 Franklin dealers on Saturday, piled up a grand average of 32.1 miles on a single gallon of gasoline. This is the second event of the kind to be run off by the Franklin Automobile Co., this city. The first took place a year ago when ninety-four dealers averaged 32.8 miles on 1 gallon.

The demonstration this year was run along the same lines as last year's and also brought to light some unusual figures. The high record of the demonstration was made in New Haven, Conn., by Cowles Tolman, who covered 55 miles under the supervision of Professors Lockwood and Prentice of Yale University. The low record came from Oil City, Pa., where, due to cold weather and heavy road conditions, Phinney & Sloan covered but 18.3 miles.

Four of the entrants covered 50 miles or better; fifteen obtained 40 miles or better, and eighty-three traveled 30 miles or more. Last year the best record made was 51.2 miles and the lowest 17.2.

Reference to the accompanying table of results shows a wide variance in road and weather conditions. In 15 per cent. of the territories there was rain; in thirty localities high winds blew all during the demonstration, Chicago, Buffalo, Cleveland, Detroit and some other lake points reporting 50-mile gales. At Colorado Springs, where the altitude is nearly 10,000 feet, the G. W. Blake Auto Co. obtained 30.7 miles in a high wind before the gallon of fuel was exhausted. At Walla Walla, Wash., and Ishpeming, Mich., where good roads are the exception rather than the rule, the Franklin Motor Car Co. and E. R. Nelson got 34.2 and 27.9 miles, respectively.

In every case the car used was a stock six-cylinder machine and no special preparations were made for the demonstration. The tires were inflated to approximately 75 pounds and fuel testing between 60 and 65 degrees was used. The gallon measure was in each case certified by the local Bureau of Weights and Measures. Each car carried two observers in addition to the driver. Routes were chosen which would give as many different kinds of road conditions as possible. The average speed was approximately 18 miles per hour.

Departing slightly from last year's practice, many of the cars carried prominent technical authorities from such representative universities as Toronto, Rensselaer Polytechnic, Brown, Armour Institute, Stevens Institute, Sheffield Scientific School of Yale, Cornell, Pennsylvania, Syracuse, Massachusetts Institute of Technology, Cincinnati, Washington, Nebraska, Lehigh, and Pratt Institute of Brooklyn, N. Y.

Bradfield To Head King's New Department of Sales

DETROIT, MICH., May 4—H. C. Bradfield, of Indianapolis, is now associated with the King Motor Car Co., of this city, as head of a new department in sales. Bradfield has lately been associated with the Premier Motor Mfg. Co.

Form National Jitney Assn.

Delegates at Kansas City Advocate Business Methods —Insurance Plan

KANSAS CITY, MO., May 4—*Special Telegram*—A dozen jitney bus operators, representatives of associations in Missouri, Kansas, Iowa, Illinois, Oklahoma and Texas, started the first national jitney association here today, by naming temporary officers and going into committee session to perfect a permanent society.

Results of National 1-Gallon Test by 137 Franklin Dealers

City	Dealer	Roads	Weather	Record
Aberdeen, S. D.	G. M. Worthington	Rough	Windy	22.7
Akron, O.	A. Auble, Jr.	Good	Fair	51.8
Albany, N. Y.	C. G. Heck	Heavy	Rain	30.5
Amboy, Ill.	A. Aschenbrenner	Good	Cold	25.6
Athens, O.	C. H. Welch	Dry	Clear, Cold	31.8
Atlanta, Ga.	W. M. Hull	Rough	Clear	31.3
Auburn, N. Y.	G. H. Leonard	Muddy	Rain	31.4
Baltimore, Md.	W. F. Kneip	Good	Clear	38.0
Bar Harbor, Me.	F. L. Savage	Muddy	Rain	22.2
Billings, Mont.	Arthur Barth	Muddy	Rain	20.0
Binghamton, N. Y	S. H. Lewis	Muddy	Rain	27.0
Boston, Mass.	Otto Lawton	Fair	Bad	39.9
Brooklyn, N. Y.	G. B. Perkins	Fair	Rain	36.1
Buffalo, N. Y.	George Ostendorf	Fair	Gale	26.2
Canton, O.	G. W. Belden	Good	Windy	43.5
Carthage, Mo.	A. L. Caulkins	Muddy	Clear	36.0
Charlotte, N. C.	J. D. Woodside	Fair	Rain	36.2
Chattan'ga, Tenn.	J. H. Alday	Dry	Cloudy	30.3
Chicago, Ill.	F. H. Sanders	Good	Gale	30.7
Cincinnati, O.	Newman Samuel	Dry	Clear	35.7
Cleveland, O.	R. H. Eckenroth	Fair	Gale	24.4
Colo. Springs, Col.	G. W. Blake	Fair	Gale	30.7
Columbia, S. C.	Wm. Gibbes	Good	Warm	26.1
Columbus, O.	O. C. Bell	Dry	Cold	31.7
Concord, N. H.	W. F. Darrah	Wet	Cold	33.6
Cortland, N. Y.	J. A. Farrell	Wet	Rain	28.8
Dallas, Texas	W. G. Langley	Good	Fair	38.6
Danvers, Ill.	Frank Simpson	Fair	Clear	31.5
Dayton, O.	F. B. Heathman	Good	Gale	30.5
Decatur, Ill.	C. E. Dawson	Dry	Clear, Cold	32.9
Denver, Colo.	F. C. Cullen	Heavy	Windy	21.0
Des Moines, Ia.	S. P. Johnston	Good	Windy	34.2
Detroit, Mich.	W. J. Doughty	Fair	Cold, W'dy	42.3
Duluth, Minn.	J. T. Peacha, Jr.	Heavy	Rain	35.2
Eau Claire, Wis.	G. R. Wood	Fair	Cold, W'dy	26.7
Elizabeth, N. J.	F. V. Price, Jr.	Poor	Rain	40.8
Elmira, N. Y.	Fred M. Jones	Muddy	Cloudy	31.4
Erie, Pa.	John Griffith	Fair	Cold	31.5
Fall River, Mass.	Ernest Place	Fair	Cold, Fair	37.8
Falmouth, Mass.	F. W. Crocker	Heavy	Foggy	28.9
Fleetwood, Pa.	Wilson Sell	Fair	Rain	34.1
Fort Wayne, Ind.	L. Obenhaus	Good	Windy	31.9
Galesburg, Ill.	E. T. Byram	Dry	Fair, Cool	22.6
Geneva, N. Y.	W. W. McCarroll		Rain	34.5
Georgetown, Tex.	T. J. Caswell	Dry	Fair	23.0
Gr'd Forks, N. D.	J. W. Lyons	Heavy	Cold	24.3
G'd Rapids, Mich.	J. R. Jackson	Fair	Windy	28.1
Great Falls, Mont.	B. D. Whitten	Dry	Cold	37.6
Greensburg, Pa.	E. L. Turner	Dry	Fair	28.6
Greenville, S. C.	R. N. Tannahill	Dry	Fair	34.4
Hampton, Va.	J. V. Bickford	Fair	Gale	22.0
Hartford, Conn.	H. P. Seymour	Good	Showers	40.4
Helena, Mont.	W. L. Swendeman	Muddy	Cloudy	18.4
Holtville, Cal.	W. J. Seat	Sandy	Fair	24.1
Hoosick, N. Y.	John Moseley	Fair	Rain	36.4
Houston, Tex.	Rudolph B. White	Rough	Gale	22.5
Indianapolis, Ind.	Glenn Diddel	Good	Cool, Cl'dy	35.0
Ishpeming, Mich.	E. R. Nelson	Heavy	Rain	27.9
Ithaca, N. Y.	H. L. Cobb	Fair	Showers	30.4
Jacksonville, Fla.	W. F. Winchester	Dry	Warm	30.0
Kankakee, Ill.	F. A. Babel	Good	Clear, Cool	29.1
Kansas City, Mo.	E. F. Williams	Fair	Cool, W'dy	43.7
Kingston, N. Y.	W. M. Davis		Cloudy	32.3
LaCrosse, Wis.	Alfred James	Dry	Fair	29.0
Lake Park, Iowa	H. C. Meyer	Rough	Cloudy	27.6
Lexington, Ky.	V. K. Dodge	Dry	Fair	33.5
Lincoln, Neb.	Fred M. Ryan	Rough	Gale	24.6
Little Rock, Ark.	J. F. Jones	Dry	Clear	37.1
Los Angeles, Cal.	R. C. Hamlin	Good	Windy	35.1
Louisville, Ky.	G. M. Younger	Dry	Cloudy	36.8
Marion, Ind.	M. L. Swavary	Good	Cold	33.0
Meriden, Conn.	J. F. Miller	Dry	Clear	49.2
Milwaukee, Wis.	Wm. F. Sanger	Fair	Cold, W'dy	51.2
Minneapolis, Minn.	L. A. McKay	Good	Cold	47.8
Moline, Ill.	D. H. Duncan	Fair	Windy	23.1
Montreal, Can.	H. Grothe	Muddy	Rain, W'dy	24.6
Neenah, Wis.	J. F. Stroebel	Dry	Fair	26.3
N. Bedford, Mass.	S. C. Lowe	Good	Windy	33.0
Newark, N. J.	W. L. Mallon	Dry	Cool, Cl'dy	36.5
New Haven, Conn.	Cowles Tolman	Dry		55.0
New York City	Glenn A. Tisdale	Wet	Cold, Rain	35.2
Oil City, Pa.	H. S. Phinny	Sandy	Cold	18.3
Okla. City, Okla.	J. W. Lee	Good	Warm	36.3
Paris, Ky.	C. A. Weber	Fair	Clear	34.0
Pasadena, Cal.	W. P. White	Good	Cold	31.4
Paterson, N. J.	N[illegible]das Hughes	Good	Cloudy	34.9
Peoria, Ill.	S. K. Hatfield	Good	Clear	34.3
Philadelphia, Pa.	James Sweeten, Jr.	Wet	Cloudy	41.9
Phoenix, Ariz.	George Hageman	Wet	Gale	53.0
Pittsburg, Pa.	W. Murray Carr	Dry	Clear, W'dy	34.2
Plainview, Tex.	John J. Ellerd	Muddy	Clear	21.1
Portland, Me.	H. D. Cushman	Muddy	Rain	20.9
Portland, Ore.	J. C. Braly	Good	Cold	43.8
Providence, R. I.	W. L. Wilcox	Wet	Cloudy	43.8
Putnam, Conn.	O. C. Bosworth	Muddy	Cloudy	29.8
Redlands, Cal.	B. S. Hatfield	Muddy	Rain	26.0
Regina, Sas., Can.	A. O. Store	Good	Gale	33.9
Remington, Ind.	C. B. Johnston	Dry	Fair	25.5
Rochester, N. Y.	G. R. MacCollum	Good	Cold, W'dy	34.5
Rockford, Ill.	L. J. Theus	Fair	Cold	33.4
Rutland, Vt.	O. H. Coolidge	Muddy	Rain	26.6
Saginaw, Mich.	Fred H. Witters	Dry	Cold	25.1
San Antonio, Tex.	L. F. Birdsong	Dry	Windy	35.6
San Diego, Cal.	W. S. Smith	Muddy	Rain	29.8
San Francisco, Cal.	John F. McLain	Good	Gale	36.1
San Jose, Cal.	L. Normandin	Good	Windy	35.6
Saranac L'ke, N. Y.	E. E. Bellows	Wet	Cold	30.3
Scranton, Pa.	O. D. DeWitt	Rough	Cloudy	36.4
Seattle, Wash.	W. A. Wicks	Good	Cloudy	39.3
Sharon, Pa.	C. H. Wiltsie	Dry	Windy	24.4
Shreveport, La.	J. M. Nabors, Jr.	Dry	Clear, W'dy	22.2
Sioux City, Iowa	Thomas Murphy	Soft	Windy	23.5
Sioux Falls, S. D.	Knapp Brown	Good	Cold	41.0
S. Bethlehem, Pa.	L. L. Sterner	Fair	Showers	25.8
Springfield, Mass.	F. G. Jager	Heavy	Cold, W'dy	36.1
Springfield, Mo.	H. E. Seeley	Fair	Clear	26.9
St. Louis, Mo.	J. B. Dryer	Wet	Cold, W'dy	36.9
St. Paul, Minn.	A. H. Clark	Fair	Fair	31.8
Syracuse, N. Y.	C. W. Bull	Fair	Rain	41.7
Toledo, Iowa	Harvey Jones	Heavy	Cold	24.8
Toledo, O.	C. B. Snee	Good	Windy	31.7
Toronto, O., Can.	A. W. Wilson	Good	Cloudy	34.9
Trenton, N. J.	Walter Richards	Bad	Rain	25.8
Utica, N. Y.	W. W. Garabrant	Heavy	Rain	39.3
Vincennes, Ind.	D. D. Aldrich	Poor	Cold, Gale	35.7
Walla Walla, W'sh.	R. H. Tuttle	Muddy	Rain	34.2
Walton, N. Y.	J. R. Bryce	Muddy	Rain	18.8
Washington, D. C.	D. S. Hendrick	Good	Fair	33.8
Waterloo, Iowa	R. H. Cramer	Fair	Cloudy	39.7
Wellsville, N. Y.	Dak Duke	Fair	Cloudy	27.7
West Brooklyn, Ill.	J. W. Thier	Rough	Clear, Cool	35.1
Wheeling, W. Va.	J. J. O'Keefe	Good	Clear	26.2
Williamsport, Pa.	S. A. Courson	Bad	Rain	20.3
Wilkes-Barre, Pa.	W. S. Lee	Sticky	Showers	34.1
Wilmington, Del.	Peter Hanson	Fair	Cloudy	23.1
Worcester, Mass.	F. B. Williams	Muddy	Cold, W'dy	29.7
Youngstown, O.	Jacob Stuhldreher	Good	Clear	27.9

The visiting delegates of associations, some representing several, heard addresses of welcome from city officials and discussions of the need of a protective national body. Tomorrow morning there is to be a jitney ride around the boulevards and the convention will meet again in the afternoon to hear talks by Nelson S. Riley, southwest manager of the Studebaker Corp.; J. F. Martin, manager of the Buick branch, and John T. Smith, secretary of the Missouri State Federation of Labor.

Perry T. Allen, Springfield, Mo., was elected temporary chairman. Mr. Allen is attorney for the teamsters' and chauffeurs' union in that city; it includes the jitney drivers and owners. E. K. Carnes, of Kansas City, is temporary secretary.

The sentiment of the association, as announced by Mr. Carnes, is that the unscrupulous, irresponsible men now in the jitney business should be squelched and that the association should adopt for an emblem a design bearing the words "service, cleanness, courtesy, rapid transit."

Several speakers prophesied that there would be no street car rails in cities within 10 years, that all local, but not interurban transportation would be jitneyized.

L. M. Emlet, Kansas City, spoke as a representative of the Automobile and Auto Bus Owners' National Protective and Benevolent Assn., just organized in Muskogee, Okla. It proposes to indemnify members on a mutual basis at a cost of $60 a year for buses holding up to ten passengers, $72 for ten to sixteen passengers and $84 for sixteen to twenty-two passenger types.

Pilgrim Organizer Charged with Fraud

DETROIT, MICH., May 4—*Special Telegram*—Clarence H. Leete, one of the organizers of the Pilgrim Motor Car Co., was arrested here today charged with collecting between $5,000 and $15,000 from a large number of local people to whom he had promised employment in the plant which the concern claimed to be starting. Leete, it is said, had the applicants pay as much as $200 and offered to give stock in the company for the amount given by the applicant for a position.

The Pilgrim Company was started last September to build a car designed by W. H. Radford, who resigned, former engineer of the Warren Motor Car Co.

Puritan Takes Mondex Shock Preventers

DETROIT, MICH., May 4—The Puritan Machine Co., this city, has purchased the stock of Mondex shock preventers heretofore produced by the A. & J. Mfg. Co., Binghamton, N. Y. Dealers and owners will be supplied with parts by the Puritan company.

Review of the Week in Detroit

Truck Convention the Big Coming Event—Car Factories Breaking Records

DETROIT, MICH., May 4—The truck convention under the auspices of the National Automobile Chamber of Commerce will occupy the attention of a goodly number of Detroit's automobile fraternity this week, not only those who are directly connected with the commercial car end of the automobile business, but many others who see in the discussions and papers subjects of benefit whether they make or sell passenger cars or trucks.

The new Hotel Statler will be the scene of this year's session, and ample accommodations are thereby assured. Already some of the advance guard has arrived, and from present indications this should prove to be the best and most profitable gathering the truck branch of the business ever had. To date over thirty truck concerns have signified their intention of being amply represented.

The committee on arrangements has done its work well, for it has provided recreation as well as a great number of timely subjects for discussion. Most of them deal with the selling end of the business or on topics directly related to selling, the engineering details of truck work being left to the S. A. E., as they should be.

The subject of load ratings will be taken up at length, with H. Kerr Thomas of the Pierce-Arrow company starting the ball rolling. Then there is the much-mooted topic of a truck show, with the debate opened by M. L. Pulcher, of the Federal company. Windsor T. White will take up in detail the subject of time payments on trucks and its limitations.

Production Is Booming

Cadillac has given out a few figures on the production through April of its eight, and they are causing considerable comment. Up to the first of May, the concern had shipped 8,286 cars of the 1915 type, and of this number 2,325, or over a quarter, were turned out in April.

While on the subject of production, the trade has been put in possession of some interesting figures from several of the other plants as well.

The Saxon Motor Co. shipped over 1,800 cars in April, which is three times the output of April, 1914. For the first 4 months of this year, over 6,200 Saxons have left home for all parts of the country, and it is expected that about 3,000 more will go out during this month of May.

In April the King company shipped 576 eights and 180 fours. It was about the middle of January before King was able to make deliveries on its eight, and since then 1,352 of them have been shipped.

The Ford organization built 16,108 more cars in April this year than during the same month the previous year. The total for the month just passed was 46,510, the largest number ever produced in a month.

500,000 Fords in 1916

There is much speculation now as to what the price of the Fords will be for the 1916 fiscal year. Some have it that 500,000 will be turned out, making a price reduction corresponding to the cut of last year possible.

Some day, when Ford gets tired of building assembly plants, it will abandon making complete cars in the parent factory here, but will simply produce parts to be assembled in the territory in which they are sold. While this is merely speculation, it has been voiced several times as an opinion by business men.

Of great interest to the automobile public of Michigan is the bill which passed on April 29 and was signed by Governor Ferris. It is known as the garage lien law, and was fostered by the Detroit garagemen's association. In a word, it gives the garagemen protection for repair work, for they are accorded the right to hold any machine brought in for repairs until such have been paid for.

Clean Up 1915 Outputs

A number of the makers in this vicinity are now engaged in cleaning up their 1915 output preparatory to starting on 1916 models. Several will come out with announcements of new cars along the latter part of the month, and in the early part of June. It is probable that the débuts of new cars will generally be earlier this season than last, for with the usual policy of waiting until one year's output is practically sold before publicly talking of the next, there is no fixed date for anyone. It is believed that the public will see less radical departure from former design in the 1916 models, as now the makers are getting down to almost standard designs, and changes are less pronounced.

Convention visitors, visiting dealers, car demonstrators and all Detroit motorists are deprived of one of the beauty spots of the Automobile City, for the time being at least. Belle Isle, known as one of the country's finest parks, with its miles of beautiful automobile drives, is cut off from the mainland by a disastrous fire which completely destroyed the steel bridge. A temporary vehicle bridge is contemplated, pending the raising of sufficient money to build a new $1,000,000 stone affair.

Cadillac Ships 8,286 Eights

2,325 Cars Turned Out in April, Biggest Month in Company's History

DETROIT, MICH., May 3—Up to and including April 30, 1915, the Cadillac Motor Car Co. has shipped 8,286 of its eight-cylinder cars. The first cars were shipped in October, the production increasing rapidly from only a score a day to more than 125 a day at the present time. During April 2,325 cars were shipped, or an average of ninety a day. It was the biggest month of business in the 10 years the Cadillac company has been incorporated.

Smith Succeeds Thompson as Maxwell Works Manager

DETROIT, MICH., May 1—George W. Smith has succeeded A. Thompson as works manager of the Maxwell Motor Co. He was Mr. Thompson's assistant and previous to coming to the Maxwell company he was works supervisor at the J. I. Case T. M. Co., Racine, Wis.

Pneumatic Control Valveless Car Runs on Acetylene

ELKHART, IND., April 30—Orville Z. Frazier, who invented a valveless engine some time ago, has completed blueprints for a new car, called the Frazier-Elkhart. It is a seven-passenger machine with a six-cylinder valveless motor. Three types of motors are planned, one of 186, one of 90 and one of 60 horsepower. The new machine will have a number of features that are believed to be important improvements. The water in the engine is passed through the piston. It is equipped with an automatic lock clutch. The gears and brakes are controlled on the steering wheel by air. In the transmission all gears run at the same time and are equipped with an internal sliding shaft. The engine is started by depressing a crank at the dash, which starts the dynamo and generates a spark, thus doing away with all storage batteries, dry cells, electric starters and cranks. The fuel used for operating the car is acetylene gas.

Somerville Brings Out Starter

DETROIT, MICH., May 1—W. A. Somerville, former advertising manager of the Rapid Motor Vehicle Co., and the Stromberg Motor Devices Co. has again entered the automobile field with a starter to sell for less than any electric starter on the market. This starter to be known as the Rae is a double unit system with the motor and generator connected on the same shaft. Mr. Somerville has organized the Somerville Special Agency. The Morgan Electric Co. will manufacture the starter either in Detroit or in some of the Michigan and Indiana towns that are trying to secure the factory. A service station will be opened on Woodward avenue. The first starters will be for Ford cars but later it will be made for all makes.

Convertible Bodies Are Standard for 1916 Haynes Line

NEW YORK CITY, May 4—For 1916 the Haynes light six will be equipped with new five- and seven-passenger and roadster bodies, all of which will be convertible for summer or winter service; the winter tops will be supplied at an extra charge. Mechanically there will be no material changes, the 3 1-2 by 5-inch block motor, with Stewart-Warner vacuum fuel feed, dry disk clutch, 34 by 4 tires and other features of the 1915 car being retained.

Hub Builds 2 1-2-Ton Gasoline-Electric Truck

COLUMBUS, O., May 1—The Hub Motor Truck Co., this city, has completed the first model of its gasoline-electric truck and is now preparing to open a factory for their manufacture on an extensive scale. The office of the Hub company has been established in the Terminal building at Third and Rich streets.

L. H. Pierce and O. C. Howard have charge of the designing and manufacture of the truck, which is the first of its kind produced in Columbus.

Electricity generated by a gasoline motor furnishes power to drive the vehicle. The Hub company was incorporated under the laws of Ohio with a capital of $300,000 for the purpose of building and marketing the trucks.

The model completed is a 2 1-2-ton vehicle and is equipped with a 30-horsepower gasoline engine which is sufficient to generate all the electrical current necessary. Trial runs made with a full capacity load on hills and bad roads show the truck's ability as a saver of fuel, consuming only a gallon for every 15 miles traveled. The motors are built in the rear wheels making the connection without transmission, etc.

Hawkins Visits Seattle

SEATTLE, WASH., April 30—N. A. Hawkins, general sales manager of the Ford Motor Co., of Detroit, was a visitor in Seattle this week, inspecting the big assembling factory in this city, which supplies the trade in Washington, Idaho and western Montana. Hawkins was honored guest at the banquet given by the Seattle Chamber of Commerce.

King Ships 45 Eights a Day

Has Turned Out 1,352 Eights —576 Eights and 180 Fours in April

DETROIT, MICH., May 3—The King Motor Car Co. shipped 576 eight-cylinder cars and 180 fours during April. Shipments of the first King eights began about January 15, and since then 1,352 cars of this model have been shipped by the King company.

Production of eights is now at the rate of forty-five a day and this will be increased to seventy-five a day within the next 4 weeks. The total production of 7,000 is expected to be completed during the second half of July. An average of ten to fifteen King fours is now the daily output.

The foreign business of the company has been increasing very rapidly of late. To date 138 eight-cylinders have been shipped to London and an order for 200 more has been received from the same party. Twenty-four were shipped to Manila recently, also sixteen to Russia and lots of three or more to different countries in South America.

$250,000 Ford Plant in Milwaukee

Will Produce 18,000 to 20,000 Cars a Year—To Employ 400 to 500 Men

MILWAUKEE, WIS., May 1—The Ford Motor Co., Detroit, Mich., is about to expend $250,000 or more in the erection and equipment of an assembling plant in Milwaukee which will produce 18,000 to 20,000 complete cars annually and have a pay-roll of $600,000 a year, employing 400 to 500 men. This information, from authoritative sources, is further substantiated by action taken before the Milwaukee common council this week in the direction of special privilege ordinances making possible the construction of this building on a large tract of land adjacent to the Chicago & Northwestern road's main line along the lake shore, and bounded by Prospect avenue and Kenilworth and Windsor places.

According to A. W. L. Gilpin, manager of the Milwaukee Ford branch, it is contemplated to erect a seven-story reinforced concrete factory, 160 x 330 feet in size, costing about $250,000. It will supplant the rather small assembling plant established in Milwaukee about 2 years ago but long ago found wholly inadequate to take care even of the entire Wisconsin demand for Fords.

The plant will be one of 25 which the Ford company is establishing in populated centers throughout the country. By 1916 it is figured that the Wisconsin absorption of Fords will at least equal the annual production of the Milwaukee Ford assembling plant.

MILWAUKEE, WIS., May 3—Construction on the assembling plant of the Ford Motor Co. will be started at once, an ordinance granting the company special privilege to enable it to work doubly fast having been granted by the common council.

Turk Is Inter-State Designer and Production Manager

MUNCIE, IND., May 1—At a special meeting of the directors of the Inter-State Motor Co., owing to a heavy increase in production T. J. Turk, engineer, was appointed designing engineer and production manager for the coming year.

Anderson Succeeds Harris as Hupp Sales Manager

DETROIT, MICH., May 1—Lee Anderson, who some time ago became advertising manager of the Hupp Motor Car Co., has now also assumed the position of sales manager, succeeding Frederick A. Harris, who has resigned.

Ide in Charge of Simms Magneto Detroit Office

EAST ORANGE, N. J., May 3—Jack Ide, formerly sales representative of the New Departure Mfg. Co., has resigned and joined the selling force of the Simms Magneto Co., this city. Mr. Ide will have charge of the Detroit office which has been opened in the Whitney building.

Harry Stoddard, who has been representing the Simms Magneto Co. in Detroit, has been transferred to the home office here and is now in charge of the sales department.

Superior Motor Specialty to Move to New York

PHILADELPHIA, PA., May 3—To better care for its increasing business, the Superior Motor Specialty Co., maker of spark plugs for double ignition, will remove May 10 from its present location at 44 N. Fourth street, this city, to 30 Irving place, New York City.

Elwood Joins Marmon Sales Force

INDIANAPOLIS, IND., May 3—A. L. Elwood, former manager of the St. Louis, Mo., branch of the Locomobile company and more recently sales manager of the Chicago branch of the same concern, has joined the sales force of the Nordyke & Marmon Co. Mr. Elwood will do territorial work in connection with Marmon agents.

Stearns Production Gains 55%

Factory Is Running at Full Capacity Night and Day —Men Scarce

CLEVELAND, O., May 1—The F. B. Stearns Co. is enjoying a period of unequalled prosperity this season. The factory is running night and day with a full force, yet needs more men than it has been able to get. The company has been advertising in half a dozen cities for machinists. It is paying time and one-third on its night shift. Production in March was 55 per cent. greater than during March last year, in April 70 per cent. greater, and if all signs do not fail will go 100 per cent. over the corresponding period a year ago in May.

Woodruff To Go Abroad on War Contract Work

CONNERSVILLE, IND., May 3—In response to increasingly numerous inquiries from abroad, A. A. Woodruff, commercial manager of the Lexington-Howard Co., this city, expects to sail for Europe on May 8 on war contracts and export business. Mr. Woodruff expects to remain abroad not over 5 weeks as the company's factory is said to be operating at double capacity and to be turning out twice as many cars as at any time in its history.

Record Order for Davis Eights

Company to Supply 250 Motors for Railway Coaches for 5 Years

MILWAUKEE, WIS., May 1—The Davis Mfg. Co., a large manufacturer of gasoline motors for heavy duty vehicles of all kinds, has closed an order for practically the entire construction of an average of 125 gasoline-propelled passenger coaches for a period of 5 years for the Railway Engineering & Equipment Co., an organization which has recently embarked in the business of manufacturing self-propelled railway coaches for the use of steam and electric railways on short hauls, connecting lines, in cities and elsewhere to cut operation costs, facilitate traffic and economize on the use of expensive steam or electric equipment.

The Davis company has completed a model coach for the Indiana concern, and a party of officials arrived in Milwaukee last week in the car to close the contract and make local demonstrations. The party included General Manager A. R. Burkdoll, Chief Engineer W. D. Worth and other officers.

The contract has been in view for more than a year, and in anticipation thereof the Davis company selected a site and broke ground for a large new plant in West Allis, the manufacturing suburb of Milwaukee, about 10 months ago. The work was carried on slowly until early this week, when orders were issued to complete the plant immediately. It will be devoted largely to the new industry.

Each coach is propelled by two eight-cylinder gasoline engines through double friction drive applied to every wheel. The passenger capacity is 100 and the cost complete is $20,000. The cost of operation is approximately 5 cents per mile, placing the new coach in the jitney bus class, so far as operation cost is concerned. The first year's requirements will be about forty and the fifth year's 300. The coach work will probably be done in Milwaukee, so that the entire car will be a Milwaukee product.

The Davis company manufactures motors for several large pleasure car and truck builders of America, and exports a great many motors annually. The present plant in the Menomonee valley will not be abandoned when the new West Allis works are opened, being needed to supply a miscellaneous demand for Davis motors.

Holdaway Smooth-Tread, Non-Skid Tire Enters Field

LOS ANGELES, CAL., April 23—The Holdaway Tire Co., is the latest addition to the manufacturing ranks of Los Angeles. The new Los Angeles-made tire is claimed to be the only smooth-tread, non-skid tire on the market. The inventor conceived the idea of inserting small fabric plugs into the tire in such a manner as to keep the tread smooth and at the same time prevent the car from skidding. In the tests the Holdaway tire proved a success and the retail branch is now doing a prosperous business.

Mead Goes to Cheltenham Advertising Agency

NEWARK, N. J., May 3—C. L. Mead for several years advertising manager of the Lovell-McConnell Mfg. Co., this city, has resigned to join the forces of the Cheltenham Advertising Agency, New York City. Mr. Mead's successor has not yet been appointed.

Schwalbach Leaves Bearings Co. of America June 1

NEW YORK CITY, May 3—Alex Schwalbach leaves the Bearings Co. of America on June 1. For 6 years he has been advertising and publicity man for the F. & S. bearings imported by the former, J. S. Bretz Co., and its successor, the Bearings Co. of America.

Business Methods Adopted by Detroit S. A. E.—Dunham Chairman

Section Is Placed on Sound Financial Basis—Paid Secretary in Charge—Paper by A. P. Brush on Scientific Chassis—Birdsall Honored—Record Attendance

DETROIT, April 29—The Detroit section of the Society of Automobile Engineers is at last being placed on a sound financial basis with a paid assistant secretary to be in charge, a condition made necessary because of the rapid growth of the section, which naturally should be the largest in the country. The financing of this move is being taken care of by voluntary subscriptions from Detroit manufacturers and other concerns with branches in this city. Already $600 has been pledged and approximately $2,500 will be needed.

This new plan of conducting the section was made public to-night at the regular monthly meeting, at which over fifty attended, the largest meeting of the year. The attendance was largely due to the presenting of a very illuminating paper by A. P. Brush, consulting engineer, on scientific chassis engineering, and also due to the fact that it was the annual election of the section.

The officers, all of whom were unanimously elected, are: George W. Dunham, chairman; J. G. Vincent, vice-chairman; Fred J. Fisher, treasurer; W. H. Conant, secretary; George M. Holley, executive member, and K. W. Zimmerschied, member of the national nominating committee.

During the 4 years of the existence of the Detroit section, E. T. Birdsall has presided. He has been the first and only chairman, and on this, the occasion of his retirement, he was presented with a silver cigarette case, suitably inscribed.

A complete report of Mr. Brush's paper appears on pages 802-805 of this issue.

Metropolitan S. A. E. to Discuss Governing at May Meeting

NEW YORK CITY, May 4—At the regular May meeting of the Metropolitan Section of the Society of Automobile Engineers the evening will be given over to the subject of speed governing. There will be two papers, one by Theodore Douglas, president of the Duplex Engine Governing Co., entitled Governing Truck Speed and the other on Governing the Speed of Internal Combustion Engines, by Frank Trego, chief engineer of the Knox company. The governing committee is also making an endeavor to secure a preliminary report of the work of the Research Committee on governors. The meeting will be held at the Automobile Club of America in this city from 8.30 to 10.30 p. m. A number of firms building trucks with governors have been asked to send representatives.

Keegan Is Briggs & Stratton Sales Manager

CHICAGO, ILL., May 3—J. F. Keegan, for several years secretary of the Fulton-McCutchan Co., this city, has resigned to become a sales manager of the Briggs & Stratton Co., Milwaukee, Wis. Mr. Keegan assumed his new duties May 1.

New Era Engineering Co. Incorporated to Manufacture Automobiles

JOLIET, ILL., April 30—The New Era Engineering Co. has incorporated with a capital of $30,000, the incorporating commissioners being M. M. Case, A. S. Golding and Oscar Blaess.

Manufacture, assembly and sale of automobiles, motors and all the parts and accessories of the same, is the object of the concern.

Detroit Violators Warned by Tag

Police Notify Culprits of Traffic Ordinance Violated as Indicated on Card

DETROIT, MICH., April 29—In its effort to further improve traffic conditions, the Detroit police department has issued red tags to be carried by those patrolmen whose duty it is to specially look after the observation of the traffic ordinance by automobilists.

The tag bears the following heading: "You are violating the traffic ordinance as indicated by the check-mark below. This notifies you to have the same corrected within 48 hours or complaint will be made in court." Then follows a list of twenty-nine violations which are the ones, according to the police department, which occur most frequently.

In front of each of the enumerated violations there is a blank space and when the patrolman finds a car which is violating the rules he checks or makes a mark opposite the violation enumerated in the list. Then the tag is attached to the offender's car and the patrolman records in his note-book the license number of the car and the nature of the violation. A few days later he or some other traffic man investigates the cases they have noted in their note-books or reports and in case the recorded violation has not been corrected then the matter is reported to the court for further action.

In addition to the tags the police department has also issued a summarized pocket book edition of the new local street traffic ordinance which became a law March 1, 1915. The same summarized rules have also been printed on a large card or tag to be hung in garages, show rooms and offices. Following is a reproduction of the policemen's red tag:

DETROIT POLICE DEPARTMENT.

YOU ARE VIOLATING the traffic ordinance as indicated by the check-mark below. This notifies you to have the same corrected within 48 hours or complaint will be made in court.

.....No tail light.
.....White light does not shine on rear license tag.
.....Tail light out.
.....Tail light dirty.
.....Tail light lens broken.
.....Tail light defective.
.....Headlights glaring.
.....No license tag (front or rear)
.....License tag mutilated or defaced
.....License tag obscured or dirty.
.....License tag swings.
.....No side lights.
.....Side lights out.
.....Side lights dirty.
.....Side light lens broken.
.....Side light defective.
.....Side light obscured.
.....No horn or other device for signal.
.....Device for signal inadequate.
.....Muffler cut-out control in wrong place. (Ord. 170-A., Sec. 6.)
.....Not properly parked, should be parallel
.....Not properly parked, should be at an angle.
.....Parked in safety zone.
.....Parked within 75 feet of intersection where street car stops
.....Parked on cross walk.
.....Parked within less than 15 feet of fire hydrant
.....Parked over 1 hour limit.
.....Motor running when left unattended
.....Controller switch not locked and key not withdrawn.

Apply at any police station for summary of traffic ordinance.

DETROIT POLICE DEPARTMENT.

Boston to Have Truck Show Next March

BOSTON, MASS., May 4—The annual meeting of the Boston Commercial Vehicle Dealers' Assn. was held today, and it was voted to cooperate again with the Boston Automobile Dealers' Assn., and to have a show in March, by taking a section of Mechanic's building at the same time as the passenger car show. The election of officers resulted as follows: Josiah S. Hathaway, White, president; James W. Maguire, Pierce-Arrow, vice-president; Day Baker, General Vehicle Co., treasurer; Chester I. Campbell, secretary. The above officers together with the following comprise the board of directors: P. S. Altman, Kelley-Springfield; C. P. Rockwell, Jeffery; Norman Halliday, International Motors; John L. McCone, Overland, and John H. MacAlman, Stearns. With the exception of Mr. McCone, all were re-elections.

May Raise Pa. Fees 50 Per Cent.

Success for Federation's Fight —Fees Too High Already —Bill May Not Pass

Harrisburg, Pa., May —The effort of Governor Brumbaugh and the administration forces to double the automobile license fees in Pennsylvania has been met with a storm of protest from motorists throughout the state and the Pennsylvania Motor Federation has carried on a splendid fight that promises to end in success.

At a hearing the motorists showed that in some cases the increased license fees would amount to a 5 per cent. tax, and they also pointed out that the motor clubs affiliated with the Motor Federation had during the past few years spent hundreds of thousands of dollars on road repair and that the federation bore the greater part of the expense in the effort to pass the $50,000,000 loan for road improvements a year ago.

The committee offered a compromise of a 50 per cent. raise on passenger vehicles and to leave the fees doubled on commercial vehicles. The campaign of publicity conducted by the federation has shown that 80 per cent. of the truck traffic is confined to corporate limits and that the great proportion of the trucks do not reach the state roads.

The bill came out of committee with a general raise of 50 per cent. in all classes of fees and the exemption from license fees of motor vehicles owned or operated by charitable institutions.

The following table shows the present and proposed fees:

PNEUMATIC TIRE CARS AND TRUCKS

Horsepower	Proposed	Present
Under 20	$7.50	$5
From 20 to 35	15.00	10
35 to 50	22.50	15
Over 50	30.00	20

FOR SOLID TIRE MOTOR VEHICLES

Pounds	Proposed	Present
Under 4,000	$7.50	$5
4,000 to 5,000	15.00	10
5,000 to 10,000	22.50	15
10,000 to 15,000	30.00	20
15,000 to 24,000	37.50	25

Leading members of the House of Representatives now admit that the bill has little chance to pass in its present form, and unless a compromise satisfactory to the automobile associations is made the fees will remain as at present.

The federation made every effort to put through a light bill that would have required all vehicles to carry lights to show from front and rear, but the country members objected to having lights on farm wagons, and the bills were defeated.

The Stern bill requiring automobiles to be equipped with fenders was defeated in the house this week. The bill received only 16 votes, 108 being cast against it. The Jones jitney "regulator" was also stricken from the house calendar. The measure would have made it necessary for owners of jitney buses to file a $2,500 bond with the state and pay 2½ per cent. of the gross receipts to the municipality in which the cars were operated. The measure was the most drastic of the several jitney bills introduced in the legislature.

A bill creating a department of motor vehicles with a commissioner at a salary of $4,000 a year has been introduced in the senate by Senator Beidleman, of Dauphin county. The bill is designed to take from the highway department the administration of all laws relating to motor vehicles and giving the new department control of all such laws. The bill creates a chief inspector and assistant inspectors not to exceed 10 and not more than 30 examiners to examine applicants for automobile licenses.

Connecticut Boosts Truck Fees

5-Ton Truck to Cost $75—Cheapest Is $11—Lights on All Vehicles

Hartford, Conn., May 3—Connecticut's amended automobile bill having passed the Senate this week is now before Governor Holcomb for his signature, which is expected the first of the week. The bill provides for about the same law as has heretofore existed, with the possible exception of truck fees. These have been considerably increased. Under the new law a 5-ton truck will cost $75, the lowest truck license costing $11. Another feature is the doing away with livery licenses which have been much in demand heretofore because of the low fee. Hereafter livery cars will carry individual numbers the same as private cars. This hits at the individual who in no sense was entitled to a livery license but had one because he could get it cheap. However, the real sting comes on the legitimate livery man and where a number of cars are used the fee will come rather high. No more operator's numbers are to appear above the dealers' license plates. Another feature that has made a favorable impression is that an officer desiring to make an arrest must display his badge of office on the outside of his outer garment.

Dazzling headlight ordinances now in force in the several cities and towns of the state may become inoperative. All vehicles must carry lights, in cities as well as in towns. This feature is especially agreeable to automobilists.

Can Stay 10 Days in R. I.

New Regulation Fair to Non-Residents—Fail to Boost License Fees

Providence, R. I., May 1—The Rhode Island legislators have evacuated the capitol and gone to their homes with the 1915 session at an end. And they have not left much of a mark in the way of motor legislation after them. Not that they did not intend to do something, but things went from bad to worse with them this year. There was a bill introduced again to increase the fees very materially. But it rested in committee until it was too late to have a public hearing on it. Not to have the hearing would have been illegal. And the motor organizations were primed to fight it, so the bill died.

The most important change relates to non-residents, and Rhode Island, the first state to put in the notoriously unfair 10 days' clause, has seen the error of her ways and now has a favorable clause. This is due to the holding up of Rhode Islanders by Massachusetts officers in retaliation against Rhode Island officials. The new clause provides that any motorist from another state may go there as often as he wishes provided he does not stay more than 10 consecutive days at a time. He may go 9 and return for 9 more. It also provides that if a resident of another state engages in business in Rhode Island he must register.

The legislature increased the appropriation for the automobile department to $12,500, and it passed a jitney bill calling for $500 per passenger ef the vehicle's capacity, with cities and towns making regulations for licenses, speed, stops, etc.

The big problem of highways was left untouched, due to politics and failure to reach a compromise, so that the roads of the state will be left in very poor condition.

Michigan Garage Lien Bill Is Now a Law

Detroit, Mich., May 4—The Michigan garage lien bill which is fostered by the Detroit Garage and Station Operators Assn. has unanimously passed both houses of the Michigan legislature April 29 and was signed by the governor. It becomes effective in 90 days. It provides the garage man with a very effective weapon in that he automatically obtains a lien on any vehicle on which work is done, until charges for the work are paid. Heretofore, garagemen have had to look to the individuals for payment rather than having the car as security.

To Auction Part of New Columbus Buggy Company May 12 and 13

Manufacture of Vehicles Will Be Discontinued and Even Trade Names Will Be Sold—To Continue Supplying Parts to Owners of Company's Cars

COLUMBUS, O., May 3—Announcement is made by C. A. Finnegan, president, and Eugene D. Hofeller, secretary, of the New Columbus Buggy Co., that a large portion of the business, including equipment, raw materials, and finished products will be disposed of at public auction at the plant on Dublin avenue, May 12 and 13.

The property to be sold has an estimated valuation of $300,000. There are said to be several prospective tenants for the buildings under the new plan.

The company will continue to make and market parts and accessories for the automobiles which were manufactured by the company, which includes the Columbus electric and the Firestone-Columbus gasoline cars. There are between 7,000 and 8,000 of the cars made by the company in use and it is planned to continue to supply parts to these owners. This part of the business, together with materials on hand, is estimated at $100,000. The machine shop where the parts are made will be retained by the company.

Neither automobiles nor horse-drawn vehicles will be manufactured in the future. At the auction the thirty-five electrics, fifteen gasoline cars and a number of second-hand cars will be sold to the highest bidders. Parts for the manufacture of 500 buggies will also be sold. The company will also dispose of all lumber on hand and all equipment for the manufacture of automobiles. This includes fifty separate motors. The estimated value of the machinery is $75,000. The sale will also include the right to use the names, Columbus electric and Firestone-Columbus.

The buildings, outside of the machine shop, will be converted into power buildings with 250,000 square feet of floorspace. One of the smaller buildings has already been leased.

Messrs. Finnegan and Hofeller, who are also owners of the companies making the Thomas and the Buffalo Electric at Buffalo, have converted the Thomas plant into power buildings with considerable success. They say that later on the Buffalo factories may be moved to the Columbus plant.

L. M. Browne, who has been with the Columbus Buggy Company for a number of years, will remain as superintendent of the buildings and in charge of the parts manufacture. The plant will be open for inspection after May 5.

Gasoline 14 Cents in Denver

DENVER, COLO., April 28—Fourteen cents a gallon is the gasoline price now being made by all the filling stations in Denver. The garages, however, are still charging 1 to 3 cents higher than this price as a rule, on the ground that they regard the gasoline trade largely as a side line and cannot afford to bother with it for small profit. This is the first time since January, 1912, that the retail price of gasoline in Denver has been as low as 14 cents.

Texas Refiners Boost Gasoline Price

AUSTIN, TEX., April 30—Notwithstanding the increase of production of high-grade crude petroleum, due to the development of the new Thrall field, 35 miles north of here, the refining companies of Texas have begun boosting the price of gasoline. For many months the ruling price of the fuel has been 10 cents per gallon in all parts of this state. A few days ago the Magnolia Petroleum Co. increased the price to 12 cents, and other companies followed suit. It is hinted that the price may go several cents higher in the near future. In explanation of the 2-cent raise per gallon E. P. Angus, of Dallas, representing the Magnolia Petroleum Co., said:

"Gasoline has been sold in Texas during the last 8 or 10 months at an unreasonably low price, 10 cents a gallon. The advance made is only 1 cent to garages and dealers, who take the bulk of gasoline sold, and 2 cents to consumers.

"Even in Oklahoma, the state where more oil is produced than in any other one state, the ruling price during the same period was 12 cents to garages and dealers and 14 cents to consumers, with a variation of perhaps 1 cent less or 1 cent to 2 cents more, dependent upon competitive conditions of extra freight costs.

"During the same period the price of gasoline in bulk on shipboard at Texas ports has been from 6½ to 8 cents a gallon. To any bulk price at seaboard must be added at least 4 cents a gallon as a marketing expense, 1 6-10 cents a gallon as freight cost, and a reasonable amount as profit to the marketing department. It will be seen by an analysis of these figures that the price of gasoline in Texas has been unreasonably low, and, therefore, when the price was advanced by our competitors we met it."

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Antimony	.27½	.28	.29	.29	.30	.32	+.04½
Beams & Channels, 100 lbs.	1.31	1.31	1.31	1.31	1.31	1.31	......
Bessemer Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Copper, Elec., lb.	.18½	.18½	.18⅝	.18⅝	.18⅝	.18⅝	+.00⅛
Copper, Lake, lb.	.19	.19	.19	.19	.19	.19	......
Cottonseed Oil, bbl.	6.58	6.56	6.52	6.66	6.62	6.61	+.03
Cyanide Potash, lb.	.21	.21	.21	.21	.21	.23	+.02
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	4.20	4.15	4.15	4.15	4.15	4.15	—.05
Linseed Oil	.64	.64	.64	.64	.64	.65	+.01
Open-Hearth Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, refined	..	..	.82	.82	.82	.82	......
Rubber, Fine Up-River, Para	.60	.60	.60	.60	.60	.60	......
Silk, raw, Ital.	3.90	..	3.90	..	..	3.90	......
Silk, raw, Japan	3.50	..	3.50	..	..	3.52½	+.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	42.00	40.00	39.50	39.50	39.00	41.00	—1.00
Tire Scrap	.04¼	.04¼	.04¼	.04¼	.04¼	.04¼	......

Market Prices Steadier

NEW YORK CITY, May 3—Market prices this week were steadier. The drop of lead to $4.15; the closing of tin at $41, and the rise of antimony to 32 cents, were the most important changes during the week. Electrolytic copper continued quiet and less firm in the domestic market. Temporarily, the demand from domestic consumers is light and there are few export inquiries for unwrought copper. During April the total copper exports were 16,822 tons, making the total exports since the first of January this year, 88,746 tons. There was no change of consequence in the crude rubber market last week. Reports in regard to the condition of trade in various rubber goods continue favorable. Manufacturers, however, continue to purchase sparingly.

Goodyear Capital May Be Increased $10,000,000

AKRON, O., May 3—The Goodyear Tire & Rubber Co., it is expected, will make a large increase in authorized capital stock. This is now $7,000,000 preferred and $8,000,000 common, all issued, and current report has it that the authorized common will so be increased as to make the total of both kinds $25,000,000.

The company will hold a stockholder's meeting June 1 to arrange for taking more young partners into the company. For several years the company has selected from among its most progressive employees in various departments these young men whom it permits to purchase stock on an easy payment plan. The custom has been to sell the stock on a 5-year basis, letting dividends, etc., accumulate on the stock and taking payments from the partners until the end of the period at which a settlement is made and the stock turned over to the purchaser. Owing to the fact that the company has no stock to distribute among this year's young partners it is necessary to vote an increase in the common stock, which matter will be taken up June 1.

Boston Dealers Accept Used Car Central Market Report

BOSTON, MASS., May 1—The Boston automobile dealers, at least those who are members of the dealers' association, have accepted the Used Car Market Report. The payment will be made from the funds in the treasury, and the service will be furnished free to all the members. In other words there is not a unanimity of opinion regarding the value of the service as some of the members have a feeling that others may not state the true facts in every transaction as to what the actual value each sale represented to the firm.

Tire Stocks Feature of Market

Studebaker Leads Activity in Car Securities—Many Fluctuations on Rumors

NEW YORK CITY, May 1—Tire issues were the most prominent in this week's securities quotations. The automobile shares were in fair demand, however, with Studebaker, on the expectation of a 5 per cent. dividend on the common stock, a leader both in activity and strength. Goodyear common showed the largest gain of the week, that of 23 points. It is stated that the Goodyear stockholders will probably be asked to authorize a capital increase to $25,000,000. It is also stated that no increase in the preferred is contemplated. The new common stock will be held in the treasury and used for the future needs of the company. It was stated also that the company has already made provisions for the retirement of $350,000 of the preferred, thus anticipating the 1915 requirements in that respect. There was a quiet accumulation of Goodrich stock, and the basis of it was the expectation that the earnings for the first half of the year would be high.

Bauer Returns from West

DETROIT, MICH., May 1—Howard A. Bauer, formerly assistant sales manager of the Oakland Motor Car Co. and now assistant sales manager of Apperson Bros. Automobile Co., Kokomo, Ind., has returned from an extensive tour through the west with an itinerary that included Salt Lake, Denver, Omaha, Davenport, Des Moines, Minneapolis, St. Paul and Kansas City. Mr. Bauer found the situation had improved greatly at all of these places and he was able to verify statements that the season was above normal.

Kelly-Springfield to Share Profits Over $1,000,000

NEW YORK CITY, May 3—At the annual meeting of the Kelly-Springfield Tire Co., today, the directors were reelected. They are: Van A. Cartmell, F. A. Seaman, Austin Poole, Stephen Peabody, Gustave Maas, A. J. Scheuer, and J. Oppenheim.

A resolution was passed authorizing the setting aside of a fund for distribution among the officers and employees in a profit-sharing plan, providing that 10 per cent. of the net profits above $1,000,000 be used in the fund.

Argo, Hollier Eight and Detroit Electric in England

DETROIT, MICH., May 6—Guy Lewin, the British dealer who was in this country a couple of months ago, has been again in Detroit seeking to place orders for a number of trucks for the French government. While negotiations for these contracts were in progress he filled in his time by taking up the Hollier eight, the Argo and the Anderson electric, as new British agencies.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	245	..	285	..	..
Ajax-Grieb Rubber Co. pfd	98	102	100	..	..
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	80½	82½	80	87	..
Chalmers Motor Co. com	80	82	90	95	—3
Chalmers Motor Co. pfd	90	92	95	97	+3
Electric Storage Battery Co	52	52½	52	54	..
Firestone Tire & Rubber Co. com	283	288	465	..	+10
Firestone Tire & Rubber Co. pfd	108	109½	110	112½	..
General Motors Co. com	77½	78½	143	145	—2
General Motors Co. pfd	91	92	101	100	+ ½
B. F. Goodrich Co. com	26	27	50	52	+2
B. F. Goodrich Co. pfd	88	89½	102	102½	+1
Goodyear Tire & Rubber Co. com	168	172	262	..	+23
Goodyear Tire & Rubber Co. pfd	94	95½	104½	105	+ ½
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	13½	14½	—2½
International Motor Co. pfd	..	15	29	32	—2½
Kelly-Springfield Tire Co. com	..	..	135	137	+5
Kelly-Springfield Tire Co. 1st pfd	..	..	83	86	—1
Kelly-Springfield Tire Co. 2d pfd	..	..	130	140	..
Maxwell Motor Co. com	8	8½	52	53	+3
Maxwell Motor Co. 1st pfd	35½	36½	84	86	+2½
Maxwell Motor Co. 2nd pfd	12¼	12¾	40	42	+2
Miller Rubber Co. com	..	..	180	189	..
Miller Rubber Co. pfd	..	..	104	106	..
New Departure Mfg. Co. com	123	124	137	138	..
New Departure Mfg. Co. pfd	105½	107	106	110	..
Packard Motor Car Co. com	103	..	105	115	+4
Packard Motor Car Co. pfd	94	98	99	..	+2
Peerless Motor Car Co. com	18	25	20	22	..
Peerless Motor Car Co. pfd	..	70	..	55	..
Portage Rubber Co. com	..	30	35	38	..
Portage Rubber Co. pfd	..	85	85	88	..
*Reo Motor Truck Co	8¾	9¼	14½	15½	— ¼
*Reo Motor Car Co	20¾	21¼	32	33	— ¾
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	47	50	69½	71½	+2½
Stewart-Warner Speed. Corp. pfd	99	100	103	105	+1
Studebaker Corporation com	32½	33	76	78	+10
Studebaker Corporation pfd	83	86	101	103	+1
Swinehart Tire & Rubber Co	62	66	81	90	+1
Texas Company	143½	145	137	139	..
U. S. Rubber Co. com	55	56	70	71	+1
U. S. Rubber Co. pfd	100½	101	108	109	+1½
Vacuum Oil Company	228	231	216	218	+7
White Company pfd	97	100	103	108	..
Willys-Overland Co. com	60	62	116	118	—2
Willys-Overland Co. pfd	88	90	100	102	— ½

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Chalmers Motor Co. com	80	82	93	94½	+ ½
Chalmers Motor Co. pfd	90½	93	95	97	—1
Continental Motor Co. com	156	.	.	185	—2½
Continental Motor Co. pfd	..	80	82	85½	..
General Motors Co. com	79	81	143	144½	—1½
General Motors Co. pfd	91½	93	100	102	..
Maxwell Motor Co. com	8¾	9½	52½	54½	+5½
Maxwell Motor Co. 1st pfd	39	40½	84	86	—3
Maxwell Motor Co. 2nd pfd	14½	15½	40½	42½	+3½
Packard Motor Car Co. com	103	.	..	..	..
Packard Motor Car Co. pfd	94	98	95	..	—4
*Reo Motor Car Co	22	22¾	..	32¾	— ¼
*Reo Motor Truck Co	8¾	9½	14¾	15½	+ ¼
Studebaker Corp. com	..	..	77½	79½	+11½
Studebaker Corp. pfd	..	..	101	103	+2

INACTIVE STOCKS

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
*Atlas Drop Forge Co	..	21	..	26	..
Ford Motor Co. of Canada	..	560	700	..	+100
Kelsey Wheel Co	..	195	195	..	..
*W. K. Prudden Co	..	21	19¼	19½	—1½
Regal Motor Car Co. pfd	..	35	14	20	+2

BONDS

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
General Motors, notes 6s, 1915	101	102	..	..	..
Packard Motor Co. 5s, 1916	95	98½	98¼	..	..

---

*Par value $10; all others $100 par value.

Work Started on Twin-City Speedway

2-Mile Track to Be Completed September 1—Designed for Speed of 110 M. P. H.

MINNEAPOLIS, MINN., May 1—Work is well under way on the new Twin-City speedway. Engineers have staked out the tract and the track and today contractors are estimating bids for the grading. Work is to begin at once and it is expected to complete the job by September 1. The track will cost $750,000. It is to lie at an angle from the north and south line to conform to topography in such a way that a hill protects the drivers' faces from the sun in the late afternoon.

Plans under way will call for a 2-mile oval concrete track. It is to be practically level at the inside and so banked on the turns of the oval that a speed of 110 miles there will be possible. The gradient at the turns is not yet determined. The track will be properly tiled and sewered so that racing can begin almost as soon as a rain ends. The width is 80 feet and the safety zone will be 40 feet. A 9-foot board fence painted white will surround the grounds. Every eighth mile a post will be placed as a marker.

The site is 360 acres of land just south of the city limits of Minneapolis and adjoining the Fort Snelling government reserve.

The Twin City Motor Speedway Co. of Minnesota has been incorporated at $1,000,000. It has been financed and no stock is for sale. F. H. Wheeler, of Indianapolis, is understood to have taken one-third the stock, and St. Paul men who are on the official list the bulk of the remainder. Dr. Dutton has some stock.

Officers are as follows: President, F. H. Wheeler; vice-president, H. E. L. Habighorst of St. Paul; treasurer, C. W. Van Orsdol of St. Paul; secretary and manager, Dr. C. E. Dutton; additional directors, J. F. Sperry, of St. Paul; Orin O. Kellogg, of Minneapolis, and D. F. Wheeler, of Indianapolis.

Chevrolet Stars in 5-Mile Events at Newark Race Meet

NEWARK, N. J., May 3—Automobile racing was revived in Newark yesterday at Olympic Park, when the Matty Matthews Auto Racing Assn., Inc., under the sanction of the A. A. A. staged a series of 5-mile events on the 1-2-mile dirt track.

Though no records were broken, the times made were fair, considering the condition of the track. In the time trials, 1-mile, free-for-all, G. C. Jessop, New York City, in a Chevrolet, negotiated the distance in 1 minute 13 1-5 seconds, with Joe Dickinson, in a Dickinson Special, second, his time being 1 minute 18 seconds.

Jessop's Chevrolet also won the 5-mile, Class E, non-stock event for cars under 300 inches piston displacement with Grover Bergdoll in an Erwin 40, second. Jessop's time was 6 minutes 28 2-5 seconds.

Willie Haupt in an Erwin Special, won the 5-mile handicap, free-for-all, Class E, non-stock event, in 6 minutes and 37 1-5 seconds. Bergdoll's Erwin came in second with Watson's Mercer third.

The attendance was about 2,500. The next race meet will be held on Decoration Day afternoon.

Galesburg Race Meet Plans Complete—$3,000 in Prizes

GALESBURG, ILL., May 3—The Galesburg District Fair Assn. has fully completed arrangements for its automobile race meet on June 9. A 100-mile race will be held instead of the 200-mile event. J. G. DeLong, of Chicago, will direct the contest. F. J. Wagner will be the starter.

The purse will be $3,000, divided as follows: first, $1,200; second, $800; third, $500; fourth, $300; and fifth, $200.

Marmon Starts 75 Times on High

Model 41 Makes 12.17 M. P. G. in Dense Traffic and 16.07 on Clear Road

NEW YORK CITY, May 3—A certified high-gear-in-traffic and economy test has been made by The Automobile Club of America by model 6-41, Marmon car. F. G. Carie, secretary of the Marmon New York Co., Inc., for which concern the test was made, and a sworn statement filed with the Automobile Club of America states that the car was a stock model in all particulars.

Two runs were made to determine the maximum mileage of the car with 1 gallon of gasoline. The first of these was through a route in the city selected for the heaviness of traffic and included the most densely crowded thoroughfares. The second was on an uninterrupted level course over the Coney Island boulevard. In both these tests the car was not taken out of high gear at any time and in fact during the traffic test was sealed in high gear although approximately seventy-five starts and stops were made. At the end of the traffic test the odometer showed 12.8 miles which, after correction, gave a reading of 12.17 miles and at the end of the second test on the clear road, the distance covered after the odometer had been calibrated was 16.07 miles.

Before starting the traffic test the gear lever was sealed on high and the seal was not broken until this test was completed. The car was therefore always started on high gear and in the language of the observer, Ferdinand Jehle, the clutch was not slipped in the ordinary understanding of the term. The speed was maintained at 18 miles per hour as near as possible, although traffic often interfered.

After the completion of the traffic test, the Coney Island run was immediately made with the results above stated. A test of the starting system was made by stopping the motor, letting the clutch in with the gear lever in high. The car was then started with the cranking motor.

Tacoma Speedway Nears Completion

TACOMA, WASH., April 27—Tacoma's new planked speedway is now half completed. For the entire length the track will be 50 feet wide. This is twice the width it was in some parts last year. The great curves look like the sides of a bowl, their elevation reaching 18 feet.

Plank tracks throughout the country are in abundance, but never before has the Tacoma plan, in which the 2 by 4 boards are laid a half-inch apart, on their sides been tried. Gravel is being shoved into the interstices, and the asphaltum oil is expected to take hold of this and make the track so fast that all world records for speed will be broken. Douglas fir has been used exclusively on the track. About 2,000,000 board feet will go into the course.

In addition to the work being done on the Speedway proper there has been made a complete re-arrangement of the parking spaces. The wood track will prevent a large amount of dust which troubled last year, and oats have been planted in the field adjoining the track where pleasure machines raised great clouds of dirt before. Two large bridges have been constructed crossing the track, making four entrances for automobiles to the inside field. Only one row for parked automobiles is provided by the new plans. This is within 25 feet of the track and behind the pits. There will be space for 108 automobiles.

Cooper Heads Maxwell Retail Sales

DETROIT, MICH., May 4—L. K. Cooper, who was in charge of sales for the Walter Githens Co., Maxwell distributor in Chicago, has been appointed manager of national retail sales of the Maxwell Motor Co., with headquarters at the offices in Detroit. Mr. Cooper has been identified with the Maxwell interests for years.

Mutual Liability Jitney Insurance Company Is Formed in Milwaukee

Will take All Automobile Risks—Aims to Furnish Insurance at Cost—Jitney Operators Organize and Affiliate—Other News in the Jitney Field

MILWAUKEE, WIS., May 3—The organization of a mutual liability insurance company for jitney bus owners and the introduction of a broad ordinance regulating jitney bus traffic in the common council are the latest developments in the jitney bus industry at Milwaukee.

The name of the new insurance company is the Automobile Mutual Limited Liability Co. The articles of incorporation have been filed and approved by the commissioner of insurance. Officers were elected May 1 as follows: President, Albert L. Becker; vice-president, Robert Kiefer; secretary, George L. Kohn; treasurer, George F. Harris; directors are R. C. Anderson and C. V. Kersey. Offices have been established at 617 Caswell block, Milwaukee. The new company has already offered a prize of $25 to the person offering the best suggestion for an emblem encouraging the safety first idea for drivers, to be placed on the windshield. While the mutual is formed principally to cater to jitney buses, it will take in all automobile risks. Its principal aim is to provide adequate insurance at cost to those who are practically barred from participation in liability insurance because of prohibitive rates of existing companies. Accidents have been increasing at a rapid rate and the need of protection was deemed urgent.

Jitney bus operators have been formed into a union which has affiliated with the International Brotherhood of Teamsters, Chauffeurs, Stablemen and Helpers' Union. The membership is 130. A charter has been applied for and application made for membership in the Federated Trades Council of Milwaukee.

Everything But Fare Is Regulated in Providence

PROVIDENCE, R. I., April 28—The burden of handling the jitneys is to be imposed upon the police commission, according to the regulations adopted by the ordinance committee of this city. The City Council will pass on them Monday next. The regulations will undoubtedly be adopted as recommended. The license fee is to be $5 per passenger seat and $3 a seat for cars operating between two municipalities. The bond is to be $500 a passenger seat and the license fee for driver $1. The police commissioners are to route the machines. Routes may be changed upon application and filing 50 cents. Drivers must be 21 years of age and applicants must pass a road examination for fitness and for knowledge of traffic laws. Drivers must not smoke, use liquor, solicit trade or use any mechanical device for attracting patronage. Cars are to be limited to seating capacity, children under 7 years of age excluded, but no person with a child can occupy the front seat. Standing on running board, doors, etc., is forbidden. No jitney can stop to take on or discharge passengers within 40 feet of the white pole used by the trolley company, and none shall stop within 50 feet of any corner or intersecting street used by trolley cars. Cars must not stand in the streets or squares and three principal streets are to be barred to jitneys until after July 1. Every jitney must carry in front a sign with large letters designating route and fare to be charged. Fare is not regulated.

Warren, R. I., the first town to enact regulations for jitneys under the act passed last week by the General Assembly, has similar rules except the fee is $2 a passenger seat and brakes must be in good condition.

Trolley President Petitions to Substitute Jitneys for Cars

BELVIDERE, ILL., May 1—Bion J. Arnold of Chicago, president of the Elgin, and Belvidere Electric Railway company, is willing to give the jitneys a chance in Belvidere. His street railway system is said to be a white elephant on his hands and he has filed with the state board of public utilities a petition seeking permanent relief from operating the Belvidere line. He offers to substitute jitney buses, claiming that he can save money by tying up the trolley cars and operating only the buses. Action was deferred by the council until the utilities commission could act upon the earlier petition.

Jitney Owners Must Have Chauffeurs' License in New York

ALBANY, N. Y., May 2—Owners of automobiles who convert them into jitney buses and drive them for hire must obtain chauffeurs' licenses, according to an opinion handed down by Attorney General E. E. Woodbury today. The opinion was based on that provision of the motor vehicle law which reads:

"The term chauffeur shall mean any person operating or driving a motor vehicle as an employee or for hire."

"The driver of the jitney bus is driving it for hire as much as the driver of any other public conveyance," the Attorney General holds. "It is therefore my opinion that such chauffeurs should be licensed."

First Jitney Express Line

NEW LONDON, CONN., April 29—The expected development of the jitney bus invasion of this State has come in a jitney express line, the first in Connecticut, which is to be operated between New London and Old Saybrook, taking in Waterford, Niantic, East Lyme, and Old Lyme en route. For articles weighing up to 5 pounds the charge will be 5 cents, and each additional 10 pounds will call for another 5-cent charge. The limit of weight has been set at 105 pounds, packages weighing that amount to cost the sender 55 cents. Glassware, crockery and other breakable articles are charged for at double rates.

Reprieve for Louisville Jitneys

LOUISVILLE, KY., April 30—Hearing of the motion for a temporary injunction against Mayor Buschemeyer and the members of the Board of Public Safety and the Chief of Police to enjoin them from enforcing the jitney ordinance recently passed by the General Council was postponed until next Thursday by Judge James Quarles today on motion of City Attorney Pendleton Beckley, who announced that he was not ready to enter into an argument on the merits of the ordinance. Pending the hearing of the motion for a temporary injunction the jitney owners will be permitted to operate their cars on the streets of the city without giving bond, although the City Attorney made a brief, though hard fight to require the plaintiffs to furnish a bond pending the hearing of the motion for a temporary injunction.

It is the belief of those connected with the legal controversy growing out of the passage of the ordinance that practically the entire summer will have passed before the legality of the ordinance is finally passed upon by the Court of Appeals.

The plaintiffs allege the ordinance is unconstitutional and ask the court to enjoin the city from enforcing any of its provisions or conducting any prosecutions under the ordinance pending the action, and that upon a final hearing of the case to declare the measure unconstitutional.

The plaintiffs maintain it will be impossible for them to execute bond, as no bonding company will indemnify them unless they deposit $5,000 in cash or convertible securities in that amount, which, the plaintiffs say, none of them is able to do; that if the said ordinance is enforced the plaintiffs will be deprived of their liberty and property without due process of law, and denied the equal protection under the Bill of Rights of the Constitution of Kentucky, and that they will be compelled to discontinue operating jitneys in the city.

Tax Jitneys $12.50 per Seat Yearly in California

SACRAMENTO, CAL., April 24—An annual tax of $12.50 per seat on all jitney buses has been fixed by the Senate. Sight-seeing motor buses and taxicabs are exempt.

One senator argued that the decreased income of the traction companies, owing to the competition of the motor buses, had cost California almost $300,000 per year in taxes upon the gross earnings of the traction corporations. It is claimed that the tax of $12.50 per seat on motor buses carrying 5-cent fare passengers, will give back less than one-third of what the state is losing. The tax, it is claimed, is but one-tenth of 1 cent per passenger.

Pennsylvania Railway and Power Company Can Operate Jitneys

HARRISBURG, PA., April 29—The House on April 27 passed a bill giving street passenger railways and motor power companies the right to own, lease and operate jitney lines in connection with their railway systems. Following the passage of the bill a measure regulating the operation of jitney buses was stricken from the ledger.

$10 Per Seat in Edmonton

EDMONTON, ALTA., April 30—The city of Edmonton has passed a by-law applying to owners and users of jitney buses which became effective April 26. It reads as follows: By-law No. 632, being a by-law to regulate the use and operation of jitney cars in the city of Edmonton, and among other things provides that all such vehicles and their drivers shall be licensed as follows:

1. For every car coming within the purview of the by-law an annual fee of $10 for every seat (excluding the driver's seat), according to the seating capacity of the car as set forth in the application and in the license, the seating capacity being determined by the seating capacity for which the car was made or sold, and in other cases determined by a measurement of 18 inches for each passenger, a separate license being required for each car.

2. For every driver other than the licensed owner an annual fee of $5. In case any person applying for a jitney license under the provisions of this by-law has obtained a license as a common carrier of passengers, or for a vehicle for hire during the current year under the provisions of by-law No. 532, the sum paid for such license shall be credited to the sum payable by the applicant under the provisions of this by-law, and all licenses issued under this by-law shall expire on December 31 next succeeding the date of issue of the same and no deduction shall be made by reason of the license being issued after the first of January in this or any other year. Fares, routes and license plates must be prominently displayed.

Jitney Men on Strike Against Ashtabula Ordinance

ASHTABULA, O., April 30—All jitney bus owners of this city, numbering about twenty, suspended operations April 29, pending investigation into the constitutionality of the stringent jitney bus ordinance passed by the City Council earlier in the week. Bus owners at Ashtabula have organized to make a fight, but apparently none cares to take the initiative by starting a test case. In the meantime petitions asking the council to reconsider its action will continue to be circulated and attorneys will be consulted with a view to taking action provided the council fails to repeal the bill at its meeting next week.

The objectionable ordinance, which was indorsed and recommended by a special committee of the Chamber of Commerce, requires every driver of a jitney to buy a license and give bond.

The license fee is placed at $100 while the cars will be bonded for $5,000 if of a capacity of nine passengers or less and $8,000 if having a larger capacity.

The ordinance also provides that no person under 21 years may operate a car, that all cars must run from 5 a. m. to 11 p. m.; that cars may carry only one more passenger than the capacity rating allowed by the manufacturer, that violators of the ordinance may be fined not to exceed $50 and that drivers violating the ordinance shall have their licenses revoked.

The ordinance comes as the result of numerous jitney accidents and the strenuous campaign of the street car company which declares the jitneys have deprived it of about $2,000 a month revenue. About 20 jitneys have been operating and of course have been doing a rushing business, owing to the vastly superior service rendered over the crowded car lines.

10-Cent Limit for Jitney Fares, Rules St. Louis Court

ST. LOUIS, MO., April 28—Police Judge Hogan ruled today that a jitney driver should not be permitted to collect more than 10 cents for a single fare, even late at night, unless he displays a placard announcing a higher rate.

The case in which this decision was rendered was that of a service car driver who caused the arrest of two men after they refused to pay 75 cents each for a ride of several miles late at night. The men, who were charged with peace disturbance, were discharged by Judge Hogan.

McLaughlin-Buick Builds Jitneys

OSHAWA, ONT., April 30—The McLaughlin-Buick Co., Ltd., this city, has at the present time under design the construction of a jitney car that will be comfortable, irrespective of the roads or weather conditions. These special jitney cars are of a heavier build than the ordinary touring cars now in use; they are slower and will seat sixteen persons. Some of these are already appearing in some Canadian cities.

Rust Protection By Mixing Chrome Salt with Oil or Paint

(*Continued from page* 812)

Some of these salts, and especially those containing chromium, are very active protectors against rust, and the same is the case with lime water and alkaline lyes of carbonate of potash and soda containing more than 1 per cent. of these salts. Sulphates, on the other hand, are very active rust promoters.

The best rust protection is on these principles effected by providing a mixture of the favorable salts with other protecting materials in such manner that the salts cannot be washed away. But where the question is of unpainted iron not exposed to shock or friction the simplest method is to prepare emulsions of concentrated solutions of a chromium salt with animal or vegetable oils or fats and to use such an emulsion for a coating. Similar emulsions with milk of lime are also effective but difficult to proportion so as to avoid the formation of soap. Experiments with the admixture of the salts with siccative oils and varnishes have not yet led to definite results as to the preferable materials.

Factory Miscellany

Crow Gains Require Addition—To enable the Crow Motor Car Co., Elkhart, Ind., to care for its rapidly growing business, a substantial addition with 6,000 square feet of floor space is being pushed rapidly to completion. A second story is being built over that part of the factory occupied by the body department. The sheet-metal and blacksmith departments will be moved to the second floor, and first floor of the main building will be devoted to assembling motor-car chasses. Orders have been coming in so rapidly from all parts of the country that it has been necessary to work nights.

Drop Forge Plant Operating—The James McKay Co.'s new forging plant at McKee's Rocks, Pa., is now in operation on crank and cam shafts, connecting rods and other miscellaneous forgings.

Lozier Replenishes Entire Stock—The entire stock of parts for all Lozier models ever made has been entirely replenished at an expense of about $100,000. A 1-day service for parts has been established.

Locomobile Makes Extension — The Locomobile Co. of America, Bridgeport. Conn., in addition to an extension at its Seaside Park plant has rented the new factory recently built by the Bridgeport Engineering Co.

New Tire Plant Starts May 15—The New Castle Tire and Rubber Co.'s plant in New Castle, Pa., will start operations on May 15. Rubber tires will be manufactured exclusively for a time until the plant is working well.

Studebaker Installing Steel Stamping Machine—The Studebaker Corp., Detroit, Mich., is installing a steel stamping machine in its stamping and enameling plant. It represents an investment of $20,000 and weighs 200,000 pounds. It requires 60 horsepower to operate.

Youngstown Tube Betterments—Contracts amounting to $3,000,000 for the construction of 200 by-product coke ovens at Struthers, near here, were awarded to-day by the Youngstown Sheet & Tube Co., Youngstown, O. The company plans extensions to cost $5,000,000.

New Company Buys Factory — The Wentworth-Brown Co., a newly organized concern that is going to turn out trucks designed by Mr. Brown, has just bought the J. N. Leitch factory at Amesbury, Mass.

Seattle Ford Assembles 4,241 Cars—The Seattle assembly plant of the Ford Motor Co. opened March 2, 1914, and to April 27, 1915, has assembled 4,241 cars. In excess of $300,000 was paid out in wages to the employees during the past year.

Remy Adds Another Unit—The twenty-second unit has recently been erected at the Remy Electric Co.'s mammoth plant at Anderson, Ind., to take care of the steady increase in their business. In keeping with the policy of this company to preserve intact all jigs, dies and fixtures used in the manufacture of their products, a portion of the new building will be occupied by additional safety deposit vaults for these tools. The remainder of the building will be devoted to additions to the punch press and automatic screw machine departments.

Students Visit Wisconsin Plant—About 100 engineering students from the Ohio State University, Columbus, spend 2 days in Milwaukee last week to gain practical knowledge of engineering. Among the plants especially selected for the inspection was that of the Wisconsin Motor Mfg. Co., producing the Wisconsin motor. The students were particularly impressed with operations on a number of sixteen-valve engines of the special racing type which the company is completing for several concerns, notably the Stutz company. From Milwaukee the party traveled to Detroit.

Manufacturing Centers Want Skilled Men—Cleveland, Toledo and other automobile manufacturing centers are calling on Detroit for skilled mechanics, according to Ralph Hoagland, who deals in employees for the plants. The Detroit demand is greater than the supply and Detroit is advertising for men in at least 12 different cities and without success. Unskilled labor is still to be had for the asking, but there is promise of a shortage in this field also, and that before very long. Good wages are now being offered for skilled labor, much higher than was paid at the time the market was glutted.

The Automobile Calendar

May 5-6	**Detroit, Mich., Motor Truck Convention of the N. A. C. C., Hotel Statler.**
May 8	**Salem, Ore., Track Races; Northwest Automobile Assn.**
May 15-16	**Vancouver, Wash., Track Races; Northwest Automobile Assn.**
May 15-16	**Columbus, O., Track Race, Columbus Automobile Club.**
May 17	**Spokane, Wash., Show, Davenport Hotel.**
May 17-18	**Boston, Mass., A. A. A. Annual Meeting.**
May 18-19	**Boston, Mass., annual meeting of the American Automobile Assn.**
May 27	**Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.**
May 29	**Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.**
May 29	**Philadelphia, Pa., Stone Harbor Memorial Day Run from Philadelphia.**
May 29-30	**Seattle, Wash., Track Races; Northwest Automobile Assn.**
June 3	**New York City, 11th Annual Automobile Outing for Orphans; Orphans' Auto. Day Assn. of N. Y.**
June 7-11	**San Francisco, Cal., National Electric Light Assn.**
June 9	**Galesburg, Ill., 100-Mile Race, Galesburg District Fair Assn.**
June 12	**Brighton Beach, Track Race; E. A. Moross.**
June 14-17	**Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.**
June 19	**Chicago, Ill., 500-Mile Race, Chicago Speedway.**
July 3	**Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.**
July 4	**Visalia, Cal., Road Race; Tulare County Automobile Assn.**
July 4-5	**Tacoma, Wash., Road Race, Tacoma Speedway Assn.**
July 5	**Omaha, Neb., Speedway Races, Omaha Motor Speedway.**
Aug.	**Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.**
Aug. 2-3	**San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.**
Aug. 20-21	**Elgin, Ill., Road Race.**
Sept.	**Indianapolis, Ind., Fall Show, Indiana State Fair.**
Sept.	**Peoria, Ill., Second Northwestern Road Congress.**
Sept. 6	**Providence, R. I., Speedway Race; F. E. Perkins.**
Sept. 6	**Detroit, Mich., Speedway Race; Detroit Speedway Club.**
Sept. 13	**Oakland, Cal., Pan American Road Congress.**
Sept. 17-18	**Peoria, Ill., Illinois Garage Owners' Assn. Convention.**
Sept. 20-25	**San Francisco, Cal., International Engineering Congress.**
Oct. 1-2	**Trenton, N. J., Track Races; Inter-State Fair.**
Oct. 6-16	**New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.**
Dec. 31	**New York City, Show; Grand Central Palace.**
Jan. 22, 1916	**Chicago, Ill., Show; Coliseum.**

The Week in the Industry

DURRELL Manager Now—W. O. Durrell, formerly with the Diamond Tire Co., at Boston, Mass., has accepted the position of manager of the Pennsylvania Tire Co.'s branch in that city to succeed George Lawrie, who has gone into business for himself.

McKay Back in Tacoma—Will O. McKay, formerly manager of the Locomobile agency in Seattle, has returned to Tacoma, joining the sales staff of J. W. Leavitt & Co., Overland distributor in that city.

Gowdy Goes with Buick—C. E. Gowdy, for a long time manager of the service department of the Cadillac agency at Springfield, Mass., has resigned to accept a similar position with the Springfield Buick Co.

Hennem Columbiana Tire Mgr.—The Columbiana Tire and Rubber Co., Columbiana, O., has appointed as its general manager W. G. Hennem, formerly sales manager of the Mansfield (O.) Tire and Rubber Co.

Garage

Roskam-Scott Moves—The Roskam-Scott Co. has removed to 1896 Broadway, at 63d street, New York City. The floorspace covers an area of 11,000 square feet.

Boston Auction Co. Moves—The Boston Automobile Auction Co., which has been located at 1112 Commonwealth avenue, Boston, Mass., has moved in town to 148 Berkeley street.

Silver Opens New Branch—The C. T. Silver Motor Co., New York City, has opened a branch in the Bronx for the distribution of Overland and Peerless cars at 520-522 Willis avenue, which is at 149th street and Third avenue. A. D. Frost is the manager.

New Garages for Milwaukee—Three large garages are about to be erected in Milwaukee, Wis., to fill the needs of three widely separated sections of the city. A permit has been granted to build a large garage at West Water and Sycamore streets, in the heart of the city. R. Grossenbach will build a 22 by 144-foot garage at Fifth and Center streets, on the north side. William Scheutt has plans for a new garage at Prospect and North avenues, to be 45 by 143 feet in size. In addition, scores of smaller garages are under construction or contemplated in various sections of the city.

Motor Men in New Roles

Hoffman Sales Mgr.—P. G. Hoffman, for 2 years retail salesman of Los Angeles Studebaker branch, has been appointed sales manager of the branch there.

Lucas McNaull Tire Mgr.—A. Lucas has been appointed manager of the tire depot and service station opened by the McNaull Tire Co., Akron, O., at 16 Alexandrine street East.

Horan Lozier's N. Y. Mgr.—J. H. Horan has been appointed manager of the New York City branch of the Lozier Motor Co. The branch is located at 11th avenue and 47th street.

McClure Sales Mgr.—M. W. McClure has been appointed southwestern sales manager for the International Harvester Co.'s trucks and will have his headquarters in Dallas, Tex. Mr. McClure was only recently with the Marion Motor Car Co.

Robinson Quits the Regal—C. R. Robinson, who formed the C. R. Robinson Co., in Boston, Mass., some time ago to handle the Regal line in that city, has retired from the company owing to ill health and H. N. Klegge is carrying on the business.

Gray Sells Velie Interest—W. A. Gray, for 2 years manager of the Velie Motor Co. of Missouri, St. Louis, has sold his interest in the company and on June 1 will leave its employ. Mr. Gray has not yet definitely decided upon his future connections.

Noble Maxwell Branch Mgr.—Edward Noble, who has been associated with the Hodgins Fosdick Motor Co., Spokane, Wash., has taken the position as branch manager for this company at Walla Walla, Wash., and will act as distributor of Maxwell cars in that section.

Livingston Promoted—Joseph Livingston, formerly connected with the Indianapolis sales force of the Studebaker Corp., has been promoted to the position of assistant sales manager of the Omaha, Neb., branch, to take the place of J. C. Gerspacher, who recently severed his connection with the company.

McLaren Chalmers Rep.—J. C. McLaren, long in the Chalmers service at various points, has been appointed Tacoma representative and has opened salesrooms and service station at 710-12 Commerce street. Mr. McLaren was recently Chalmers representative for Northern Canada.

Sharp Appointed Mgr.—Al Sharp, for years associated with the Pierce-Arrow Motor Sales Co., in Seattle, Wash., has been appointed general manager of Rothweiler & Co., distributor of Cole cars in the Puget Sound country and subagents for the Ford in Seattle.

Herrick Resigns from Apperson—Harvey Herrick, former American road race champion, has severed his connection with the Los Angeles Apperson branch and joined the Earl C. Anthony organization in the capacity of sales manager, handling the Grant line exclusively, with headquarters in San Francisco.

Lininger Heads New Detroit Co.—The National passenger cars and the Bessemer trucks are now being handled in Detroit by the Metropolitan Motor Co., which has secured temporary quarters on Palmer street near Woodward avenue. William Lininger, until recently sales manager of the Vulcan Mfg. Co., Painesville, O., and a former distributor here, is at the head of the new company.

Dealer

Detroit Chandler Station Opened—A service station for Chandler owners has been opened in Detroit, Mich., by the Gordon Auto Sales Co., 1000 Woodward avenue. Edward Monasmith, from the Chandler factory in Cleveland, is in charge.

Bosch Makes N. Y. Lease—The Bosch Magneto Co., New York, has leased the seventh floor in the building on the corner of Fifty-seventh street and Broadway, New York City, in order to permit of necessary expansion. The new quarters will house the advertising department and also the installation department for electric lighting and starting systems.

Hupp to Open Wholesale Branch—The Hupp Motor Car Co. has planned to open its own wholesale branch in Boston, Mass., after the manner of the Studebaker and Buick companies, and it has already opened offices there with R. C. Hutchins and Fred Nichols in charge temporarily. The wholesale business had formerly been handled by the Wentworth-Fosdick Co., and this company will continue as the retail agents in Boston, the other dealers throughout New England being required to do their business direct with the wholesale branch instead of the Wentworth-Fosdick Co.

Recent Incorporations in the Automobile Field

Canada

MONTREAL—Mystery Tire Co. of Canada; $400,000; manufacturer. H. Farmer, E. Lalumiere, E. Farmer.

Colorado

DENVER—Orton Sleeping Auto Co.; $50,000; to manufacture sleeping berths for touring automobiles. A. Orton, C. M. Montague, G. Smith.

District of Columbia

WASHINGTON—Federal Motor Mfg. Co.; $100,000; to manufacture automobiles. R. B. Owen, W. F. A. Buchner, Babette Buchner.

Delaware

DOVER—Havana Autocab Co.; $1,000,000; bus service on Island of Cuba. H. E. Latter, N. P. Coffin, C. M. Enger, of Elkton, Md.

Illinois

AURORA—Auto Supply and Accessories Co.; $5,000; accessories manufacture. E. H. Robinson, J. A. Kramer, F. B. Shearer.

CHICAGO—Commonwealth Motor Co.; $100,000; manufacturer. C. E. Heckler, C. W. Lambern, Guy Guerinsey.

CHICAGO—International Motor Contest Assn.; $2,500. A. E. Pearson, I. K. Straus, Isidore Goodman.

CHICAGO—Spring Governor Co.; $100,000; to manufacture spring governors and other devices for automobiles. J. A. Macknight, J. J. Cullen, J. F. Mooney, C. J. Dahlstrom, Homer Milligan.

Indiana

BRAZIL—Service Garage Co.; $2,000. M. C. Coopriders, C. H. Zellars, A. M. Shattuck.

CRAWFORDSVILLE—R. & R. Mfg. Co.; $100,000; manufacturing accessories. A. L. Ringo, A. T. Grady, E. H. Tillson.

ELKHART—Eugene Atkins Co.; $10,000; accessories manufacture. W. A. Bump, W. H. Ellwood.

INDIANAPOLIS—American Standard Motor Co.; $100,000; automobile and truck manufacturing. H. B. James, P. and L. A. Gardner.

INDIANAPOLIS—A. and M. Transit Co.; $10,000; garage. N. A. Aufderheide, W. H. Montgomery, F. W. Rossmann.

INDIANAPOLIS—Double Tread Tire Co.; $2,500; tire manufacturer and dealer. W. C. Lusk, C. E. Kramppert, K. A. Killilen.

INDIANAPOLIS—General Motor Service Co.; $10,000; dealer. C. L. Ballenger, P. Englehart, S. M. Fitch.

INDIANAPOLIS—States Motor Car Co.; $30,000; automobile and parts manufacture. R. C. Cope, W. R. Smith, Walter Myers.

LAWRENCEBURG—Dearborn Motor Co.; $2,000; dealer. J. W. Oberting, W. Meyer, E. A. Bauer.

NEW ALBANY—Lapping Auto Bus Co.; $500; omnibus and transfer business. G. B. and C. B. Lapping and Elmer Miller.

VINCENNES—Motor Safety Device Co.; $25,000; to manufacture automobile safety devices. Elmer Schatz, Bert Whitehouse, W. P. Pelzer.

Kentucky

LOUISVILLE—Big Jitney Co.; $500. Samuel Olson, A. C. Thompson, F. W. Cecil, E. P. Olson.

LOUISVILLE—Firestone Jitney Co.; $500. C. F. Aufenkamp, E. D. Aufenkamp.

LOUISVILLE—M. & M. Jitney Co.; $900. Morris Monsky, Max and Sam Munsey.

LOUISVILLE—Nickel Automobile Co.; $10,000; jitney bus line. Wm. A. Baker, S. S. Jones, W. P. McDonogh.

Louisiana

ALEXANDRIA—Alexandria Jitneymobile Co.; $25,000; jitney bus line. P. A. Gilham, W. B. O'Neal, Gus Gehr and others.

Massachusetts

WATERTOWN—Hood Tire Co.; $20,000; to manufacture tires. C. W. Dailey, Jr., H. E. Bose, R. Muir.

Michigan

DETROIT—Associated Lozier Purchasers of Wayne County; $20,000. Theodore Friedman, Murray Rothschild, Harry Frank.

DETROIT—Kosmath Co.; $50,000; to manufacture automobile trucks and delivery cars. E. T. Birdsall, G. L. Sintz, F. C. Sibley.

DETROIT—Standard Motor Parts Co.; $300,000; to manufacture automobile parts. E. J. Dayton, W. S. Grant, Oscar Gumbinsky.

DETROIT—Wolverine Garage Co.; $1,200. A. T. Hamlin, J. R. Glitsert, C. C. Harnbridge.

PONTIAC—Pontiac Chassis Co.; $100,000; to manufacture automobiles. R. A. Palmer, E. P. Waldron, M. D. Hubbard.

Missouri

ST. LOUIS—Carter Motors Co.; $3,000; to manufacture engines and automobile parts. C. O. Baxter, A. H. Little, H. H. C. Weed.

ST. LOUIS—Detroit Electric Car Co. of Missouri; $2,000. M. B. Strauss, C. D. Long, C. M. Rice.

ST. LOUIS—D. C. Gilliland Mfg. & Auto Supply Co.; $8,000; to manufacture automobile supplies. D. C. Gilliland, E. P. Orner, H. F. Sossemann.

ST. LOUIS—St. Louis Auto & Transportation Co.; $2,000. C. F. Betz, Jacob Hagelstein, Richard Mederacke.

WEBB CITY—Auto Transportation Co.; $30,000; automobile line. E. J. Pratt, D. C. Morris, A. H. Rogers.

New York City

NEW YORK CITY—O. C. Arilta & Co.; $25,000; dealer. O. C. Arilta, David Morris, G. L. Stamper.

NEW YORK CITY—Bradley Packard Auto Renting Co.; $500. J. H. Bradley, J. A. Clynes, E. J. Dooling.

NEW YORK CITY—B. L. B. Mfg. Co.; $12,000; accessory manufacturing. L. E. Bregaud, G. G. Boathinen, G. N. Nelson.

NEW YORK CITY—Briarly Tucker Auto Service Co.; $2,000; garage. J. W. Briarly, H. W. Briarly, H. J. Tucker.

NEW YORK CITY—Clark & Kendrick; $10,000; repairing. W. C. Clark, A. R. Kendrick, L. J. Rose.

NEW YORK CITY—Clayton Auto Painting & Trimming Co.; $20,000. Wm. Berkowitz, Morris Schwartz, Abr. Schwartz.

NEW YORK CITY—Coalition Co.; $8,000; manufacturing motors, vehicles. Abram Wyse, H. C. Gibson, Emil Frankel, Woolworth Bldg.

NEW YORK CITY—Columbus Circle Gasoline & Oil Co.; $5,000. Maurice Deutsch, 50 Church street; E. I. Ahrweiler, E. M. Grossman.

NEW YORK CITY—Cosmopolitan Export Co.; $30,000; automobile supplies. Concetta De Prade, Giovanni De Prade, Almo Landi, 1777 Broadway.

NEW YORK CITY—Dan Mar Corp.; $25,000; devices for making tires puncture proof. Celia Selenuen, David Greenbaum, Moses Lewis, 383 St. John's Place, Brooklyn.

NEW YORK CITY—Electric Automobile Delivery Corp.; $10,000; garage and dealer. Geo. Tiernan, F. H. Parcells, J. B. Purcell, all of 50 Wall street.

NEW YORK CITY—Greeley Square Garage Co.; $2,000. E. B. McNally, Jeannette Teplitz, J. T. Ryan.

NEW YORK CITY—Guttag & Stengel; $1,000; mail order business in automobile supplies. C. M. Rosenthal, J. M. Baum, Max Horowitz, all of 35 Nassau street.

NEW YORK CITY—M. George Tigar Bearings Co.; $10,000; manufacturing bearings for automobiles and machinery. M. G. Tigar, A. B. Tigar, Sol. Cohen, 5217 New Utrecht avenue.

NEW YORK CITY—Hub Garage Co.; $2,000. H. Ahr, A. Ahr, J. T. Booth.

NEW YORK CITY—Kim Sales Co.; 02,500; to deal in springs, shock absorbers. Daniel Houston, S. O'Brein, G. C. Norton.

NEW YORK CITY—Leuner & Hannon; $500; expert bankmen of New York. Joseph Leuner, James J. Hannon. Both come from Bronx, N. Y.

NEW YORK CITY—Lexington Auto Supply Co.; $15,000; dealer. M. A. Noble, R. H. Waddell, A. M. Nascher.

NEW YORK CITY—Liesmann's Garage; $1,000. H. Liesmann, Edw. Eberhart, F. A. Eberhart.

NEW YORK CITY—Lucerne Garage Corp.; $3,000. C. H. Minder, P. W. Hanrahan, R. J. Algie.

NEW YORK CITY—Malcolm Motor Car Co.; $35,000; dealer. G. J. Rubin, E. J. Otis, Max Greenberger.

NEW YORK CITY—McFarlan Six Sales Co.; $10,000; dealer. S. J. Fleet, F. L. Shelp, H. E. Persons.

NEW YORK CITY—Motor Vehicle Sales Corp.; $1,000; dealer. H. T. Edwards, Henry Caplan, T. G. Durkhan, all of 68 William street.

NEW YORK CITY—Motor Utilities Co.; $25,000; automobiles, motors, engineers, machinists. R. E. McLear, R. C. Lipman, L. E. Johnson, 115 Broadway.

NEW YORK CITY—Multiple Worm Axle Corp.; $100,000; worm-gear driving mechanisms for motors and vehicles. A. W. Chase, A. L. Knll, J. W. Rowland, 32 Broadway.

NEW YORK CITY—New York Electric Garage Corp.; $50,000; garage for electrics. I. W. Bonner, R. R. Livingston, J. W. Crandall, all of 165 Broadway.

NEW YORK CITY—Safety Auto Equipment Corp.; $10,000. S. M. Richardson, H. A. Vincent, Moses Ely, 2 Rector street.

NEW YORK CITY—Security Vehicle Lock & Brake Co.; $50,000; to manufacture automobile locks. Selman Liss, Leopold Tropp, Bert Rivkin, 555 E. 169th street.

NEW YORK CITY—Safety Brake Co.; $2,000; to manufacture brakes for automobiles. August Marhenke, Henry Kilmer, Henry Kragel.

NEW YORK CITY—Seubert Bearing Co.; $1,000,000; to manufacture ball bearings, etc. L. H. Seubert, Hotel Marseilles, New York City; C. A. Whitney, W. E. Lowther.

NEW YORK CITY—Simpson Motor Corp.; $3,000; dealer. Edw. Cynamon, G. H. Levine, Abr. Levine.

NEW YORK CITY—Smith, Norem & Co.; $20,000; manufacturing automobiles. R. F. Kraus, W. M. Smith, H. P. Norem, all of 1790 Broadway.

NEW YORK CITY—Sheepshead Bay Speedway Corp.; $2,500,000; to maintain and operate automobile speedway. L. P. Reeder, G. H. Brevillier, A. M. Fowler, both of 32 Liberty street.

NEW YORK CITY—Theobald Auto Exchange; $2,000; dealer. J. L. Dunham, W. P. Buchter, J. B. Kalmuk.

NEW YORK CITY—Witherbee Storage Battery Co.; $10,000; batteries, appliances for automobiles and electrical goods. E. F. Jacobsen, C. J. Steirerman, M. J. Hanlon, 52 Brook St., Tompkinsville, N. Y.

NEW YORK CITY—Yankee Heavy Oil Motor Co.; $50,000; to operate refineries, manufacture metal products and machinery. G. Keiser, E. J. Dooling, J. A. Clynes.

NEW YORK CITY—Gillett-Johnson Co.; $5,000; dealer. F. D. Gillett, C. L. G. Johnson, A. J. Johnson.

NEW YORK CITY—West 67th Street Garage; $5,000; Lillian Carlin, S. L. Cohen, Rose O'Rourke, all of 31 Nassau street.

NEW YORK CITY—63d St. Garage; $5,000. George Buchfass, W. Layman, 1904 Broadway; T. F. MacMahon.

NEW YORK CITY—Hammond-Williams Convertible Top Co., $5,000; manufacturer tops, waterproof covers, slip covers, etc. J. C. Hammond, Aaron Bachofsky, 1328 Broadway; C. D. Williams.

NEW YORK CITY—Helicion Tire Co., $100,000; manufacturer. L. E. Maginn, S. W. Rogers, T. H. Soule, 2 Rector street.

NEW YORK CITY—Heina Tire Co.; $15,000; tire manufacturer. W. M. Heina, E. V. Derks, E. A. Kummler, 618 Newark avenue, Jersey City, N. J.

NEW YORK CITY—Hotel Rental Service; $2,500; renting. W. Trock, M. Trock, 315 W. 79th street; C. A. Hitchcock.

NEW YORK CITY—I. T. Motor Renting Co.; $2,000. H. L. Toomey, C. C. Ingraham, P. B. Ingraham, 3915 Broadway.

NEW YORK CITY—Ideal Auto Supply Co.; $10,000; dealer. Frank Weinstein, Samuel Kaplan, H. G. Kosch, 128 W. 46th street.

NEW YORK CITY—Joseph J. Kittel; $10,000; dealer. Miriam Kittel, J. J. Kittel, R. H. Kittel, 496 Riverside drive.

NEW YORK CITY—Lobell-Aborn Auto Co.; $6,000; dealer. M. H. Lobell, 940 Tiffany street, Bronx; J. Aborn, M. Jawitz.

NEW YORK CITY—J. T. MacWilliam; $1,000; dealer in automobiles and accessories. M. R. MacWilliam, J. T. MacWilliam, S. G. Sterne, all of 510 W. 140th street.

NEW YORK CITY—Mecca Rubber Co.; $1,000; tire manufacturer. E. J. Kern, G. B. Marshall, K. W. Tompkins, 222 W. 141st street.

NEW YORK CITY—Monarch Auto Supply Co.; $10,000; dealer. Louis Levene, 6 W. 107th street; Max Richman, Leopold Philip.

NEW YORK CITY—National Tireseal Co.; $100,000; manufacture secret compound for sealing tires. David Lock, 157 W. 54th street; G. W. Lebolt, S. Stern.

NEW YORK CITY—New Denver Ford Starter Corp.; $20,000; manufacturing starters, parts and accessories. J. Robinson Duff, 35 Broad street; M. L. Effinger, J. T. McGovern.

NEW YORK CITY—Primer & Mixture Regulator Co.; $5,000; carbureter devices for automobiles. E. A. McCoy, A. J. Weiss, Frederick Richardson, 1590 Amsterdam avenue.

NEW YORK CITY—Regent Garage; $1,000; dealer. K. Donnelly, J. G. Donnelly, 40 W. 127th street; W. J. Doyle.

NEW YORK CITY—E. Schoonmaker Co.; $25,000; tire manufacturer. Ellis Schoonmaker, L. N. Mansuy, H. I. Huber.

NEW YORK CITY—Seventy-fourth Street Co.; $500. W. Korn, 875 Park avenue; J. L. B. Mayer, B. Mayer.

NEW YORK CITY—Shaw Pearson Motor Corp.; $2,000, dealer. O. F. Shaw, Jr., H. E. Meyn, 363 Lenox road, Brooklyn; F. A. Hallock.

NEW YORK CITY—Transport Tractor Co.; $100,000; motor tractors. A. W. Moffat, 11 Cedar Court, Flushing, N. Y.; F. B. Stimson, F. J. Stimson.

NEW YORK CITY—Tremont Tire & Supply Co.; $2,000; dealer. N. J. Finney, E. A. Finney, M. B. Coleman, all of 543 E. 184th street.

NEW YORK CITY—United Auto Truck Co.; $5,000; dealer. D. Diamond, P. Diamond, 329 E. 20th street; Louis Weltzman.

NEW YORK CITY—Universal Safety Brake Co.; $25,000; automobile brakes. Samuel Wiesenberg, 341 Crimmins avenue, Bronx; L. M. Bernfeld, Rose Bernfeld.

NEW YORK CITY—Yankee Heavy Oil Motor Co.; $50,000. E. J. Dooling, Brooklyn; J. A. Clynes.

New York

ALBANY—Yellow Taxi Service; $500; automobile livery business. H. W. Maclellan, E. V. Stratton, C. D. Hakes.

BROOKLYN—B. H. S. Co.; $500; dealer. M. M. Black, G. Heatler, P. H. Siegel.

BROOKLYN—East New York Garage; $1,000. B. T. Foreman, C. A. Cornelius, H. K. Cornelius.

BROOKLYN—Robert A. Hill's Garage; $1,000. R. A. Hill, M. E. Hill, R. R. Palmer.

BROOKLYN—Watkins Street Garage; $5,000. S. Morris, A. Bernstein, W. Domroe.

BUFFALO—A. F. Oliver Gear & Machine Co.; $20,000; manufacturer. A. F. Oliver, C. L. Wiedrich, M. S. Gibbs.

ELMIRA—Elmira Motor Sales Co.; $1,000; dealer. Harry Thompson, W. H. Messimer, H. F. Lundy.

FAIRPORT—Diamond Tire Sales Co.; $10,000; dealer. T. P. C. Forbes, Alexander Forbes, Julius Bindrim, 511 Lafayette avenue, Brooklyn.

HORNELL—Transcontinental Wheel Co.; $125,000; to manufacture wheels, rotary appliances. H. Orsenige, E. J. Orsenige, F. V. Ubeezl.

INWOOD—J. M. J. Garage; $5,000. A. H. Jenkins, Lester Jacobson, Martin Morrison, Hollywood, N. Y.

MT. VERNON—Vernon Heights Garage; $3,000. E. E. Ultecht, A. A. Ultecht, W. J. Terwilliger.

NIAGARA FALLS—A. D. Allen Automobile Co.; $2,500; automobile renting. A. D. Allen, L. A. Allen, C. E. Allen, 551 Eleventh street.

NEW ROCHELLE—Westchester Auto Sales Co.; $10,000; dealer. P. J. Holdsworth, J. L. Froeborn, B. M. Holden.

PEEKSKILL—Adjustable Wheel Co.; $5,000; to manufacture wheels for automobiles and other vehicles. J. H. Murray, R. C. Weaver, J. W. Husted.

PELHAM MANOR—K. Auto Service; $500; garage. D. A. Dusenberry, E. A. Kaye, R. H. Kaye.

ROCHESTER—Kwad Motor Vehicle Co.; $2,500; dealer. W. M. Kipp, M. L. Allen, R. L. Davis.

ROCHESTER—Rochester Motoring Assn. and Service Co.; $10,000; supplies. Bert Van Tuyle, M. L. Kenning, L. H. Kenning.

Recent Incorporations in the Automobile Field

New York

Rochester—White Star Jitney Line; $50,000; bus line. Wm. Cross, W. J. Dever, G. V. Kendolf.

Rome—Rome and Northern Auto-Bus Co.; $2,000; automobile bus line between Rome and Boonville. Gaylord Jones, A. S. Noonan, W. C. Perry.

Syracuse—Bartlett & Smith Motor Co.; $10,000; dealer. G. W. Bartlett, E. C. Bartlett, G. W. Stickney.

Syracuse—Syracuse Auto Bus; $15,000; bus line. C. J. Piquet, Adam Helterline, W. H. Hinckley.

Troy—Empire Motor Truck Corp.; $10,000; dealer. L. A. Robinson, A. L. Johnson, Walter Dix.

Wantagh—Wantagh Garage; $1,000. Birdsall Jackson, Walter Ashdown, G. S. Jackson.

White Plains—Central Transfer & Taxi-Cab Co.; $5,000. G. L. O'Brien, E. A. O'Brien, W. A. O'Brien.

Oklahoma

Tulsa—Southwestern Motor Wheel Co.; $10,000; dealer. F. P. Peterson, E. W. Richey, R. E. E. Andrews.

Ohio

Akron—Akron Auto Livery Co.; $40,000; taxicab service. C. F. Schnee, A. L. Schultz, M. C. Mitchell, C. C. McNeil, E. L. Schnee.

Athens—Butcher Buick Co.; $10,000; dealer. R. C. Fulton, Ura Butcher, E. A. Van Den Broeck, A. H. Boggs, J. D. Connell.

Canton—Reo Motor Sales Co.; $10,000; dealer. John Jacob, Jr., Edgar Harris, F. X. Volzer, P. Campbell, William Jacob, Olivia Daum.

Cincinnati—Cincinnati Motor Coach Co.; $10,000; bus lines. C. R. Kearn, Louis Bauer, A. J. Kaufhold, L. N. Bachman, Hartzell Abbott, C. W. Melzer.

Cincinnati—Fulton-Colwell Co.; $10,000; dealer. H. F. Fulton, F. C. Colwell, R. P. Goldman, Robert Kromer, F. Watson.

Cincinnati—Northern Garage Co.; $1,000. H. H. Doepke, W. L. Doepke, F. Morris, E. B. Ulrich, H. H. Wiggers.

Cincinnati—Talbot Tire Armor Co.; $10,000; puncture-proof tire armors. F. R. Talbot, F. Morris, G. M. Spear, C. H. Davis, W. Schmidt, Jr.

Cincinnati—White Mfg. Co.; $10,000; rubber articles and automobile accessories. I. J. Cooper, W. L. Busch, W. C. Latta, A. E. Arking, F. F. Cooper.

Cleveland—Colonial Grube Auto Service Co.; $10,000; repair shop and taxicab company. W. H. Swarts, N. B. Taylor, A. E. Goldhamer, I. M. Cortice, H. R. Brackenridge.

Cleveland—Theodore Kundtz Co.; $2,000,000; to manufacture automobile bodies, trucks, wheels and other articles made from wood or metal. Theodore Kundtz, Theodore Kundtz, Jr., Nick Winkel, J. J. Gedeon, Frank Friedle, R. S. Edgerly.

Cleveland—Marvel Automobile Supply Co.; to Marvel Accessories Mfg. Co.

Cleveland—Nova Motor Truck Co.; $10,000; dealer. J. J. Klein, W. H. Stein, William Gobson, M. V. Amerman, C. D. Mason.

Cleveland—Lake City Mfg. & Supply Co.; $10,000; automobile dealer. G. H. Hanna, J. J. Gillespie, J. E. Filbin, Fred Amsden, J. W. Sheahan.

Cleveland—Scripps-Booth Sales Co.; $10,000; dealer. M. G. Summers, R. C. Carter, W. H. Stevens, J. B. Stevens, C. S. Thomas.

Cuyahoga Falls—Falls Clutch and Machinery Co.; $1,000; clutches and automobile parts. Charles McClusky, L. H. Adams, Arthur Higgs, H. P. Day, P. V. Ross.

Cuyahoga Falls—Globe Rubber Co.; $20,000; tires. F. J. Creque, F. C. Francisco, T. J. Francisco, L. H. Adams.

Dayton—J. L. B. Motor Co.; $15,000; dealer. C. W. Dale, S. C. Kusworm, Charles Troy, J. L. Baker, J. W. Baker.

Elyria—Elyria Tire & Rubber Co.; $250,000; manufacturer. A. G. Snow, E. P. Parshall, G. G. Gilbert, C. W. Neubrand, J. L. Lind.

Leipsic—Standard Auto Accessory Co.; $3,000; to manufacture accessories and parts. R. F. Thompson, C. W. Fogle, W. S. Thompson, Frances Thompson, Adelaine Werner.

Lima—Garford Motor Truck Co.; $5,000; to manufacture and sell trucks. E. W. Stevens, J. R. Immler, P. J. Long, A. C. Fenwick, R. W. Lelebot.

Medina—Medina County Garage Co.; $10,000. A. C. Marsh, F. F. Clark, H. E. Kimmell, C. R. Warner, T. F. Hallock.

Reynoldsburg—Reynoldsburg Transportation Co.; $2,000; bus line. N. H. Rickley, C. L. Graham, J. J. Enlows, A. J. Green, W. S. Scully.

Sandusky—Robert Motor Mfg. Co. of Sandusky; $50,000; to manufacture motors and other machinery. B. B. King, W. H. Burke, R. K. Ramsey, J. C. Fyle, A. K. Iler.

Springfield—Ensign Motor Co.; $30,000; garage. H. C. Ensign and others.

Springfield—L. & L. Co.; $10,000; dealer. R. H. Leason, T. Leason, J. P. Cole, E. V. Elser, T. D. Hodge.

Springfield—Springfield Auto Deflector Co.; $2,500,000; accessories manufacture. H. O. Wheeler, G. C. and M. B. Martin, R. C. Lorenta, E. J. Twoomey.

Toledo—Pilliod Motor Co.; $100,000; to manufacture automobiles and trucks. C. J. Pilliod, C. J. Pilliod, Jr., G. H. Hartman, S. Farner, Jr., G. J. Defenthaler.

Toledo—Richter Automobile Machine Co.; $25,000; dealer. W. E. Richter, C. F. Gilchrist, H. C. Warner, C. A. Moon, G. F. Blank.

Toledo—Seyfang Garage Co.; $1,000. F. M. Seyfang, H. H. Blair, Fred Mundbenk, C. C. Seyfang, J. J. Blair.

Toledo—Toledo Motor Coach Co.; $10,000; bus line. V. E. Phelps, E. M. Phelps, W. E. Phelps, O. E. Phelps, C. S. Machner.

Toledo—Toledo Motor Speedway Co.; $10,000; to give racing exhibitions. P. T. Garner, A. A. Reckberger, A. E. Pierce, J. H. O'Leary.

Youngstown—Youngstown Transportation Co.; $12,000; to operate motor buses and taxicabs. I. M. Hartzell, Mark Perkins, R. C. Wright, J. R. Claxton, W. B. Young.

South Carolina

Hartsville—McDonald Bros. Motor Co.; $5,000; dealer. Carl McDonald, L. J. McDonald.

Tennessee

Elizabethton—City Garage; $5,000. J. H. Grayson, W. M. Vaught, J. P. Bowers.

Memphis—Donelson Auto Supply Co.; $5,000; dealer. L. R. Donelson, Jr., A. J. Donelson, J. D. Martin.

Memphis—Union Jitney Co.; bus line. Casey Todd, J. W. Spence, W. A. Schmitt.

Texas

Austin—Capital City Auto Co.; $8,000; dealer. W. M. Graham, H. H. Taylor, L. S. Houston.

Houston—Overland Sales Co.; $1,000; dealer. J. E. Hero, G. W. Graham, D. Riegel.

Kansas City—Byerley-Hoole Tire & Repair Co.; $5,000; dealer. C. T. Byerley, J. C. Hoole, H. A. Bantillier.

Virginia

Richmond—Richmond Jitney Bus Co.; $10,000; bus line. E. R. Alphin, M. Libbey.

Washington

Wenatchee—Wenatchee Tire & Auto Co.; $5,000; dealer. G. K. Seaman, Ray Sagendorf, Phillip Sagendorf.

Seattle—West Coast Motor Co.; $250,000; dealer. J. B. Hill, B. B. Martin, J. C. Doyle.

Wisconsin

Beloit—R. & L. Instrument Co.; $25,000; to manufacture signal devices for motor cars and trucks. J. E. Keeley, L. S. Carr, H. D. Bell, J. I. Floyd.

La Crosse—National Gauge & Equipment Co.; $200,000; gauges and parts. D. G. MacMillan, P. M. Gelatt, J. M. La Voque.

Milwaukee—Auto Mart; $20,000; dealer. I. Lazarus, E. Lazarus, G. Glicksman.

Milwaukee—Auto Service & Supply Co.; $10,000; dealer. R. B. Mueller, T. A. Eberhardt, Dr. J. Moeller.

Milwaukee—J. J. Dougherty Co.; $6,000; dealer. J. J. Dougherty, C. E. Signer, R. A. Schwartzburg.

Milwaukee—Milwaukee Auto Tire Exchange; $10,000; dealer. W. R. Thomson, L. E. Schroeder, W. N. Durkin.

Racine—Racine Handy Mfg. Co.; $10,000; to manufacture automobile specialties. H. B. Mansfield, C. C. and R. C. Thronson.

Racine—Wisconsin Machinery Co.; $10,000; to manufacture, rebuild and repair tools, engines, machinery. R. T. Ingalls, Charles Rasmussen.

Sheboygan—Rummele Kriel Co.; $10,000; garage. E. H. Rummele, E. L. Kriel, A. F. Rummele.

Spring Valley—Kriesel Motor Co.; $25,000; gasoline engines. Rudey Kriesel, Phoebe Kriesel, J. E. Gruelle.

Automobile Agencies Recently Established

PASSENGER CARS

Arizona

Douglas	Stanley	Reno Brothers

California

Fresno	Oldsmobile	Neuderaut Motor Car Co
Needles	Chevrolet	R. B. Wilkin
Oxnard	Kissel	J. L. Milligan
Pasadena	Chevrolet	Hoard Bros. & Nelson
Pomona	Chevrolet	E. M. Hubach
Riverside	Chevrolet	R. G. Stewart
San Bernardino	Chevrolet	E. Reber
San Bernardino	Trumbull	F. W. Lockwood
San Diego	Chevrolet	L. J. Phelps
Santa Ana	Chevrolet	Pierce & Drake
Santa Barbara	Chevrolet	S. G. Ore
Taft	Chevrolet	C. H. Allinson

Colorado

Boulder	Stanley	C. G. Hickox
Denver	Rauch & Lang	Colorado Motor Car Co.
Denver	Milburn Electric	Auto Sales Corp.
Denver	Imp	Tremont Garage
Denver	Hollier	G. H. Estabrook
Denver	Marmon	Roberts Auto Co.
Denver	Inter-State	Wm. Thorney Auto Co.
Ft. Collins	Franklin	H. D. Parker
Limon	Dodge	R. L. Ritter

Iowa

Council Bluffs	Oldsmobile	Raapke Motor Co.

Maine

Brunswick	Oldsmobile	W. F. Senter
Portland	National	Maine Motor Car Co.

Maryland

Baltimore	Briscoe	T. B. Kinnamon

Massachusetts

Boston	Lozier	J. J. McCarthy
Boston	Premier	G. X. Bishop
Brockton	Chandler	A. L. Turner
Quincy	Reo	T. W. Hodgkinson
Springfield	Allen	F. Schmidt
Springfield	Moyer	F. Schmidt

Michigan

Alpena	Oakland	A. Hansen
Crystal Falls	Dodge	Bregger Auto Sales Co.
Grand Rapids	Apperson	Kibby & Pierce
Harrisville	Ford	C. M. Lund
Holly	Grant	Holly Garage
Jackson	Jackson	Lette Auto & Taxi Co
Saginaw	Argo	S. H. Heginbottom & Sons
Three Rivers	Crow-Elkhart	Cook & Hagenouch

Minnesota

Northfield	Oldsmobile	C. E. Hathaway

Missouri

Hannibal	Franklin	E. C. Long

Ohio

Cincinnati	Briscoe	Citizens Motor Car Co.
Cincinnati	Enger	E. L. Jones
Cleveland	Monarch	Albaugh Motor Sales Co.
Cleveland	Saxon	Albaugh Motor Sales Co.
Cleveland	Detroiter	Albaugh Motor Sales Co
Cleveland	Princess	Albaugh Motor Sales Co
Cleveland	Apperson	Stark Auto Co.
Cleveland	Oakland	Adams Oakland Co.
Cleveland	Moon	Dunham Motor Car Co.
Columbus	Marmon	Marmon Motor Car Co.
Marion	Dodge	N. H. Davis
Loudonville	Buick	G. W. Carey
Massillon	Buick	W. F. Wagner
Mechanicsburg	Briscoe	E. R. Stockwell
Newark	Kissel	W. B. Nye
Minerva	Buick	C. C. Cooper
Mt. Sterling	Briscoe	B. H. Candy
Newark	Briscoe	S. E. Forsythe
Newark	Buick	Spillman Bros. Garage
Newcomerstown	Buick	F. Mulvane
New Concord	Buick	J. H. McKinney
New London	Buick	O. E. Hemenway
New Washington	Buick	J. E. Weiss
Niles	Buick	J. E. Heathman
Pickering	Briscoe	J. M. Boyle
Radnor	Briscoe	Radnor Elevator Co.
Rayland	Oldsmobile	A. B. Oliver
Richwood	Briscoe	Roberts & Perry
Richwood	King	Kagay Bros. & Shafe
Sebring	Buick	Cooper & Sebring
Spencer Station	Buick	J. F. Kennedy
St. Marys	Franklin	Charles Wirtz
Uhrichsville	Buick	L. J. Lytle
Warren	Buick	W. H. Marsh
Wadsworth	Buick	Niswender & Pierce

Oregon

Ashland	Stanley	Staples & Son

Pennsylvania

Harrisburg	Franklin	Ensminger Motor Co.

Rhode Island

Providence	Apperson	Baird North Co

Tennessee

Nashville	Kissel	W. Howard Douglas

Texas

Childress	Moon	Pigott Auto Co
Fort Worth	Oldsmobile	Oldsmobile Sales Co.
Lubbock	Oldsmobile	W. G. Sherrod
San Antonio	Chevrolet	H. L. Knight

Washington

Harrington	Ford	Charlton & McInnes
Odessa	Oakland	J. A. Murbach
Spokane	Hudson	Hawkins-Twitchell Auto Co.

Wisconsin

Dodgeville	Overland	Ellis & Vivian
Elkhorn	Regal	Opitz Bros.
Ellsworth	Studebaker	J. Gaarden
Ellsworth	Dodge	J. Gaarden
Ft. Atkinson	Allen	H. Lalk
Grand Rapids	Hupmobile	Leon Arpin
Ladysmith	Ford	Ryall's Garage
Mayville	Dodge	Pioneer Auto Co.
New Richmond	Dodge	M. C. Emerson
New Richmond	Sphinx	Quinlan Bros.
New Richmond	Paige	C. J. Mulrooney
New Richmond	Studebaker	J. P. Johnson
Oconto Falls	Reo	Bunn & Kaufmann
Rhinelander	Ford	Oneida Garage Co

DANN INSERT

"The Inter-leaf Shock Absorber"

and BEEFSTEAK

IT would be just as inconsistent to try to get the nourishment out of a beefsteak by tying it to the **outside** of your body, as it is to try to get results from a shock absorber by hanging it on one end of a spring—and on the **outside** of the spring, at that.

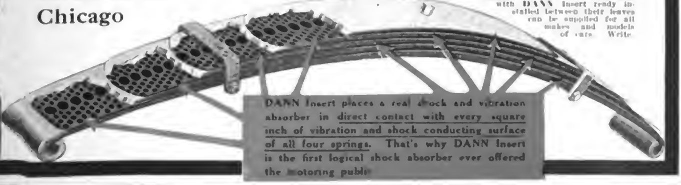
Any shock absorber to be effective must be **built into** all four springs. It must be **integral** with the spring, not an appendage, not an auxiliary. It must act **from tip to tip,** between every single spring leaf, for a spring vibrates not at one point only, but throughout its entire length and breadth. Such a shock absorber is DANN Insert. It is the only inter-leaf shock absorber on the market.

Ask your dealer, or send us postal for full information and new illustrated booklet on "Inter-Leaf Shock Absorption." It tells a wonderful and interesting story.

DANN SPRING INSERT COMPANY

2282 Indiana Ave.
Chicago

DANN Oil Cushion SPRINGS with DANN Insert ready installed between their leaves can be supplied for all makes and models of cars. Write.



DANN Insert places a real shock and vibration absorber in direct contact with every square inch of vibration and shock conducting surface of all four springs. That's why DANN Insert is the first logical shock absorber ever offered the motoring public

To Buyers of Sixes

We urge you to examine all the Sixes

This is the easiest way to sell you an Overland.

Price considered, the Overland Six is superior at every point. It has

—better looks—more graceful lines

—the longest wheel base

—the most up-to-date 45 horsepower en bloc motor

—it gives the most flexible performance

—it rides the smoothest

—it more comfortably seats seven adults

—it has high tension magneto ignition

—it has the finest bright French finish, long grained hand-buffed leather upholstery.

For these practical advantages alone you should get an Overland Six in preference to any other.

Order yours now.

Handsome catalogue on request. Please address Dept. 320.

"Made in U. S. A."

The Willys-Overland Company

Toledo, Ohio

Other models $795 to $1600.

All prices f. o. b. Toledo

[Automotive Industries

…VILLE BRANCH
B-19-…
am…

The AUTOMOBILE

Vol. XXXII
No. 19

NEW YORK, MAY 13, 1915

Ten cents a copy
Three dollars a year

Saves Washing Car

S. C. JOHNSON & SON,
Racine, Wis.

Gentlemen: In answer to your letter of the 24th, I had a hard time to get my boss to try the Wax on a new car he has to demonstrate with, but landed him and now he will not use anything else. He thinks it is great. It has saved me washing the car every day. Once a week or once in two weeks will keep the car looking like new.

It is great stuff believe me. I take great pains in showing it up.

Yours very truly,
K. PAUL,
… Elm St., Schenectady, N. Y.

Thought Car Was Repainted

S. C. JOHNSON & SON,
Racine, Wis.

Dear Sirs: I must tell you a lit-

What Kept Car So Nice?

S. C. JOHNSON & SON,
Racine, Wisconsin.

Gentlemen: We used the
…x on the auto and had sev-
… inquiries regarding the shine.
…ne man, a stranger, called
…y phone, asking what we
…to keep the car looking so
… He is now a user of
…n's Wax also.

Yours truly,
E. F. LINGQUIST,
Logansport, Ind.

Leaves Hard, Dry Surface

S. C. JOHNSON & SON,
Racine, Wisconsin.

Gentlemen: I have never used anything that anywhere near equals Johnson's Prepared Wax for giving a high gloss that will turn rain and dust.

All polishes that I have ever used before leave such an oily surface that the body will collect more dust after using it than before, but your Wax leaves such a hard, dry, as well as glossy surface that dirt does not stick to it, and for the first time I can now polish my car without getting my hands all over grease and oil and mussing things up generally.

Yours very truly,
Chicago, Ill. B. F. SAWIN.

Jo

—is t
sun-p
glossy
ed W
samp

RA

Makes Car Easy to Clean

Gentlemen: Upon the arrival of your sample can I had the Wax applied to my car in light coats. Each coat was allowed to dry well and then well rubbed before the application of the next. After the third coat the varnish seemed to me to have acquired a gloss of greater depth and the car looked as well as when new. After a few rain storms I had the car washed clean of the mud acquired and was more than pleased to find the car still bright without the application of another coat of Wax. An occasional coat of wax has kept the car looking well and easy to clean during our rainy and muddy winter.

Very truly yours,
ERNEST O. BILLWILLER,
Stockton, Calif.

A Hard Polish—That Collects No Dust

S. C. JOHNSON & SON,
Racine, Wis.

Gentlemen: I find that Johnson's Prepared Wax is a very fine preparation to use on automobile bodies. The wax does not collect dust like most body polish. I find that it retains its hardness under this southern sun. The car I used this polish on had lost its original gloss. After applying one coat of the Wax the finish looked like new. Johnson's Prepared Wax is the best polish that I know of for auto bodies. I remain

Yours truly,
JOHN BARON, JR.,
El Centro, Calif.

Send us 10c for a can of Johnson's Prepared Wax—sufficient for one application on a large car.

THIS COUPON

S. C. JOHNSON & SON
RACINE, WISCONSIN

I enclose 10c for a can of Johnson's Prepared Wax—sufficient for one polish on a large car.

Name ....
Address ....
City & State ....
My accessory dealer is ....
....

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1213 Reading

STREET RAILWAY BUYS 100 BRISCOE CARS

Will Be Operated As "Jitneys" in Richmond, Virginia

Selected Because of Fuel Economy

To get its share of "Jitney" traffic in the most *economical way* the Virginia Railway and Power Company of Richmond, Va., has purchased 100 Briscoe Cars. Twenty-seven have been shipped and are already in service. Each car will carry four passengers besides the driver.

Fuel Economy was the reason for the selection of Briscoe Cars. *Unusual fuel economy* is made possible by the French type of motor used in the Briscoe, which has made remarkable Economy records in the hands of over 5000 users in the last year.

This is only one of the many reasons why the Briscoe is the easiest and most satisfactory car for dealers to handle.

A liberal contract is offered to responsible live wire dealers who wish to increase their profits by the sale of Briscoe Cars. Get in touch with us without delay.

BRISCOE MOTOR CO., INC.
JACKSON, MICHIGAN.

Briscoe

Completely Equipped

$785.00

Vol. XXXII New York—Thursday, May 13, 1915—Chicago No. 19

The AUTOMOBILE

Science in Spring Manufacture

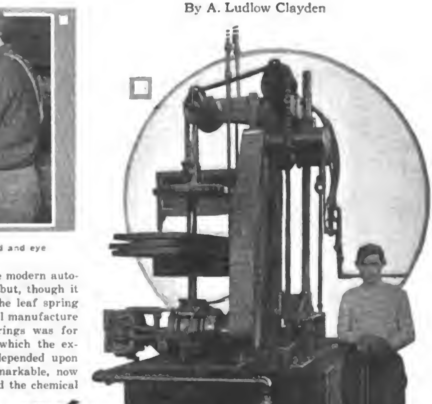
Brains and Machines Replace Skill of Hand and Eye

By A. Ludlow Clayden

The Old—Method of cambering springs by hand and eye

OF the many parts which go to make up the modern automobile the oldest probably is the wheel, but, though it was not discovered for centuries later, the leaf spring is without doubt the second in antiquity. Like all manufacture in the pre-machinery days, the making of springs was for centuries, an art; or rather, a handicraft in which the excellence or otherwise of the resulting article depended upon the skill of the workman. It is somewhat remarkable, now that we know so much about heat treatment and the chemical constitution of steels, that the old craftsmen managed to make such good springs in days when science was undreamed of, but it is perhaps still more remarkable that so generally useful an article as a leaf spring, which has remained unchanged in principle for so many years, should only quite recently have attracted the attention of real engineers of the modern school.

It has been the prerogative of America to create machines to do better work than the hand of man in the making of all sorts of things. Articles of diet, tools, vehicles and implements all owe their low price and their high quality to American mechanical genius either directly or indirectly; there is hardly a



THE NEW—Machine which cambers automatically, quenching the plate in same operation. As shown the dies are beneath the oil in the tank and the operator is ready to withdraw the plate when it has cooled. Observe the difference in the age and look of the boy as compared with the men in the illustration above product of a factory the world over that has not American brains behind it in one way or another. Yet, and this is a most surprising fact, it is only within the past few years that the engineers of this country have turned their attention to devising processes which will cheapen and improve the leaf spring, without which it would have been difficult to develop any sort of vehicle with better riding qualities than the farmer's wagon. This despite even the pneumatic tire, for the spring does much that the tire can never do, just as the spring alone is of much reduced value when the air cushion is not available.

Old-Fashioned Spring Making

The way in which springs were made a century ago, and the way in which they are still made throughout Europe and in some American spring factories, depends almost entirely upon the skill of the men who forge and bend the leaves. Giving a piece of steel a spring temper is a very old art, but before the days of metallurgical research, and the pyrometer for measuring the high temperatures of a furnace, it rested with the workman to judge the correct heat at which to forge and quench the steel. By years of practice with the simple steels of years gone by, it was possible for a man to reach so high a degree of skill that he could make a very good spring indeed. In fact it is still to be noticed that spring making is often a family handicraft, the father instructing the sons and they their offspring from generation to generation.

It is perhaps, from the point of view of romance, and the pride of men in the skill of their hands, a pity that this state of things should be passing away, a pity that yet another of the ancient arts should give way before the all devouring machine, but laying sentiment aside, there is no doubt that a few short years will see a state of affairs in which a man can be trained into a spring maker as readily as he can be made an elevator operator. The smallest modicum of common sense suffices to operate a good machine, and the good machine for making springs is rapidly making headway. To the advantage, of course, of everyone who wants good springs of even quality, and cheaply.

The Importance of Material

Even if the machine will make better springs than the unaided man, there is another way in which the automobile demands more than was asked for the buggy. It is necessary to choose the steel to stand up under the vastly more severe conditions of the automobile. Just as we can use steel of low strength if we do not mind weight in an automobile frame, for example, so can we use low-tensile steels in a spring. But remembering that a spring is being constantly bent to and fro, it is obvious that some materials will withstand more of this treatment before tiring than will others. If one can measure the life of an automobile motor by the number of revolutions it makes, so many hundreds of millions perhaps—just so can the life of a spring be measured. Given definite dimensions and a definite number of leaves, etc., a spring will get tired sooner or later, according to the steel of which it is composed. Nor is the matter one of tensile strength only, it does not follow that the strongest steel will necessarily be the best for a spring, and here we come to the commencement of every succssful modern spring factory, namely the engineering laboratory.

Laboratory—Alpha and Omega

In the plant of the Perfection Spring Co., Cleveland, O., one can just now see the old giving way to the new; the machine replacing the man as fast as new machines can be made and installed, so the factory just at the moment is especially interesting. In the following account of the procedure there we get a clear idea of progress from the past into the future and we must begin, as we shall end, with the learned scientist and the elaborate tools of his trade.

A separate building of two stories, lined with glazed tile and not unlike a hospital theater at first glance; such is the laboratory at this particular plant, and we must begin on the upper floor, where there is a chemical testing room. Having found by experiment downstairs, to be dealt with in a moment, what sort of steels make the best springs, it is essential to check the work of the steel maker to see that the specifications are adhered to.

There are several sorts of steel used in the making of Perfection springs, some better than others, according to the life for which the customer is prepared to pay and it is the chemist's business to take a piece from every tenth bar or so of the steel which comes into the stockroom and to analyse it. He finds if the impurities, which cannot ever be eliminated altogether, are present in too great a quantity; if there is the proper proportion of carbon, and of silicon or chromium or both. So this test is not child's play, but means the daily use of delicate apparatus. Here is one of the *few* highly skilled men that replaces the many which the old method called for.

Nor is his work all chemical, for there is alongside his bench a microscope which shows him the structure of the steel, though this is used more to check the stages of *manufacture* than for examination of the raw material.

On the ground floor in the same building are small heat treating furnaces and also testing machines of various kinds. There is a special sort of gas-fired furnace, in which degrees of heat can be regulated very accurately, and beside it is a bath of molten salt used for drawing the steel.

Tempering Modus Operandi

Here let it be interposed that in making springs the steel is heated to a high temperature, a bright red heat, and then bent into the proper camber, after which it is heated again at a lower temperature to bring it to its full strength. After cambering, while it is still very hot indeed, it is plunged into oil and so tempered. This leaves it brittle, and the purpose of the second heating is to remove this brittleness just sufficiently and without removing the springiness also, as annealing would do. The exact temperature at which the cambering is done and the proper heat for drawing vary with different sorts of steels, and the purpose of the laboratory furnace is to find out by experiment the proper heat at which to bend and quench the steel in oil. The salt bath, as it is called, is a metal vessel in which molten salt is contained, it being easy to keep the temperature constant at any desired degree of heat, just as it would be easy to keep water at any steady temperature below boiling by adjusting a gas flame beneath the vessel.

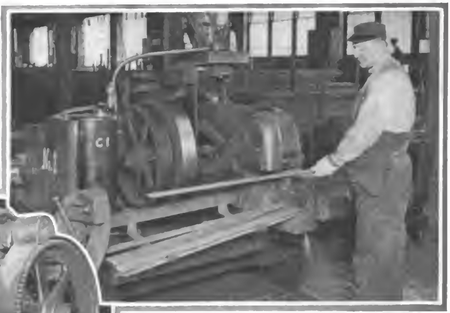
Thus steel spring leaves plunged into this molten salt take a perfectly even temperature, and when they have soaked long enough they are taken out and allowed to cool slowly in the air. When they are cold the laboratory men take them into the adjoining room and bend or break them in machines which test the absolute strength, the limit of elasticity, the degree of hardness and the number of times the plate can be bent to and fro before breaking.

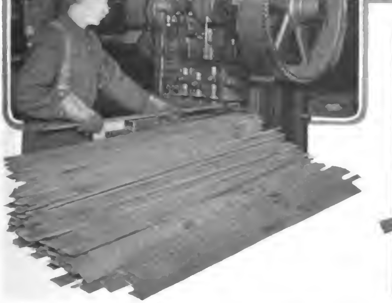
When all these tests have shown the laboratory superintendent the proper treatment for a particular steel, then shop orders are issued so that the steel shall be heated and cooled in the same way and to the same degree in the actual manufacturing process.

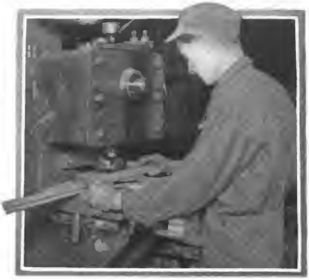
Checking the Quality

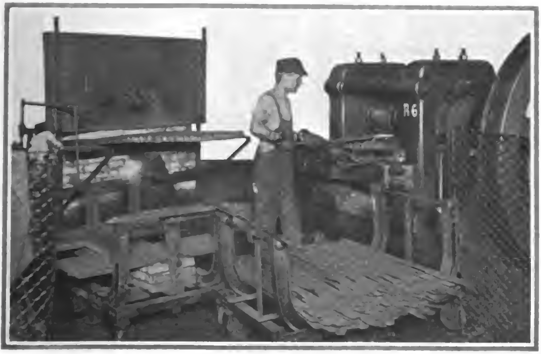
Not only is it necessary to find out the proper treatment, but it is equally vital to watch the factory in order to see that the large scale work therein properly mimics the laboratory researches. Thus test pieces are constantly taken from the shop furnaces and quenching baths and tested to destruction in the laboratory. From the figures thus obtained the results of laboratory tests on the sample pieces of steel taken

Right—The shearing machine which bites the bars of alloy steel into the proper lengths. Below—Cropping or trimming the ends of spring leaves. This is done on the cold steel







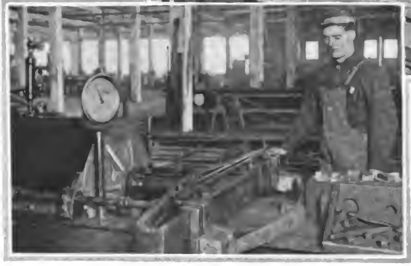


Above—Punching the center hole in a spring leaf

Left—Rolling out the ends of spring leaves to make the old type with rounded ends

Painting leaves with graphite and final assembling

Below — The Break-down test which takes the first set out of the spring and precedes final assembly



from the stock room daily are tabulated alongside the results of tests on the same steel stock as taken from the factory furnaces. The comparison shows at a glance how closely the shops are approaching the ideal conditions and indicate where improvement is possible or necessary.

Laboratory First and Last

Thus the laboratory tells the shop how to work and then sees that it obeys instructions. It is in this way that the laboratory both begins and ends the making of springs, for it is equally responsible, firstly, for seeing that the instructions are correct and, secondly, for observing that those instructions are carried into effect.

Lastly, the laboratory has a machine appealing greatly to popular imagination in which every now and then a complete spring taken from stock is tested. This machine holds the ends of the spring and pushes the center up and down, just as an axle moves relative to the frame of a car, and after some immense period of time perhaps a plate breaks or the whole spring tires and loses strength. When these things happen research at once begins to find out why, if possible, and to seek means to make the next spring stand a greater number of deflections before it fails.

Shearing the Steel

Steel comes into the factory in the form of rolled bars, the thicknesses being different and the widths, of course, also being not all the same. It is supposed to be treated by the maker so that the quality is even, and this the laboratory checks in the manner that has been described. The steel is stored in great racks, and in front of these is a rail track, along which can be moved the cropping machines. An order comes along from the proper quarter for so many lengths of such-and-such a size of steel. The great machine is run into place opposite the proper heap of steel bar and the stock is fed between its giants jaws. A single bite suffices to clip through the toughest plate and the requisite lengths of steel drop off, to be collected, stacked and passed on.

There are two ways of shaping the ends of spring leaves, the old one is to roll out the ends and sides so as to lengthen the leaf a little and make its extremities into a half round. This is the usual sort of spring, and properly to roll out the ends needs a good deal of skill, for while the leaf may be *lengthened* it must not be *widened*.

The alternative method, which the Perfection Spring Co. believes to be better, is to crop or snip the ends to a blunt point, afterwards bevelling off the edges by grinding in semi-automatic machines run by boys. In either case the idea is to weaken the end of one leaf so that there is no sudden edge where the stress passes from one leaf to another. Either thinning the end by rolling it out, or cropping it to a point enables the stress on one leaf to flow into the next without sudden changes in stress—without a step, so to speak.

Of the two processes the cropping is preferred by this company because it calls for no heating, and the less a bit of spring steel is heated and cooled the better, except for the two essential tempering and drawing heats.

Punching Center Holes

Next comes the making of the hole in the center of the plate to accommodate the bolt which eventually will hold the spring together, and this may in practice precede the operation of end shaping. The holes are made by a punch, and in some of the Perfection springs this hole is afterwards cupped on one side so that one plate is automatically registered with the next. To do this it is necessary to heat the middle part of the plates, but the operation of making the hole needs no unusual skill, nor does that of cropping and bevelling the ends to a diamond point.

Cambering the Leaf

Even a spring which is to be flat when in position on the car, has to have its leaves cambered, or bent to a curve, for it is the flattening out of the spring's natural curve that enables it to support the load elastically. It is in this operation that the old process calls for the greatest skill, but before coming to this let us consider the furnaces in which the plates are heated before cambering.

Even before this process the top plates have to have the eyes on their ends rolled up to accommodate the bush for the shackle bolt, and this is done by heating the end and then inserting it in a machine which takes hold of the leaf and pulls the end around by a sort of cam action. Curiously enough, this apparently simple machine has proved troublesome to get just right, so an alternative method is to bend the end of the plate over a series of dies. There are usually three bends in this tool, and they may all be done in succession without reheating if the plate is thin enough. With a thick plate reheating is necessary after the major amount of bending is done. The tool is quite simple as it consists of jaws which bite the end of the leaf between curved surfaces, so forcing it to conform to the dies. The handling of either type of eyemaker is easy and to learn to do the job is neither a long nor difficult process.

To return to cambering, the plates are placed, on edge, in a furnace which is kept rigidly to the temperature which suits the steel being used at the moment, and they stay therein long enough to soak at the full temperature the proper length of time. To get this effect, instead of putting in a furnace-full and taking them all out at once, only two or three plates are withdrawn at a time, cold ones being put in to take their places.

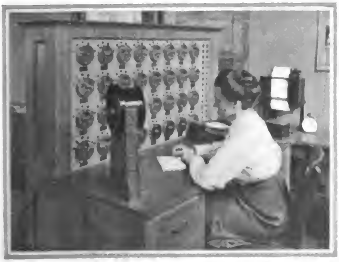
Master Pyrometer System

Now, it is the most important thing in the world that these furnaces should not be so cold that the plates are strained by cambering, nor so hot that the strength of the steel is impaired. With modern alloy steels this means that only a few degrees variation is allowable. To keep this checked all the time an electric pyrometer, or high temperature thermometer, is installed in each furnace and the wires leading to the recording board are brought into a little room in the main office building. Here there sits a woman, whose sole duty is to read the temperature of one furnace after the other without ceasing. One girl comes after another, and day or night the record is kept.

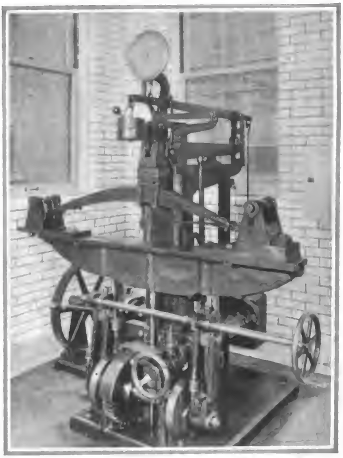
On the desk beside the operator is a telautograph, on which the record is entered, and the other instrument is on the foreman's desk in the shop beside the furnaces. At every minute of the 24 hours of the day this record continues; the foreman sees to the adjustment of the oil burners to give more or less heat as required, and the furnaces are kept at the proper degree. This elaborate system takes out of the hands of the shop the keeping of the record, so there is no chance of error unless one of the pyrometers should fail, and repeated laboratory tests of these maintain their efficiency. If a heat is wrong there stands an irrefutable record of the mistake; there is not the smallest chance of human fallibility.

The Old and the New

So much for the heating. In the old hand-method each plate as it came from the furnace was seized upon by two men who gripped it between the jaws of tongs, and bent it by hand to a curved template. By eye they judged the accuracy of the curve, by hand it was made, and by hand the plate, still red hot, was plunged into a bath of oil. Now this produces excellent work so long as the men are utterly reliable, but it is easy for one lacking in skill or in care to bend a little wabble in the plate or to twist it a little, and plates as bent and quenched by this method are seldom really true and have afterwards to be corrected by hammering, which calls for more highly skilled labor and is none too good for the steel.



The pyrometer record board which is watched from year's end to year's end. From it are regulated or checked the temperatures of all the furnaces. The operator writes on the telautograph in the background which transmits a written message to the furnace foremen



The laboratory machine which tests springs to destruction by repeated flexure up to hundreds of thousands of reversals to the limit of elasticity

The new way is to pull the plate from the furnace, drop it on a die in a machine, pull a lever which brings down another die on top of the other; so squeezing the plate to absolutely true form, and then, in the same motion, sousing plate and dies beneath the surface of oil in a great tank.

Not only is the new process quicker, but the human element is eliminated. In a few moments, almost, a man could get the knack of dropping the hot plate on the dies, for it is located by the center bolt hole, and once it is in place the machine sees to the rest.

At the Perfection Spring Co.'s plant, as has been said, both the old methods and the new are to be seen, because the machines cannot be made fast enough to eliminate all handicraft. In a short time, however, this will have been done and the hit-and-miss methods removed forever, so saving expense and waste material in the form of scrap. The machine improves the average value of the product because its action is regular, and it simplifies manufacture and inspection to an immense extent.

Next Stage Is Drawing

As has been explained the plate is now in finished form, but it is far too brittle, so it passes to another furnace,

Analysis part of laboratory where chemical constitution of steels used is checked

where the temperature is lower. Here it soaks for a predetermined time, the heat being checked by the pyrometer as before, and when a load of plates have had their heat bath the carriage upon which they rest inside the furnace is pulled out and the plates allowed to cool off at their leisure. This is called drawing the temper.

The salt bath, as explained in the laboratory equipment, is used also for drawing, as it enables the heat to be kept even, more readily than the usual type, but there are some mechanical difficulties in connection with large salt baths which render their complete adoption a little difficult.

Final Stages—Grinding and Buffing

Now, when they are cooled, the plates are covered with a thin layer of scale, due to the heating, and this is removed by grinding and buffing with abrasive wheels. This completed to the inspector's satisfaction, the plates of different sizes meet each other for the first time to be bound up into the completed spring.

Steps in Assembly

It is found that a spring when first assembled has a greater set than really belongs to it, so it is put in a machine which bends it to the limit that it is ever expected to be bent, beyond that limit in fact. It is found that after this first bend it does not recover its first shape completely, but takes its final, natural form which only age in use or accident can ever alter. It must return a given degree or it means that one or more of the plates are not up to standard, but if all is well the spring comes apart again, has the leaves painted with graphite and is assembled finally with center bolt and rebound clips, being then ready for shipping.

Pressing Bushings Into Eyes

Intermediately between cooling after drawing and the removal of scale from the top plates of springs comes the pressing into the eyes of the bronze bushings, and grinding the eyes to proper width. This is done by pushing the end of the plate between two revolving grinding wheels, which operate equally on both sides of the eye and prevent the proper width from being obtained lopsidedly by grinding off too much one side and not enough the other, as might be possible if the sides were ground one at a time.

There is a rigid final inspection, and throughout the stages through which each part passes are detail inspections, but these have not been mentioned as they have nothing to do with the process per se.

Quantity and Quality

Thus told the tale is simple, so simple that it strips the glamor from the spring maker's art, and show it as a simple sort of manufacture, devoid of mystery, which indeed it is. But, let it not be forgotten that the coming of machinery has been made possible only by master brains, that the delicacy of the heat treatment derives its practicability from the work of men of science in many lands, and we see that for the hand skill of the many is substituted the brain force of a few. We have in such a plant as this, replaced *quantity* of craftsmanship by *quality* of direction, and with a few highly trained minds controlling a force of unskilled labor we get a better product than could possibly have come in quantity from all the handicraftsmen in the world.

Owner Not Responsible for Chauffeur on His Own Errands

NEW YORK CITY, May 8—The owner of an automobile is not liable for an accident caused by his chauffeur while the latter was driving the machine on an errand for himself without the knowledge of the owner, though he had frequently used it in doing errands for himself without asking for or receiving express consent, and the owner had not forbidden such use, according to a decision handed down recently in the Court of Appeals by Judge Collin.

Annie Reilly was injured by the car of A. W. Connable, operated by the chauffeur of the latter on an errand for himself, and brought suit to recover damages from Mr. Connable. The appellate division of the Supreme Court in the second judicial department affirmed a judgment in favor of the plaintiff entered May 7, 1913, and the decision just delivered by Judge Collin on the appeal, reverses the finding of the lower court.

Reo Chassis for University of Michigan

LANSING, MICH., May 7—The Reo Motor Car Co., Lansing, has furnished to the automobile laboratory of the University of Michigan a complete 1915 Reo the Fifth chassis for demonstration and lecture use before the classes in Automobile Engineering. Tests upon the various chassis units may also be run by squads of advanced students in the automobile laboratory testing course.

Professor Leonard examines a polished bit of heat treated steel beneath the microscope

Truck Makers to Decide on Standard Service Policy

Sentiment at Detroit Convention Is Opposed to Shows for Commercial Vehicles But Favors N. A. C. C. 90-Day Warranty—Next Meeting in October or Earlier

By L. V. Spencer

DETROIT, MICH., May 6—Sentiment among commercial vehicle manufacturers as a whole is opposed to motor truck shows; they favor the 90-day standard warranty of the National Automobile Chamber of Commerce, and they have acted to devise a standard service policy. These important matters and many others of vital interest to the commercial car industry were taken up in the 2-day Motor Truck Convention here under the auspices of the N. A. C. C., which was brought to an end tonight. It was also voted to hold the next convention in October or even earlier at the discretion of the Chamber.

The gathering was an unqualified success, viewed from every angle. More real business was transacted than at any previous meeting of the truck men, and a great deal was accomplished to weed out the undesirable features of the industry as it is today. Price cutting was dealt a blow by the sentiment of the delegates, and what was even more important, a committee was named to decide upon a form of service policy to do away with the indefinite and expensive service methods now being practiced in a more or less haphazard manner by the makers and their dealers. In order that this policy may represent the views of all factions, a committee of five nonmembers of the N. A. C. C. was appointed to work in conjunction with the commercial vehicle committee of that body.

The convention heard the pros and cons of selling trucks on time payments, and it discussed at length the question of how to handle the growing problem of the used vehicles. The need of a standard means of arriving at a truck's load rating was recognized, and suggestions of a formula to cover all types of vehicles were considered, although no definite action was taken at this time. Much thought was paid the dealer in the discussions and the papers, for it was felt that he must be given more assistance and help in his selling problems if the makers are to survive. The idea held by some that the dealer cannot make money if he handles his business judiciously was nailed as a bad mistake.

MOTOR TRUCKISMS

The commercial vehicle business should be second only to the railroads.—M. L. Pulcher, vice-pres. and gen. mgr., Federal Motor Truck Co., Detroit.

No man living can determine the value of a used truck by a superficial examination. . . . The used truck question can be handled just as the shoe merchant handles the used shoe question. —W. L. Day, gen. mgr., Commercial Motors Truck Co., Pontiac, Mich.

The dealer is the most satisfactory channel through which to sell trucks.—Robt. O. Patten, Truck Sales Mgr., Pierce-Arrow Motor Car Co., Buffalo.

The future of the electric truck does not lie in displacing the gasoline truck, but in ousting the horse. . . . The future of the electric truck is the future of electricity.—P. D. Wagoner, pres., General Vehicle Co., Long Island City, N. Y.

No other branch of industry with which I am familiar gives, as a general proposition, so much in the way of free service as our own automobile business.—Alvan Macauley, vice-pres. and general mgr., Packard Motor Car Co., Detroit.

The discussion which subsequently led to the appointment of a standard service policy committee was one of the most enlightening and valuable parts of the session. The feeling was general that the indiscriminate giving of service should be curbed and that a policy to which all could adhere uniformly would be of the greatest value. It would give the dealers something to go by, and there would be less tendency on the part of truck owners to abuse the liberal good will of the maker and dealer.

The commercial vehicle committee of the N. A. C. C., consisting of W. T. White, president the White Co., Cleveland, chairman; Alvan Macauley, vice-president and general manager, Packard Motor Car Co., Detroit; P. D. Wagoner, president, General Vehicle Co., Long Island City, N. Y.; H. Kerr Thomas, assistant manager, Pierce-Arrow Motor Car Co., Buffalo; and M. L. Pulcher, vice-president and general manager, Federal Motor Truck Co., Detroit, will be assisted by the following five truck men whose firms are not members of the organization at this time: V. E. Brown, president, Sternberg Motor Truck Co., Milwaukee; E. T. Birdsall, president, Kosmath Co., Detroit; Henry Lansdale, vice-president, Denby Motor Truck Co., Detroit; J. C. Millman, secretary-treasurer, Stegeman Motor Car Co., Milwaukee, and H. E. Wilcox, vice-president, H. E. Wilcox Motor Co., Minneapolis.

They will seek to arrive at some definite and sound basis for free truck service, and will report at the fall meeting of the manufacturers.

The service policy subject was opened by Alvan Macauley, whose paper was entitled Can Manufacturers Have a Standard Service Policy? Mr. Macauley thinks they can, and he is very clear in his paper as to the reasons why. W. L. Day, general manager of the General Motors Truck Co., Pontiac, Mich., is equally sure that no free service policy is required. His company has cut out entirely what is known as free service, and he believes that under this system the owners take better care of their vehicles because they are on their own responsibility

Warranty No............. Vehicle No.............

This is to Certify that we, the

Sample Motor Vehicle Company

of Detroit

Warrant *each new motor vehicle manufactured by us, whether passenger car or commercial vehicle, to be free from defects in material and workmanship under normal use and service, our obligation under this warranty being limited to making good at our factory any part or parts thereof which shall, within ninety (90) days after delivery of such vehicle to the original purchaser, be returned to us with transportation charges prepaid, and which our examination shall disclose to our satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on our part, and we neither assume nor authorize any other person to assume for us any other liability in connection with the sale of our vehicles.*

This warranty shall not apply to any vehicle which shall have been repaired or altered outside of our factory in any way so as, in our judgment, to affect its stability or reliability, nor which has been subject to misuse, negligence or accident, nor to any commercial vehicle made by us which shall have been operated at a speed exceeding the factory rated speed, or loaded beyond the factory rated load capacity.

We make no warranty whatever in respect to tires, rims, ignition apparatus, horns or other signaling devices, starting devices, generators, batteries, speedometers or other trade accessories, inasmuch as they are usually warranted separately by their respective manufacturers.

In Witness Whereof *we have caused this Warranty to be signed by our duly authorized officers.*

....
Company Name

....
Signature and Title of Officer Signature and Title of Officer

Date...................., 191

Standard Warranty approved by the N. A. C. C.
December 3, 1913

with them. Also the free inspection and minor adjustment service which Mr. Macauley advocates does not meet with Mr. Day's approval, as he contends that it brings about carelessness, and might encourage damage suits should anything go wrong with the vehicle after an inspection by the dealer or branch.

Divergent Views of Service

It was between these two men that the discussion was the liveliest. Each representing a strong factor in the industry, and with views on the matter of service so widely divergent, it was a case of submitting telling arguments pro and con, with the rest of the convention generally acting as the jury, although some of the others voiced views on one side or the other. Mr. Day laughingly accused the convention of being afraid to put so rigid a policy as that of the General Motors Truck Co. into effect, though they all realized that it was based upon sound business. He said that it was a big step to take, but that once taken it would prove itself.

The Packard Policy

Mr. Macauley outlined the new Packard dealers' service policy, under the provisions of which the dealer will, for one year, inspect monthly the trucks he has sold, and make minor adjustments gratis, if the truck is brought to his service department for attention. If not brought to him, and he is obliged to send a workman to wherever the truck may be located, he will inspect and adjust monthly for one year, doing whatever work can be completed within 3 hours at each visit, for a schedule of charges as follows:

Within a 10 mile radius......................	$1.50
Within a 20 mile radius......................	2.50
Within a 30 mile radius......................	3.00

Beyond 30 miles a special arrangement is made in accordance with the distance.

Within the first month after delivery, adjustments are made as often as the owner desires, providing he brings the truck to the service station. After that, regular rates are charged except for monthly inspections. If delivered within 100 miles, the dealer will also provide an instructor for 3 days in order to acquaint the driver with the truck.

The General Motors Truck Co., on the other hand, is really the pioneer in the policy of not according any of this free service, charging for any attention to the truck from the very outset, at its regular repair rates. Mr. Day stated that it was being followed with success throughout the entire dealer and branch organization, and was making more careful truck men out of the owners.

Too Much Free Service

Most of the delegates felt that they are now giving too much in the way of free service in order to allow the dealers to make money, for much of the profit which they get on the vehicle is eaten up in the gratuitous work done to keep the owner satisfied afterwards. Mr. Macauley called attention to this by saying that no other branch of industry with which he is familiar gives, as a general proposition, so much in the way of free service as the automobile business.

He goes on further to say:

"The existence of this liberality of free service is undoubtedly due to the fact that as soon as the automobile business was born, scores of manufacturers took it up simultaneously, and from the very outset there was the very keenest competition, which patrons availed themselves of to extract from motor car manufacturers most lavish promises, either expressed or implied, as to what would be done for them without charge. In nearly every other line of business, history shows usually some one pioneer who developed it to the point of success, and who established precedents as to repair work and service before he had serious competition, and, under these circumstances, the pioneer manufacturer did not make extravagant promises of free service, and later manufacturers who came into his field usually fell in with the precedents he had established.

"What kind of service is promised you when you buy a yacht, or a gun, or a locomotive, an installation for your power-plant, machine tools, an elevator, or whatnot? In all of these lines we expect the manufacturer to make good if he sells us an article that is below his established standard of excellence. Also, we know perfectly well that if we ask him to do anything more, we shall expect to pay the bill for time and materials, and a reasonable profit. Custom has educated us what to expect, and we accept the result without any feeling but that it is only fair and right to pay the bill. The public generally is willing to pay what it thinks is fair, but what it thinks is fair depends entirely upon its education, and I feel that we have all failed in our duty towards our patrons and our dealers in not educating them as to what is right and economically possible in the way of service. We have either left them in an indefinite frame of mind, or worse, we have led them to believe that we are willing to give more than we should give, and are able to give.

"The public naturally will take all the free service it can get, and whatever is given is accepted as a matter of right."

This sentiment against indiscriminate and lavish service was voiced by all who spoke, but none seemed to feel that they could follow the lead set by Mr. Day, although they agreed that it was the ideal method.

A Delicate Point

Vernon Munroe, president of the International Motor Co., cautioned the truck committee to approach the subject with the greatest care, as it is a selling policy, and one which must be fair and equable in order for all to abide by it.

W. T. White pointed out that no policy which the N. A. C. C. or any similar body could devise would be absolutely binding, but it would form a basis for individual policy and serve as a moral support. He characterized it as a beacon light—something to steer by.

A great deal of interest was evidenced in the used truck question. Here again Mr. Day struck a body blow at the present policy of taking used trucks in part payment for new ones, often at exorbitantly high amounts so that the dealer was not able to get a profit after disposing of the old car. His answer to the topic, How Can the Used Truck Question Be Handled? and on which he read a paper was that the motor truck makers can handle the used car question just as the shoe merchant handles the used shoe question. His company does not take any truck in part payment for a new one, and the plan is working to his satisfaction.

H. H. Hills, sales manager of the Packard Company, believes that Mr. Day has hit the nail on the head, although he stated that the used truck problem cannot be wholly eliminated. Failures, new and better trucks, lighter and faster types are all developments which make older cars become obsolete, and someone must handle them. He believes that a salesman handling *used* trucks should not have anything to do with *new* truck business, as he is apt to be unfair to one or the other in order to follow the lines of least resistance in making the sale.

Business Conditions and Used Trucks

H. E. Wilson thinks that general business conditions are in part responsible for the used cars on the market, and that often a dealer, to hold the trade of a good customer, will have to take in an old truck.

Mr. Pulcher of the Federal outlined his company's policy of getting each dealer to report to the factory periodically just what used vehicles he has on hand, and whenever a certain type or size is wanted, the dealers write the factory to learn where they can get such a truck from another dealer. Alfred Reeves explained the used car market report scheme used by Chicago dealers as a basis for prices on second-hand cars. This gives them a fixed value, and is something for the dealer to work on. It is primarily for passenger cars, but is being extended to trucks as well.

Opposed to Truck Shows

In putting itself on record as opposed to truck shows, the convention was practically united on the matter. Only two spoke in favor of shows, these being M. L. Pulcher, who read a paper in support of them, and Alfred Reeves, general manager of the N. A. C. C. In seeking to establish them, Mr. Pulcher pointed out that they should be entirely divorced from the passenger car exhibitions, as these detracted from the more staid truck shows that have in the past followed the passenger car weeks at New York and Chicago. He wanted to have an outdoor affair at some central point so that the ability of the various vehicles could be demonstrated. Such an event could be held in the fall when the passenger car business of the dealers is slow and would not interfere.

The dealers would get a new spirit of enthusiasm out of such a show, Mr. Pulcher added, and pointed out that in past exhibitions too much contradictory data has been given the prospect, who went away bewildered by the many conflicting claims he had heard. There has been too little of the educational spirit.

Truck Field Days at Sheepshead Bay?

But the convention was not with him, although Mr. Reeves explained that when people will pay to see what you have to sell them then they are interested. This interest was further attested at the recent national shows, he said, by the record breaking attendance. Truck shows could be made more profitable by bringing to them interested prospects, and by demonstrating loading and unloading ability for various classes of service. He thinks the new Sheepshead Bay speedway will be an excellent place to have truck field days.

There were some in favor of a truck field day, although the advantages of this were questioned. Many felt that interested buyers would not come to a show, but would go to the factory or the salesroom of the maker's agent in preference.

In some quarters exhibits in connection with state fairs were greatly favored as being a direct means of getting to the prospects not in the big cities. J. C. Millmann, of the Stegeman company was particularly in favor of this method of reaching local buyers, saying that makers have been overdeveloping the large cities and forgetting the bigger markets at large.

Mr. Macauley of the Packard company is not very enthusiastic over shows, and has seen no case where they paid direct results. Delegates from Pierce-Arrow, Knox, White, Autocar and International Motor Co., declared themselves against shows as a general proposition, though some of them were interested in the field day idea of demonstrating and thus provoking the interest of the general public.

Standard Warranty Approved

The members of the convention apparently had the matter of the N. A. C. C. standard 90-day warranty all thought out beforehand, for it was approved without much discussion as being the most advisable way to handle the question of replacements. This warranty is now in use by a large number of manufacturers and is proving satisfactory. It is fair because any defective materials or workmanship should develop in 3 months of reasonable service. It gives a good basis of adjustment, and now a concern would really be foolish not to work under its provisions.

Time Payments Discussed

W. T. White took up very logically the Advantages of Selling on Time Payments and How Such Sales Should be Handled. He laid down a good rule to follow in such business by saying that there are three classes of sales. They are, first, cash sales, second, reasonably short time sales where the buyer has a good financial standing in Dunn and Bradstreet, but whose ready cash is limited, and third, the time payment sales where the buyer has poor rating and a risk is taken in selling him. Mr. White pointed out that good business would sanction making sales in the second class, but that in the third, they should be undertaken guardedly after thorough investigation of the case. He dwelt upon the importance of exacting monthly payments in the latter kind of deals, as it beats the system of agreeing to take the balance in a lump sum in 6 months or a year. The security in the truck is always getting better with the monthly method.

Cost of Handling Important

The cost of handling time payments is of great importance, Mr. White said. He cited the sewing machine business, with which he is also connected, as being a good example of time payment plans in their most aggravated forms, because such goods are sold in small instalments to workers, and the like. In this line, the loss is about 10 per cent. but the cost of handling is not over 1 per cent. as one man and a stenographer can handle a million dollars worth of it so far as the office work is concerned. Mr. White has also found that it does not hurt the business to repossess goods when the buyer does not meet his payments. The public rather regards it as good business on the part of the seller.

All agreed that time payments were a good way to conduct the selling in cases where proper security is given. Methods of working this through dealers were discussed, and the brokerage business in payment notes was taken up. It was evident that the delegates thought notes a necessity to such transactions.

Dealer Best Selling Channel

C. W. Squires, Jr., sales manager, General Vehicle Co., suggested that dealers not be allowed their commission on time sales until all the payments have been made. The manufacturer takes the risk, he said, and since he has to wait for his money, the dealer ought to also. This would tend to discourage partial payment sales unless absolutely necessary.

R. O. Patten, truck sales manager of the Pierce-Arrow company, read a paper in which he answered the question: Can a Dealer Make Money Selling Motor Trucks? He believes the dealer to be the most satisfactory channel through which to sell trucks, providing he gets the cooperation of the manufacturer. Ordinarily he has too little ammunition from the maker. Not enough confidence is placed in the dealer who should know such things as chassis weight, horsepower, speed, gasoline consumption, etc., and thus could talk intelligently to the prospect without making extravagant statements. The prospect often gets the impression of being deceived through no intention of the dealer.

Dealers can make money if the factories operate in an educational way, if they do not cut prices nor give too much service free, and if they only take in old cars on a proper basis. These were the general sentiments on the subject.

Need for Standard Load Rating

H. Kerr Thomas submitted a formula for arriving at a standard load rating, which he believes would apply with justice to all trucks. This would prevent much of the present difference in rating when one make of truck rated at 2 tons, for example, is smaller than another 1 1-2-ton make. The Thomas formula would take into consideration road weight, load capacity, size of engine, gear ratio and so on. It was praised though no action on it was taken at this time.

E. T. Birdsall said that the Thomas formula seems a good method of rating, but it has its limitations. In applying it to small sizes of trucks he finds that it brings the motor too small for the car, and from a selling point of view it is not advisable to put a small motor in the vehicle even if it will do the work. It is particularly good, though, because it is based upon practice with a number of makes of cars.

Future of Electric Truck

The future of the electric truck was considered in a paper by P. D. Wagoner who said that the future of this type of car is the future of electricity. He believes that to electric trucks is due the credit of having borne the brunt of truck introduction, for they were first in the field, and did the missionary work of showing the public how much they had the advantage over horses. This led the gasoline makers to enter the field. The slowness of the electric truck business is laid to the lack of knowledge of what they will do, and to the enterprise of the gasoline machine salesmen. The future of the electric does not lie in displacing the gasoline type, but rather in displacing the horse and working in cooperation with the gasoline type. Both types have a field, and in its field, the electric is supreme, Mr. Wagoner explained.

Investigate Service Conditions

Vernon Munroe, president of the International Motor Co., dealt with the subject of, Why Service Conditions Should Be Investigated and Recommendations Made Before Selling a Customer. The truck business should be reduced to a machinery basis, he said, and each installation carefully considered before making the sale, because this pays in the end.

W. P. Kennedy, traffic engineer, emphasized the importance of conservative investigation of proposed installations, particularly quantity installations. High priced traffic men are not justified in the organizations of the average truck maker of the present unless such men can be made to serve other purposes as well. In making an investigation looking to the installing of one or more trucks, Mr. Kennedy cited instances to show how important it is to deal with the man having the final say as regards purchase thus saving time and trouble. Often the expense of an investigation can be worked so as to have the purchaser bear a share of it, since he is getting valuable information as to how best to operate his vehicles at the same time he is being shown the advantages of the make under trial.

David Beecroft, Directing Editor Commercial Vehicle, pointed out the need of having buildings properly constructed so as to shorten the loading and unloading waits, which are the biggest factor against efficient truck operation. These delays are due to improperly designed loading docks, freight terminals, narrow and congested streets, and so on. Special vehicles for special service were also his plea.

Legislative Co-operation Advised

The sentiment was also expressed of cooperating with legislators to get laws which will not be oppressive. At this time many adverse bills are in prospect, but rather than try to buck the legislators, the N. A. C. C. and the manufacturers individually should seek to work with them to get the best laws that are possible. It was felt that with the increasing use of motor vehicles, taxation for roads must come to a greater extent for the communities themselves cannot afford the expense. Thus it should be seen to that if such heavier road taxes are imposed the money be actually put to road improvement purposes rather than being diverted to other civic channels.

How to Improve Conditions

J. W. Van Allen of the Atterbury Motor Car Co., Buffalo, gave his ideas of what can be done to improve the truck business. He outlined the existing difficulties that militate against efficient truck service, touched upon the promiscuous service methods in vogue, the evils of the used car side of the business, the dangers of price cutting, and suggested some remedies.

The discussion of his paper showed a sentiment against the small maker who is getting into the business to assemble a few cars and often sells them at ridiculously low prices to get started. They believed the parts makers to blame for this condition, but when it is considered that the latter makers can never tell when a small fellow will grow into a real factor, they can obviously not discriminate if they are looking to the future and do not want to take any chances of losing good trade later.

N. Y. Car Registrations Are 159,715

Albany, N. Y., May 8—Registrations in New York City in 1915 show a 33 1-3 per cent. increase over last year, according to an official statement issued by Secretary of State Hugo.

From February 1 to April 16, inclusive, 17,138 cars, 40,918 chauffeurs and 567 dealers received licenses, as against 52,034 cars, 35,984 chauffeurs and 492 dealers registered last year. This shows a gain of 25,104 cars, 4,934 chauffeurs and seventy-five dealers over 1914.

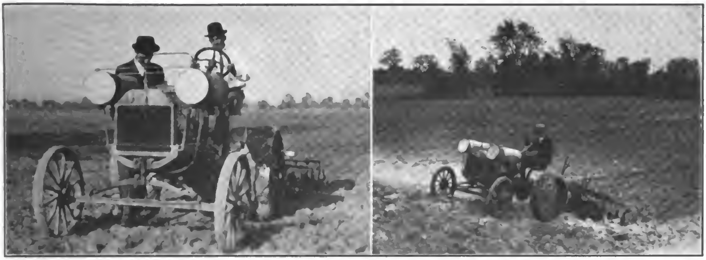
Taking the whole state, 159,715 cars have been registered this year, as against 99,849 last season. The total number of chauffeurs registered is 57,462, as against 47,262 last year, while there are 1,795 dealers registered, as against 1,394 in 1914.

The total fees collected from automobilists amount to $1,251,572, as against $954,714 collected in 1914.

Ohio Cars and Trucks Number 120,500

Columbus, O., May 8—According to a statement issued by Ohio Registrar of Automobiles, W. H. Walker, covering the period from January 1 to April 15, automobiles, including trucks, to the number of 120,500 have been registered. This is almost as many as was registered during the entire year 1914, which number was 122,504.

Chauffeurs to the number of 9,535 have been registered. It is expected that there will not be as large increase in chauffeurs' licenses proportionately as in the number of motor cars.



Two views showing the new Ford farm tractor in actual operation. It is planned to manufacture this machine to sell for $200

Ford Farm Tractor for $200

Will Be Able To Do Work of Six Horses—Said To Have Proved Satisfactory Under Severe Tests

DETROIT, MICH., May 11—The Ford Motor Co. will place on the market next fall a motor tractor for farm usage which it hopes to list at $200. It may be a little more, but the company expects that it will be $200.

During the last 3 or 4 months severe tests were made in a secluded spot with the first tractor and these trials gave the utmost satisfaction to the officials. The tests were made under all kinds of soil and weather conditions, in hard ground and deep mud. Just as with the Ford passenger cars, the principal aim of the company was to bring out a tractor, the price of which would be within the reach of almost any man of moderate means.

Similar to Passenger Car in Appearance

All the details are not yet available, but the tractor will have much of the familiar Ford car appearance. It will have the same motor, front axle and radiator, but a much stronger and shorter frame. Above the motor, supported by strong arms will be carried two large water tanks. The rear wheels will be 12 inches wide and with flanges and spikes padded. The weight now is 1,600 pounds but it is expected that this will be reduced to 1,500 pounds. The tractor will be able to do easily the work of six horses, and it is expected that it will revolutionize farming methods, just as the passenger car has so changed traveling on the road.

Well Along on Production

Within the next 2 months and 26 days the Ford Motor Co. need only build 89,567 cars in order to make good its schedule of 300,000 within the fiscal year ending August 1. This, because up to May fifth and since beginning of last August there have been made and shipped 210,433 Fords. Officials say that the scheduled output will be completed by July 1 and that it is quite likely that when the fiscal year ends very nearly or even a little more than 350,000 cars will have been made.

Ford Leads in Bay State Registration

BOSTON, MASS., May 8—The registration of motor cars in Massachusetts for the first quarter of 1915 shows the Ford to be the big leader again this year, with 10,362 machines listed. It has three times as many as its nearest rival, the Buick, which shows 3,134. The Cadillac looms up third with 2,709. The Packard is the first of the higher priced cars listed with 1,951. Then comes the Overland in fifth place with 1,775. The Studebaker is a good sixth, having 1,389. For a car that has been on the Massachusetts market but a few years, the Hudson has done remarkably well and is seventh with 1,328. The Chalmers is in eighth place with 1,160, and the Pierce-Arrow stands ninth with 1,078. The latter ranks second in the high-priced class. These nine are the only ones that rank above the 1,000 mark. The Maxwell is tenth with 945. In the first twenty-five makes registered those listed after the Maxwell comprise the following in this order: Stevens Duryea, 832; Reo, 776; White, 589; Pope Hartford, 573; Metz, 544; Peerless, 529; Oakland, 512; Jeffery, 494; Franklin, 445; Hupmobile, 413; Winton, 343; Knox, 338; Autocar, 327; Stanley, 296; Jackson, 287; Stearns, 283. Last year during the first few months the leading ten makes were in this order: Ford, Cadillac, Buick, Packard, Pierce, Chalmers, Stevens, Studebaker, Overland, Hudson.

NEW YORK CITY, May 8—The 600 employes of the Robert E. Dietz Co., manufacturer of lamps, are remembered in the will of Frederick Dietz, president of the company who died on March 31, this year. The bequests to the employes are arranged according to their length of service. About 300, who worked for the company for less than 5 years, receive $25. Some of the beneficiaries work in the Syracuse factory and others in the New York establishment.

Ball Bearings in Theory and Practice[*]

Part I

Modern Methods Produce Balls Accurate to .0001-Inch—Practical Formulae for Calculating Carrying Capacity of Radial Bearings

By B. D. Gray,
Vice-President and Manager of the Hess-Bright Mfg. Co.

THE anti-friction qualities of ball bearings have long been known. Until recent years, however, the ball bearings actually devised have been unreliable. While they lasted, they ran well, but they broke down too easily, the principal reasons being: faulty design; the use of steels insufficiently hard and not uniform; and inaccuracies of size and form, which resulted in unequal loading of the balls and the consequent destruction of those overloaded.

Very little reliable information of value on ball bearings is to be found in the usual engineering and textbooks even today. Seventeen years ago there was little of any kind extant. About that time, 1898, Professor Stribeck, the well-known head of the technical laboratories at Neubabelsberg, near Berlin, was commissioned by one of Germany's leading industrial establishments, to make an investigation of sliding, roller and ball bearings. Having taken up the manufacture of balls and ball bearings, this firm, the German Small Arms and Ammunition Works, (the DWF) Berlin, very soon felt the imperative need for a scientific basis, if the manufacture were to be removed from the domain of haphazard, blind working, resulting one time in success and another time in failure—one quite as much the result of pure chance as the other.

With characteristic thoroughness, Stribeck began with first principles, starting from the investigations of such authorities as Hertz and Auerbach on the deformation of elastic bodies.[†] Exhaustive tests served to fix the physical constants of the steels that might be suitable. Then followed a series of investigations into the conditions of correct relative motion of the bearing elements. Finally a long and patiently conducted series of observations of many types and sizes of bearings rounded out the whole. Various tentative designs were thus tested out at every point and, more important, practical working data for the use of the designer and the engineer were authoritatively obtained. As a result, the following requirements which form the basis of Hess-Bright ball bearing construction were formulated.

1. Annular rather than cup-and-cone design for radial loads.
2. Use of alloy steels of much more than ordinary toughness and hardness.
3. Microscopic accuracy of size and form, down to a small fraction of a thousandth of an inch, in order that each ball may bear its share of load.
4. Uniform hardness from surface to center of both balls and races.
5. A mirror-like polish as a final touch to perfectly ground surfaces.

Difficult as the production of a perfect ball is under ordinary shop conditions, specialists can now manufacture balls that are true spheres to within one ten-thousandth part of an inch, at relatively small cost. This led to numerous attempts to employ a series of rows of balls instead of rollers, in none of which was proper provision made for taking care of the deflection of the shaft and box under load. After an endless number of expedients to provide for proper load distribution had been tried without success, the simple plan of using a single row of balls and that of suitable proportion for the load was adopted. This resulted in a journal having no appreciable length and accordingly free from trouble caused by deflection. (Hess-Bright annular bearings will permit tilting the inner race, with respect to the outer race, approximately 1-8 inch to 1-4 inch in 12 inches, this being dependent upon ball size, groove radius, and clearance between ball and grooves.) The problem was then to proportion the diameter and the number of balls to the load to be carried. As the number of balls in a single circle was necessarily limited and as the journal diameter could not be indefinitely increased, it became important to develop the carrying capacities as affected by the shape of the ball tracks and the nature of the materials. The necessary design data were found to exist in the observation and experiments conducted by Stribeck.

It was found that the frictional resistance was least for balls rolling between straight line sections, or perfectly flat surfaces, giving two points of contact. Increasing the points of contact to three and four produced higher frictional resistance without materially affecting the carrying capacity. Curving the race resulted in an important increase in carrying capacity, with a barely measurable increase in friction. This greater carrying capacity is accounted for by the fact that in a rolling bearing, in the absence of grit, there is no wear as in a sliding bearing, but a destruction by crushing of the surfaces in actual contact. This point in the race, when overloaded, is flaked out. If, in a ball bearing, the race is curved, the stressed particle cannot be flaked or pushed out, being confined and supported by the wedges of material on either side. The resistance to crushing is thus greatly increased by curving the race.

Formula for Carrying Capacity

From his experiments, Stribeck developed the following equation for the carrying capacity of an annular or radial bearing:

$$P = k\ d^2 \frac{n}{5} \text{ in which}$$

$P =$ carrying capacity of bearing in pounds.

$d =$ ball diameter in eighths of an inch, e. g. 1-2 inch diameter ball, $d = 4$.

$n =$ number of balls in bearing.

$k =$ a constant dependent upon the material, the shape of the ball supporting surface, and the speed.

This is the commonly accepted equation for determining the carrying capacity of a radial bearing and one much made use of by those exponents of the theory that the carrying capacity of a bearing is directly proportional to the number of balls contained. Other things being equal, this would be true, but it must be borne in mind that the race cross section plays a vital part also in determining the carrying capacity of a bearing. Any device that may be employed for the insertion of a larger number of balls than can be gotten into the bearing by eccentric displacement, such as filling slots, making one side of the race groove shallow, etc., weakens the race and hence results in a decreased carrying capacity. A bearing with continuous rings, deep ball grooves, and as many balls as can be inserted without forcing, makes the best bearing. These stiff rings are susceptible of extreme accuracy of manufacture, and maintained accuracy in service, even though mounted in slightly out of round housings.

---

[*] Note—From a paper read before the Electrical Vehicle Assn., of America, Philadelphia, April 14, 1915.

[†] See Hertz, on the Contact of Elastic Bodies; also Ball Bearings, a paper by Henry Hess before the A. S. M. E., at Indianapolis, Ind., May, 1907, and contained in Volume 29 of the Transactions, which contains a translation of Professor Stribeck's report.

A few tests of deep groove bearings and other makes with larger number of balls will, I believe, prove interesting and at the same time bring out clearly the point which I wish to make. In these tests bearings corresponding to D. W. F. No. 308 were tested under a radial load of 2,500 pounds at 1445 r.p.m. The rated steady load carrying capacity of a No. 308 bearing at 1445 r.p.m. is approximately 775 pounds. The radial load of 2,500 pounds was selected in order to bring about quick results, since the number of hours run before failure occurs is all that is needed for comparative purposes, and gives a true indication of the relative endurance of the bearings.

Bearing	Number and Size of Balls	Hours Run Before Failure	Remarks
H.B. No. 6308	8 9/16"	186¾ hours	Deep groove type
H.B. No. 6308	8 9/16"	176¾ hours	Deep groove type
"A"	13 9/16"	87½ hours	With filling opening
"A"	13 9/16"	79 hours	With filling opening
"B"	8 9/16"	55¼ hours	With filling opening
"B"	8 9/16"	59¾ hours	With filling opening
"C"	11 9/16"	32 hours	With filling opening
"C"	11 9/16"	46¼ hours	With filling opening
"D"	30 7/16"	19½ hours	Two rows of balls
"D"	30 7/16"	26 hours	Two rows of balls
"E"	13 9/16"	47½ hours	Very thin races with filling opening
"E"	13 9/16"	47 hours	Very thin races with filling opening
"F"	12 0.610"	63¾ hours	With filling opening

To assemble balls into a bearing having flat races is simple enough, but when the race is curved some provision must be made for inserting balls in excess of those introduced by eccentric displacement. The obvious thing is to cut a narrow cross channel, known as a side-filling opening. But as the carrying capacity of a ball bearing with uninterrupted race section is greatest, it follows that any opening for the side filling of the balls, which would break such section, would correspondingly locally reduce the capacity. Such an opening would have to be kept on the unloaded side of the bearing, or avoided altogether. Riebe's design, our first development and the predecessor of the present annular ball bearing was of this kind. The balls were introduced through a cut in one race at the side, the continuity of the race being restored by a "filling in piece," Fig. 1. Still the cut constituted a weak point, and a screwhead was utilized to keep this joint at the unloaded side.

Conrad Invented Continuous Race

To Conrad belongs the merit of eliminating the filling opening and providing an annular bearing of continuous race and uninterrupted groove, Fig. 2 and 3. Incidentally, also, all of the troubles due to interference between balls and filling opening edges were done away with. To assemble this bearing, now generally known as Hess-Bright, HB or DWF, the inner race is placed eccentrically with the outer, the balls are filled into the crescent-shaped space between, the races are centered, the balls are distributed and a cage is provided to maintain the proper distribution, to prevent the balls from rubbing against each other, and incidentally forming a unitary device.

The problem of producing a successful ball bearing was not solved with the adoption of the proper cross section and form. It has already been pointed out that truth of shape is necessary to true rolling and the avoidance of sliding. Loading must inevitably cause some distortion and so introduce sliding action. This sliding action must be minimized by using materials sufficiently elastic to avoid permanent deformation. This demands steels of the very highest grade, most carefully hardened, and eliminates all case-hardened materials. These demands made on the ball material are made on the race materials in even higher degree. In time, the entire surface of the ball is presented to the load, vibration or change of load, either in amount or direction, sufficing to frequently bring in a new axis of rotation. As one of the races is usually fixed, it always presents the same point to the action of the load. It may safely be said that only the advent of high-grade alloy steels has made the ball bearing possible as a heavy load-bearing machine element. They are being used with satisfaction in automobiles, electrical, flour, and woodworking machinery, in street railway motors, on street and steam railway main journals, in line shaft hangers, and in countless other applications where power economy and freedom from wear are desired.

Naturally, satisfactory service from a ball bearing can only be secured when the bearing is designed to conform to the service for which it is intended. The elements entering into such design are the direction of the load, whether at right angles (radial) to the shaft, parallel with it (thrust), or acting at an angle. Within each type, sizes are affected by the loads and by the speeds. Bearings are further affected in their relative arrangement by varying combinations of load-direction, load and speed.

Ball Diameter Governs Shock Resistance

Bearings for carrying radial loads are commonly known as radial or annular bearings. Resistance to the shock of a given load is greater, the greater the ball diameter. When shock is present, of two bearings having the same carrying capacity, that having the larger balls should be used. Radial bearings, as commercially manufactured, are made up in three series—light, medium, and heavy weight series.

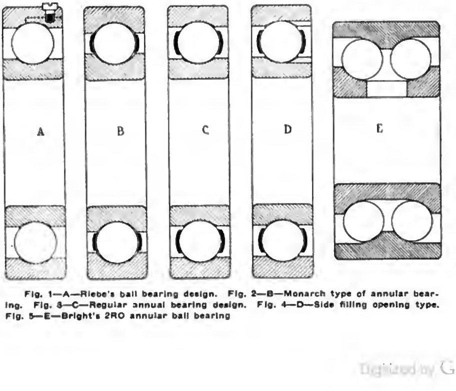


Fig. 1—A—Riebe's ball bearing design. Fig. 2—B—Monarch type of annular bearing. Fig. 3—C—Regular annual bearing design. Fig. 4—D—Side filling opening type. Fig. 5—E—Bright's 2RO annular ball bearing

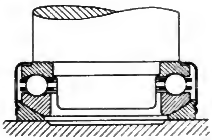


Fig. 6—Thrust bearing with spherical seat.

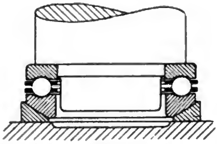


Fig. 7—Thrust bearing with a lining washer.

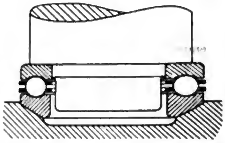


Fig. 8—Thrust bearing with a lining washer and inclosing case

Thus for a given bearing bore, a choice between three sizes of bearings of increasing capacity and ball diameter is afforded.

Bearings for carrying thrust, that is, load parallel to the axis of the shaft, are commonly known as thrust bearings. In these, the ball tracks are arranged in planes at right angles to the shaft axis. To secure the full carrying capacity, the two collars must be in practically absolute parallelism. A deviation of less than .0001-inch will concentrate the entire load on a few balls at one side, overload these and reduce the bearing capacity. To secure exact parallelism between the shoulders on a shaft and the housing seat, even under deflection and the small yet important and unavoidable errors of workmanship, one collar is generally given a spherical surface, Fig. 6, which permits it to adjust itself in its correspondingly cupped seat and thus secure the parallelism required.

Radial bearings are capable of carrying considerable thrust load, amounting in the deep groove or Monarch type to about 25 per cent. of their rated radial capacity. Where it seems desirable to subject radial bearings to thrust load, it is advisable to consult with the bearing manufacturer.

Angular loads may be carried on our 2RO bearing, Fig. 5, or by a suitable combination of radial and thrust bearings, since all angular loads may be resolved into radial and thrust components.

Mention has been made before of the necessity for precision in manufacture, and it may be stated as an axiom in ball bearing manufacture that "the value of a ball bearing is in direct ratio to the accuracy attained in the manufacture of its component parts, and the suitability of the material entering into them." The limits of tolerance are much smaller than are generally considered feasible. The finish of the working surfaces of the balls and races must be of the highest. Grinding or polishing marks that may be detected, by the eye, condemn balls and the ball tracks utterly. Oft-repeated endurance tests under conditions where the finish was the only variable, abundantly proved this, at first unsuspected, fact. The higher the finish, the better the endurance of the bearing. Micro-photographs of ball surfaces reveal that what appears to be an absolutely flawless surface is in reality composed of fine scratches, pittings and even gash-like defects, according to the care devoted to the final operation. Mere polish alone will not do; the polish must be the final touch applied to truly ground shapes.

Balls Must Be of Same Size

The balls must represent as close an approach to true spheres as it is possible to realize. Moreover, all of the balls in a bearing must be closely alike in size, the allowable variation being extremely small. It is evident that a ball larger than its fellows must receive more than its share of the load and therefore transmit a correspondingly greater pressure to the race, resulting in excessive and unsafe loading for both elements. On the other hand, an undersized ball will be underloaded, or not loaded at all; its fellows, having to take its share of the burden, must correspondingly carry more than their proportion. Variations from truth of outline have effects locally similar to size variations. To secure the necessary even division of load, the balls in a bearing may not vary more than .0001-inch from one another and from truth of shape. That this demands the most painstaking accuracy of manufacture and rigid inspection is clear.

To insure interchangeability of the bearings, the bore of the inner race and the outside diameter of the outer race are held to within a few ten-thousandths of standard size, the former being determined by proper plug gauges, the latter by snap gauges. By means of special fixtures, the eccentricity of the inner and outer races can be accurately determined. The eccentricity of the inner race is that lack of running truth noticed upon the stationary outer race when rotating the inner race and balls upon true centers. The eccentricity of the outer race is that lack of running truth shown upon a suitable indicator during the rotation of the outer race and balls upon the inner race fixed upon a stationary arbor.

But not only is accuracy in shape essential; a similarly high degree of precision in the physical characteristics of the steels is quite as essential. While the determination of uniformity of dimension is a matter of accurate measurement by methods highly refined yet familiar to many, the measurement of material quality, particularly of hardened steel, is by no means simple. Very little is, in fact, really known about the qualities of hardened steel. Ask half a dozen men, good mechanics, engineers, metallurgists or scientific investigators, what constitutes hardness, from an absolute standpoint, they will not agree on a definition since hardness is comparative, only. Various methods of determining comparative hardness are used, the two most commonly employed being the Brinell and scleroscope tests.

The Brinell test is founded upon the effect produced on a substance by a known load pressing through a spherical ball into the surface of the material to be tested. The method of working is as follows: The weight or load given in kilograms is generally 3,000 for iron and steel and 500 for softer metals and alloys. The pressure is applied hydraulically by means of an oil pump and is transmitted through the plunger to a hardened steel ball 10 millimeters in diameter, which makes a cup shaped impression on the test piece. From the diameter of this impression, the diameter of the ball and the load a formula has been developed and a table of hardness numerals computed. From this table you can readily read off the Brinell hardness numeral, knowing the load and the diameter of the indentation. This test is not very suitable for hardened rings, since having the same degree of hardness as the ball used, the indentation is small, difficult to measure and likely to introduce error.

In Shore's scleroscope a small cylinder of steel, with a diamond point, inclosed in a glass tube with graduations of arbitrary units, is allowed to fall upon the smooth surface of the material to be tested. The hardness number is the height of the rebound of the hammer. The hammer weighs slightly over 1.5 grammes. The height of the rebound from hardened steel is in the neighborhood of 100 on the scale, or about 180 millimeters, while the total fall is about 10 inches, or 254 millimeters.

After all, the final test is the finished bearing. At frequent intervals completed bearings from regular lots passing through the shops are subjected to tests for load capacity and for endurance by running them under various conditions of load and speed in special testing machines built for this purpose.

Ball bearings do not differ from other elements of mechanism, in that they must be used in conformity with their individual characteristics. Directions for correct mounting that are hereafter cited must be absolutely adhered to under penalty of failure.

A strict adherence to all of the directions, and they are neither many nor troublesome, will result in a reliability as near to absolute as even the most exacting can expect, a reliability far beyond that of any other form of journal, and such reliability is gained with the advantages of a practical absence of friction, small space occupied, and the minimum of attendance. Surely these are advantages enough to make a careful study and following of the directions worth while.

Correct Bearing Care

1—The proper size selection for the load must be made. Rated capacities are usually for steady loads and speeds. Variations from these conditions demand recognition by corresponding variations of the listed capacity.

2—Bearings must be lubricated. The oft repeated statement that ball bearings can be run without lubricant is pernicious.

3—Bearings must be kept free of grit, moisture and acid. This prohibits the use of lubricants that contain or develop free acids. It is entirely practicable, by very simple means, to follow injunctions 2 and 3.

4—The inner race must be always clamped solidly to the shaft, so that no vibration can cause it to turn. This requires that the shaft be ground perfectly true, in order that it may make contact with the race all around, not merely at a few points. Unless this is done, a peening action will start, resulting in looseness. The race itself should be mounted with a light press fit, and very solidly clamped between a nut and shoulder.

Outer Race Must Permit Slow Creeping

5—The outer race must be mounted in such a manner as to permit slow creeping. This has two beneficial effects. First, it avoids any possibility of an undesired endwise cramping of the balls in the race; second, such minute wear as occurs in the ball path is distributed around the entire circumference of the latter. To accomplish these results the housing must be accurately bored to such a diameter that the outer race will be a sucking fit in it, and the race is either left entirely free endwise or is confined between shoulders which give it a slight endwise freedom amounting to 1-64 inch or less. Only one bearing on a shaft may be confined endwise in this manner, since otherwise expansion or errors in machining or workmanship would produce undesirable axial or endwise cramping.

6—The bearing enclosures must retain oil or grease, while excluding dust and water.

Finally, after having observed the above precautions, submit your design to the bearing manufacturer and get the benefit of his experience. By so doing, many little things which you, from your experience may consider of minor importance, but which he, from his broader experience knows are pernicious, may be avoided.

(To Be Continued)

Record Demand for Tool Steel

By Consul John M. Savage

SHEFFIELD, ENGLAND, April 16—The most striking feature of Sheffield's trade today is the remarkable boom in high-speed steel. In the history of the trade nothing approaching the present demand for this article has heretofore been experienced; in fact, the present colossal requirements have never been dreamed of. Not only are orders numerous, but they are of tremendous size and value. These orders, in addition to British sources, come from Russia, France, Italy, and the United States. One order received this week from Russia amounted to 100 tons. This does not seem a large quantity when speaking of steel to those unfamiliar with the trade, but the importance of the order can be gauged by the fact that this material is quoted by the pound, and the price today is from 1s. 8d. (41 cents) to 4s. (97 cents), as against 1s. 4d. (32 cents) to 3s. 6d. (85 cents) in normal times.

An immense quantity of this steel is necessary in the production of armanents, and every engineering shop in England is busy on this work.

The resources of this city for meeting the increased demand are totally inadequate, many firms having been compelled to refuse orders because of their inability to take on additional business.

In the manufacture of high-speed steel the principal alloys used are tungsten powder or ferrotungsten, ferrochrome, and ferro-vanadium, and the supply of these alloys has failed to a great extent, which has been a further handicap to manufacturers.

High Tungsten Prices to Prevail

Prior to the war it is estimated that Germany supplied 90 per cent. of the tungsten used by British manufacturers, and since then this source of supply has been entirely cut off. British firms are endeavoring to supply this deficiency and expect to be able to place their products on the market by midsummer, although there is no certainty as to this. In any case it is thought the present high prices prevailing will continue throughout the year.

Ferrochrome (4 to 6 carbon) has advanced from 30 to 35 per cent.

The price of vanadium has remained stationary, owing to the fact that almost the entire supply comes from the United States, where there is ample production.

Ferrotungsten has advanced from 2s. 4d. (57 cents) to 4s. (97 cents) per pound of tungsten contained in the alloy.

Tungsten powder (from 96 to 98 per cent. pure) has made the phenomenal advance from 2s. 4d. (57 cents) to 5s. 6d. ($1.34) per pound.

In former times tungsten powder was the favorite form of wolfram used by local manufacturers. Since then, however, owing probably to the difficulty experienced in procuring wolfram in this form, ferrotungsten is being extensively used.

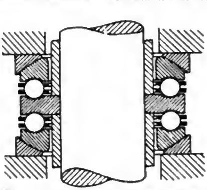


Fig. 9—Two-direction thrust bearing with spherical seats

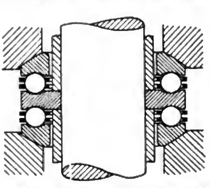


Fig. 10—Two-direction thrust bearing with a lining washer

The Rostrum

Oiling System of 1913 Pope-Hartford

EDITOR THE AUTOMOBILE:—Please explain the oiling system and how it should be regulated on a 1913 Pope-Hartford 40-horsepower touring car?

2—Kindly give me a diagram of the wiring of all the Gray & Davis lights, generator and starter, and also kindly explain how I can make the lights brighter.

3—What are the largest size bulbs which I can use in my headlights? It is equipped with a Gray & Davis starter and generator.

Newark, N. J. N. P. HANSON.

—A mechanical oiler M, Fig. 2, is located on the crankcase having a large suction pump and in addition to this a stand pipe which is used as an overflow permitting oil, when it reaches the level of the standpipe, to run back through the standpipe into the crankcase. The bottom half of the crankcase is constructed with an oil reservoir underneath and cast integral with it. The bottom half of the crankcase is provided with a standpipe, fitted with gauze which acts as a strainer, the standpipe maintaining at all times a predetermined level in the crankcase while the surplus flows through the gauze and is strained before it reaches the reservoir. There are two large additional strainers and located at either end of the case to carry off the surplus oil when going either up or down hill. The crankcase is also provided with a copper filling tube N about 1 inch in diameter and fitted with a screw cap on top to provide a means for supplying the crankcase and reservoir with oil. The case is provided with a petcock for use as a gauge when the reservoir is being filled and the reservoir is provided with a petcock in the bottom part which also acts as a gauge to determine if there is a supply of oil in the reservoir.

Filling System with Oil

In supplying the lubricating system with oil, first fill the mechanical oiler M. When this is done the surplus oil will run through the overflow pipe above described, into the crankcase which will leave the proper amount of oil in the oiler. Then remove the cap from the top of the filling tube on the crankcase, previously described, and open the upper petcock, the one in the crankcase already described, and pour oil in the filling tube until it runs out of this cock. This will take in the neighborhood of 3 gallons of oil. The best results can be accomplished by having the car in as nearly a level position as possible when it is being filled with oil and the petcock should be left open until the oil ceases to flow. You will then have the correct amount of oil in the crankcase and the motor is ready to start. In addition to the pumps in the oiler forcing oil to the cylinders a large suction pump sucks oil from the reservoir in the crankcase into the mechanical oiler maintaining a proper quantity of oil, the surplus running through the overflow pipe into the crankcase, whence the surplus oil runs through the strainers to the reservoir, from where it is again pumped up to the oiler, taking care of the lubrication as long as any oil remains in the reservoir or the oiler.

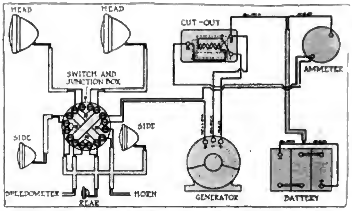


Fig. 1—Wiring diagram of the Gray & Davis system as used on the Pope-Hartford for 1913

Oil should be added through the filling tube every day, depending upon the number of miles the car is run, always opening the upper petcock to make sure that the proper quantity of oil is supplied and allowing it to remain open until oil stops running. If it is desired at any time to know whether or not it is necessary to replenish the oil in the crankcase, open the bottom petcock; and if no oil comes out of this cock the oil should be replenished at once, as this shows an absence of oil in the reservoir. The car can be driven with safety as long as any oil comes out of this petcock and when the oil is at such a point in the reservoir that it will not run out of this cock the car can still be driven until the mechanical oiler is empty. It is important that the oiler be adjusted to feed so that one drop only at a time will show in sight feeds to each cylinder.

The supply is regulated by adjustments which are located on top of oiler M, Fig. 2. No. 1, the one nearest the radiator, regulates the oil supply to No. 1 cylinder. No. 2 regulates the oil supply to cylinder No. 2. No. 3 regulates that to cylinder 3. No. 4 governs that to cylinder 3, and No. 4 regulates the supply to cylinder 4. By screwing these up you decrease the supply. Individual feeds are on top of oiler.

2—The Gray & Davis system which was used on some of these cars is illustrated as regards the wiring diagram in Fig. 1. The lamps cannot be made brighter except by using lower voltage ratings, thereby producing a greater glow at the filaments. The trouble with this scheme is, however, that the lamps burn out so rapidly that it does not pay.

3—You should use 6-volt 24-candlepower double-contact bulbs in your headlights.

Fuel Tested at Indianapolis Speedway

Editor THE AUTOMOBILE:—I have noted in several back issues of THE AUTOMOBILE articles in regard to a new fuel that was being tested by a man from Pennsylvania and which was also tested at Indianapolis Motor Speedway. I understood that there was a company formed to manufacture this new fuel but have not been able to find out any more about it. Has the new fuel proven a failure or is the company preparing to market it?

Troy, O. W. M.

—You are probably referring to Zoline which was tried out at the Speedway at Indianapolis but which was found to be a more expensive product to manufacture than gasoline. For this reason it was abandoned.

Using the Motor as a Brake

Editor THE AUTOMOBILE:—What effect does the practice of using the motor as a brake coming down a hill have on the mechanism of an automobile?

2—Which is the more economical, that is to use the above method and save gasoline and brake bands, or to use the service brake in order to save the mechanism of the car?

Johnstown, Pa. H. H. M.

—The use of the motor as a brake is generally conceded to have a more or less deleterious effect on the gears. The power through the gears is reversed since the car is now tending to drive the motor. Thus instead of having the step-down reduction we have a step-up with consequently more surface pressure on the teeth and hence more abrasion.

2—It would not seem, in view of the above, to be the correct thing to do to habitually use the motor as a brake. It is better by far to use the brake in the way in which they are intended. One should not abuse even the service brakes but should always endeavor to bring the car to a gradual rest with as little use of the brakes as possible.

Apple Used Timed Dynamo in 1909

Editor THE AUTOMOBILE:—Do you or any of your readers recall an Apple ignition system which was brought out in 1910 or 1911 in which a shunt-wound dynamo was employed with a storage battery floating on the line, and an igniter contrivance driven in timed relation to the engine?

Cambridge, Mass. AUTO WIND SHIELD CO.

—The Apple Electric Co. made and installed quite a number of shunt-wound dynamos driven in timed relation to the engine in the years 1909 and 1910. Some of these installations had the timer and distributer drive, but as this was ahead of the dual magneto development, the engines were then built with the timer drive as regular equipment.

Speed of Regal Motor at Car Rates

Editor THE AUTOMOBILE:—What is the engine speed of Model N 1911 Regal roadster at 15 miles on high gear?

2—At 20 miles, at 25 miles and at 30 miles?

3—What is the gear ratio of a model N 1911 Regal on high?

4—What is the gear ratio of a five-passenger Cadillac, 1912, on high?

Oshkosh, Wis. L. W. HOLLISTER.

—With a rear axle ratio of 4 to 1, and 32-inch wheels at a car speed of 15 miles per hour the engine will be turning over 840 r.p.m.

2—At 20 miles per hour the engine speed would be 1,050 r.p.m. and at 30 miles per hour it would be 1,470 r.p.m.

3—The gear ratio is 4 to 1.

4—The gear ratio on many of these cars is 3.5 to 1.

Vibration at High Rotative Speeds

Editor THE AUTOMOBILE:—Can you tell me what might cause excessive vibration in a 1911 Reo? This starts at about 30 miles per hour?

The main and connecting-rod bearings have been tightened. There are new bearings on camshaft; new camshaft gears which take up play in timing gears, and the valves and magneto are timed correctly. There are two new rings on each piston with new wristpins. The flywheel has been tested for looseness and found to be tight. The motor is bolted securely to the subframe. The subframe rivets near the rear end of motor were found to be loose, were taken out and replaced by bolts. The bolts are perfectly tight now but will be replaced by rivets at the first opportunity.

GEO. A. WILKINS.

Taunton, Mass.

—As a general rule vibration is due to the initial design of a motor. The probabilities are that if the gear ratio was less so that the motor did not have to run at such a high rotative speed, you would not be troubled by the vibration at 30 miles per hour. The difficulty then, would be that you would not be able to negotiate hills as well on high gear.

There does not seem to be any cure for your trouble unless you go to the expense of fitting a lighter set of pistons and connecting-rods. These would have to be very carefully balanced. It might also be that the crankshaft is not in proper running balance, resulting in whipping and distortion at high speed which, in turn, causes excessive vibration. If this is the case, the difficulties which you will encounter in trying to remedy the trouble are much greater, since it will entail the re-designing of the crankshaft.

Spokes Guaranteed for 3 Years

Editor THE AUTOMOBILE:—How often must the spokes of wire wheels be adjusted? Do road shocks loosen the enamel so that they must be re-enameled at intervals?

2—Has the M. & S. differential been very widely adopted by manufacturers? Is this differential any heavier than the ordinary type? Would such a differential be advisable on passenger cars?

Beaver Falls, Pa. E. S.

—Wire wheels are generally guaranteed 3 years against the spokes coming loose or the wheels coming out of true. Wire wheel companies do not believe in their customers attempting to adjust their own spokes as a general rule, in fact some of the companies state that the wheel is guaranteed provided the spokes are never adjusted by the user.

Road shocks should not loosen the enamel any more than it should the paint or varnish on wood. The only reason for re-varnishing being when it is scraped off through rough service.

2—The M. & S. differential has been adopted so far by one truck concern and there are said to be other concerns which are negotiating for its use.

Magneto Can Run Anti-Clockwise

Editor THE AUTOMOBILE:—Will you kindly inform me whether a high-tension magneto that runs at crankshaft speed and rotates clockwise, can be timed or changed to rotate opposite or anti-clockwise, and if so, kindly show a diagram or drawing if necessary of how to make the change.

Lee, Mass. W. K. W.

—The magneto referred to can be changed to run anti-clockwise by simply removing the gears from the distributer and resetting them so as to carry the current over the points of contact throughout the full range of spark advance at full retard and at full advance. Simply take the gears out of

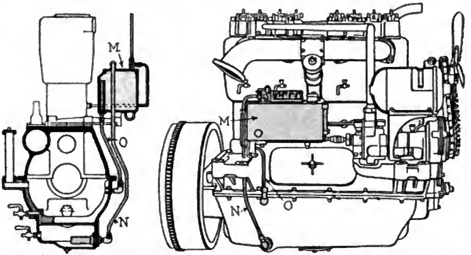


Fig. 2—Illustrating the oiling system used in connection with the Pope-Hartford 40

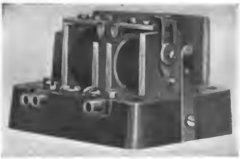


Fig. 3—Tirrel regulator for Remy system

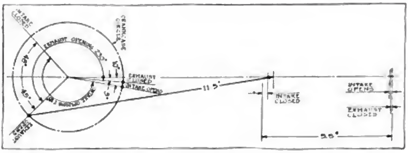


Fig. 4—Diagram showing the valve timing of Pierce-Arrow model 38-C

the distributer, revolving the armature by hand in an anticlockwise direction and when the position in which the armature turns requires a good deal of force to continue the turning, due to the pull of the magneto, insert the gear in the distributer so that it is just coming into the metal contact. If the model magneto referred to has a roller-type distributer, the same operation holds good except that the roller with the internal gear should be set so that the contacts are just meeting the small metal roller.

Bad Adjustment Causes Noise in Gears

Editor THE AUTOMOBILE:—Have a 1914 model Chevrolet Royal Mail. At low speeds there is a grinding sound in the rear axle, seemingly caused by the gears. How can this be remedied?

Baltimore, Md. A SUBSCRIBER.

—The cause is probably a poor adjustment between the bevel drive pinion and the crown gear and this can be remedied by simply adjusting the mesh between these gears. This adjustment can be made by removing the small hand hold plate located at the rear end of the propeller shaft housing and by turning a screw adjustment on the inside to the right or left to secure a tighter or looser adjustment of the bevel pinion as desired.

Six-Passenger Chandler Special Design

Editor THE AUTOMOBILE:—In THE AUTOMOBILE for April 8, I notice a cut of a six-passenger roadster body with the statement that this is now being built for a Chandler six chassis.

Will you kindly tell me whether or not the Chandler company is putting this out as a standard roadster type, or whether the body is specially built; and if so, the name and address of the builder?

Chicago, Ill. R. H. RIPLEY.

—The body referred to is a special job put out by the Brady-Murray Motors Corp., the New York agent for the Chandler company. It is not a stock body but is made to special design.

Why Pierce-Arrow Does Not Race

Editor THE AUTOMOBILE:—Will you please describe the 1915 Pierce-Arrow motor, showing and explaining the ignition, lighting and starting system.

2—Of the different races which I have seen and read about I have never noticed any Pierce-Arrow entries. Why is this?

3—How is this motor timed and what is the gear ratio?

4—Is there an automobile company putting out a 1915 car, four- or five-passenger torpedo body as stock?

5—Are there to be any free-for-all races in Michigan, Illinois or Wisconsin, this summer?

Waupun, Wis. J. B. BRIGGS.

—The motors used in the 1915 Pierce-Arrow cars were described on pages 300-303 of THE AUTOMOBILE for August 13, 1914. This description explains the ignition, lighting and starting system. It would take too much space to cover the matter here.

2—The Pierce company has never gone in for racing, but has devoted its attention to legitimate road contests, such as the Glidden tour and the Herkimer tour in Europe, considering such tests of more importance to the buyer of a touring car than the success of the special racing car, in all probability entirely different from the standard product. The company considers it a waste of time for manufacturers to enter such contests, although if races were won by a standard car of the type the public desires, it would be different.

3—The valve timing of the Pierce-Arrow 1915, 38-horsepower model is shown in Fig. 4. The standard gear ratio for the five-passenger model is 3.78 to 1.

4—There are a number of companies putting out stock 1915 models with four- or five-passenger bodies which they describe as torepdo. As a matter of fact, it has never been very clearly defined exactly what constitutes a torpedo body.

5—The Contest Board of the American Automobile Assn., New York City, has advised us that it will send you a list of free-for-all races to be held in Michigan, Illinois and Wisconsin this summer.

Warner Gears Were Fitted to Peugeot

Editor THE AUTOMOBILE:—If I understand correctly, the Peugeot car which won the Vanderbilt Cup and Grand Prix races was of foreign make throughout. Were there any gears used in the differential made by the Warner Gear Co., Muncie, Ind.? ROBT. M. COX.

Highland Park, Mich.

—The driving gears used on the rear axle of Dario Resta's Peugeot car which won the Vanderbilt and Grand Prix races were made by the Warner Gear Co., Muncie, Ind. This company made up a special set of gears with a higher ratio for the purpose of obtaining a greater speed.

Cord Tires Use Continuous Cords

Editor THE AUTOMOBILE:—Will you kindly define a cord tire?

My understanding is that it is a tire in which one or more continuous cords are used in place of woven fabric, regardless of the maker's name. Is this correct?

Charlotte, N. C. D. H. HOWARD.

—Your understanding of the construction of the cord tire is correct. The name of the maker of the tire has nothing to do with its classification under the head of cord tires or fabric tires.

Can Connect Ammeter to Old Wires

Editor THE AUTOMOBILE:—Can I install an ammeter which registers both charge and discharge; thirty points both ways, in place of the indicator? If this can be done, shall I connect it to same wires?

2—Kindly give me a diagram of the wiring of the Disco system which has a generator, motor and automatic cutout on the 1914 Paige 25?

New Brunswick, N. J. J. C. Hunt.

—The thirty-point ammeter can be installed on the wires of the indicator which you have on your car at present.

2—Referring to Fig. 5 the wiring diagram of the Disco starting and lighting system as fitted to Paige cars is given.

Two Methods of Remy Current Regulation

Editor The Automobile:—What can you tell me of the Remy lighting generator, past and present? I am interested in just one point and that is current regulation.

2—What prevents the Ford magneto generator from burning lights out with excessive voltage, at high speeds?

3—What method of current regulation is used on the Esterline?

Weymouth, Mass. H. R. Barker.

—The Remy Electric Co. has made a great many different sizes and types of generators, all of which, however, have been regulated by either the third brush method of regulation or by a Tirrel regulator.

The third brush method of regulation, Fig. 6, takes advantage of the fact that the magnetic flux of the generator becomes distorted at high speeds and bunches, or gathers, upon the sides of the pole piece faces. A third or pilot brush, which supplies current to the generator field winding, is located upon the commutator in such a manner that when this distortion of the magnetic flux occurs, it reduces the current which is supplied to the field winding. This reduction of the field current naturally causes a reduction of the generator output and prevents it from attaining a harmful voltage.

The Tirrel regulator, Fig. 3, with which many of the generators are equipped consists of a frame with a coil wound upon it thus forming an electro-magnet, a vibrating arm pivoted upon highly polished field pivots and platinum or silver contact points.

The wiring is arranged in such a manner that the generator field current passes directly across these points at low speed. As soon, however, as the speed of the generator tends to cause its output to rise above the predetermined maximum, the electro-magnet coil of the regulator is energized to such an extent that it holds the vibrating arm down, thus pulling apart the two contact points. As soon as this happens, the generator field current which has heretofore been passing through these points, is forced to pass through a resistance and is thus decreased in strength.

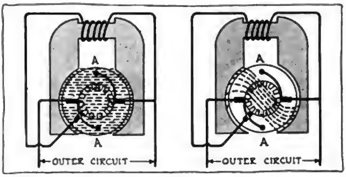


Fig. 6—Diagram showing the third brush system of regulation as used on the Remy system

This reduction of the field current naturally causes a reduction of the generator output, which, in turn, reduces the energizing effect of the electro-magnet coil, permitting a spring to force the vibrating arm up, thus bringing the contact points together again. A continuous repetition of this action sends a pulsating current to the generator field and prevents the output of the generator from attaining a harmful value.

2—The lamps for the Ford cars are designed to be strong enough to withstand the increases and decreases in current pressure.

3—In controlling the current of the Esterline generator, use is made of a combined electro-magnet and permanent magnetic field. At slow speeds these operate together increasing the current but at the higher speeds they oppose each other more and more thus holding the output constant.

Explains Backfire in Acetylene Welding Torch

Editor The Automobile:—In a recent issue of your paper, a correspondent from Somerville inquires the cause of his oxy-acetylene welding torch flashing back into the mixing chamber and asking what metal he may use to prevent this.

The cause is in the mixture or rather the speed of the mixture, and not the metal. It is a well known fact that unless the mixed gases (oxygen and acetylene) are carried forward at a certain speed, the flame will propagate backwards, that is against the flow of the gases. Unless the torch your correspondent has made is designed to prevent it, such a flashback may become dangerous if the flame is carried as far back as the acetylene tank.

Careful manufacturers of welding apparatus, who keep modern in their ideas, today make a torch which is practically free from flashbacks with ordinary use and such a torch can be purchased for less than the time is worth in making an imperfect, dangerous one.

Boston, Mass. M. Keith Dunham.

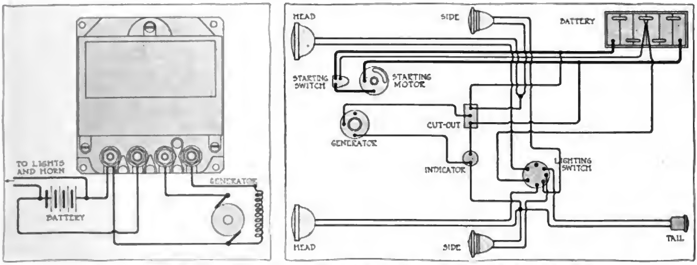


Fig. 5—Wiring diagram of the Disco system as used on the Paige cars, showing the complete system

Practicability of Applying Same Spring Elements to Motor Vehicles of All Classes

(The Improvement of Spring Systems—XIII)

By M. C. K.

WHETHER a standardization of the spring system for motor vehicles can be or ought to be undertaken with reference to its efficiency for security and comfort (rather than with reference to the dimensions of blades, clips and shackles and other details bearing almost solely upon the facilities for production), may be held to be doubtful, since it is always true that there is no magic open sesame to success in such words as "standardization" or "efficiency," which are bound to be interpreted differently by persons of different ability and judgment. To standardize poorly may impede progress as much as to standardize judiciously may advance it. And, to go further, it may even be quite rationally denied that rapid mechanical improvement presents any real advantage over slow progress to either the broad public or the automobile industry. The philosophy of moving very deliberately in industrial matters is perhaps unassailable and at all events is strong enough to prevent any undue haste, even if the advancement involved in standardization of the spring system were proved conclusively. Fear of upsetting the established order of things does not therefore restrain the writer from attempting to show a little more definitely, at some points, than in the previous article on the same subject (in the issue of April 29), that the possibility for a profitable standardization of the spring system does exist.

Suitable spring suspension for each and every type of motor vehicle would be a worthier aim than SIMILAR spring suspension for all motor vehicles, it has been said by an objector, and it would be true if one could not have both aims at the same time. In point of logic the two objectives should be in the same line of view, so far as the essentials in a spring system are concerned. Standardized spring essentials should be as the sight at the muzzle of a gun by which the final consummation of the best possible suspension for every individual vehicle can most readily be brought in line with the efforts for improvement. The relations are those between fundamentals and refinements, any standardization which goes beyond the fundamentals in matters of design defeating itself in practice by running contrary to a legitimate difference of opinion and to rational differences in the purposes of the vehicles.

Where Refinements Begin

It may be necessary, after having established a fundamentally correct spring system, to go farther in an individual case and insist, for example, that the load must be well centered between the axles longitudinally, between the wheels laterally and near the axle plane altitudinally; also that the weight of the running-gear should be minimum and that the tires should "drink the obstacle." But fundamentally it is more important to find the rough elements in a spring system which in all cases will reduce both shocks and bouncing and will neither interfere with the full exploitation of the vehicle as a transportation unit nor with the addition of special refinements where the acme of luxury is no less essential than the full measure of simple utility.

Some refinements, such as that of light running-gears, have only a conditional value. Important for a light car with very flexible springs and highly resilient tires, it becomes relatively unimportant and also impracticable for the different conditions prevailing in the case of heavy vehicles with springs under high tension from the static load alone and with tires that give but weakly resilient response to those secondary impacts of a road shock which are caused by the extension of the vehicle springs. Such a refinement therefore does not belong in a standardized spring system, but should not be excluded by it where needed and practicable. The same consideration holds good for the centering of loads. Of great importance for light cars it yields completely to the practical necessity for load distribution in utility vehicles, and the system which bids for standardization must take care of either branch of design by means of suitable modifications. The smaller the modifications need to be to meet the special requirements in all cases the better is apparently the basis provided for improvement. With this explanation of the aim in view, a standardized spring system may be defined as one by which few and simple elements can be combined to meet all the principal requirements for all kinds of motor vehicles with few variations in the shape, dimensions and materials of each element.

Indispensable Elements

In the previous article the elements mentioned as suitable for such a system were (1) a leaf spring, which may be either a half-elliptic or a quarter-elliptic or cantilever spring (C-springs and platform springs becoming apparently superfluous, while remaining available), (2) an air spring acting in conjunction with the leaf spring, IF NECESSARY, and (3) a device always affording a positive check for spring extension while having an adjustment permitting the damping of the entire rebound stroke in any desired degree and also adapted for absorbing lateral shocks and for resisting rolling and pitching of the vehicle body.

By these TWO OR THREE elements alone, it was contended, all conditions can be met well enough, in the sense explained, with the exception that special provisions may be desirable for cushioning longitudinal shocks. But while the two or three elements are not in all cases sufficient for taking proper care of violent shocks in or opposite to the direction of vehicle motion, they lend themselves to co-operation with other measures for that purpose.

As the principal shortcomings in the traditional spring system are (1) small range of action, (2) faulty action under special road conditions (potholes, sudden rise to new level, etc.) and (3) neglect of the horizontally acting force of shocks, it is evident that the advantages of an improved system must be felt mainly in (1a) more suitable flexibility for underloads, (1b) capacity for overloads and violent shocks, (2) smoother action under the most trying road conditions, and (3) a measure of protection against the horizontal shock forces, but it is also evident that the air spring, which provides the larger range of action, may be dispensed with if the dimensions of the leaf springs and the working conditions justify the omission, although its retention even under these circumstances will always mean a better protection against the unexpected and great freedom in selecting leaf spring dimensions. As air tires serve to enlarge the range of action of the ordinary spring suspension in all three directions—vertically, laterally and longitudinally—it is further evident that the improved system becomes more necessary when air tires are not used.

It may be explained briefly why the improved system as outlined in the previous article meets the requirements.

The Action Obtained

Cantilever springs being mounted obliquely, the frame-end being higher than the axle-end, also operate obliquely and therefore cushion both the horizontal and the vertical forces in the majority of shocks. The comfort they give, as usually applied, depends mostly upon this quality, even though they also oscillate more slowly than a half-elliptic spring of the same flexibility, and this feature of superior comfort is emphasized by mounting them with a yielding fulcrum. In combination with air tires, as well as with the air spring and the rebound check, they should meet the conditions for nearly all pleasure vehicles, since sharp horizontal shocks are exceptional and make a strong impression on an air tire even if it is strongly inflated, WHILE THE AIR SPRING ADDS RANGE AND EFFICACY TO THE OBLIQUE SPRING STROKE in a manner and degree that cannot be imitated with an ordinary cantilever spring without making it too long and heavy and too slow for its lighter work.

The half-elliptic can also be given a slant—as is done in a great many horse-drawn vehicles, though perhaps most frequently in platform springs—or, if a stronger horizontal spring action is needed, elastic driving-struts can be used with them (in the special manner equalizing the action on both sides of the vehicle, as referred to in other articles), as there is nothing in the relations of the half-elliptic spring to the air spring which would not permit a limited horizontal displacement of the half-elliptics, these being shackled both in front and rear.

Composite Wheels

For the heavy vehicles, however, for which air tires have not been found practicable, so far, the three elements are not quite all that is wanted, as here the horizontal shocks set up a great deal of harmful vibration in addition to the brute force of impacts. Such wheels as the Sewell wheels no doubt intercept much of the vibration where they can be used, and the air spring in connection with the slant of cantilever springs or of half-elliptics—considering also, again, the large range of gradually stiffening spring action which can be obtained by this combination—should improve the springing for horizontal as well as for vertical forces materially, as compared with present practice, but an improvement going still farther in the way of parrying the more violent impacts may be desirable and would at all events tend to increase the permissible speed where this must now be held down to a maximum of 8 to 10 miles per hour. A special wheel construction was therefore outlined in article XII as the fourth element in the standardization system, as applied to the heaviest class of vehicles, and might perhaps be adapted also to medium heavy vehicles, including omnibuses and 3-ton and 4-ton trucks. The construction previously shown in Fig. 8, in the issue of April 29, could be modified and lightened somewhat on the lines shown in Fig. 9 herewith, the special advantages for securing traction on all sorts of road surface and for starting with heavy loads remaining the same in both cases. In this lighter type there is 1 instead of 2 traction tires, the eccentricity is minimum and a flange on the driving wheel closes the crescent-shaped gap between it and the traction tire.

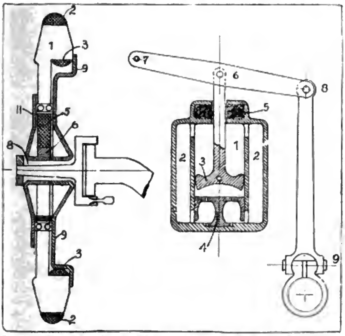


Fig. 9—Composite wheel, front; modification of driving wheel shown in Fig. 8. Fig. 10—Modification of "Bobcheck" shown in Fig. 7

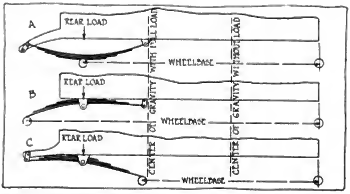

A
REAR LOAD
WHEELBASE
B
REAR LOAD
WHEELBASE
C
REAR LOAD
WHEELBASE
CENTER OF GRAVITY WITH FULL LOAD
CENTER OF GRAVITY WITHOUT LOAD

Fig. 11—Illustrating influence of spring type on wheelbase, when load distribution is given

With this fourth element—the special wheel for heavy vehicles—the standardization system should, then, be nearly complete; in so much more as the short lengths in which cantilever springs can be used in connection with an air spring without surrendering the desirable range of action are practicable for heavy loads, for which springs of this class have not been used so far, and as the half-elliptics fortified by air springs also have a free action which in the heavy vehicle class cannot be obtained by using only half-elliptics or platform springs designed for the same load and shock capacity, as these would become far too long.

Practicability of Each Element

In addition to completeness, practical adequacy must also be demanded of such a system, and in fact this demand ranks ahead of that for completeness. The question is then if each of the elements can be made to do its work properly and can be installed in a vehicle conveniently and without interference with other design requirements.

Very Robust Bobcheck

The construction of the device performing the two functions of checking, under all circumstances, all extension of the spring elements beyond their static rest-position under load and of damping spring oscillation when this may be required, by retarding the whole rebound stroke, speaks in this respect for itself, one of the mechanical forms in which it can be materialized being shown in Fig. 7 of article XII. To distinguish it, in any of the forms in which its principle

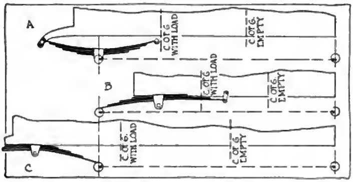


Fig. 12—Illustrating influence of spring type on vehicle frame and body, for a given wheelbase

may be embodied, from devices of similar external shape, the writer designates this device as "bobcheck," as one of its principal effects is to prevent the vehicle body from bobbing up and down needlessly after a shock has been received and has been toned down through the first compression of the spring elements, all subsequent movements being superfluous for this purpose, if they can be avoided. As this device at times must do very severe work in arresting the rebound and preventing all excessive separation of vehicle body and running-gear, it is conceived as made in very robust dimensions, but, on the other hand, no special accuracy in the workmanship is required, excepting that the fit of the shaft in its bearings should be close to avoid the need of packings, notwithstanding that the working pressures do not reach this bearing where it communicates with the atmosphere but are confined to the inner piston chamber.

It will be noticed that the chief service of the "bobcheck" is to get the spring elements back as quickly as other considerations permit to the position in which they are ready for a new shock—the same that is done for an air tire by its rotation.

In the form of the "bobcheck" shown in Fig. 10, in which the damper adjustment is omitted, the question of oil leakage is eliminated by having the piston rod pass through a gland 5 at the top of the device, the packing serving merely to wipe the rod and intercept dust from the outside. The positive piston 3 is shown with a surface like the zone of a sphere, giving it only line-contact with the cylinder wall, and this permits the joints 6, 7, 8 and 9 to be simplified while allowing relative movements of frame and running-gear in any direction.

The other elements whose practicability must be established are the special type of cantilever spring, the air spring and, for heavy vehicles, the composite wheel.

Drawbacks of Ordinary Cantilever Springs

With regard to cantilever springs in general, it is mentioned as the greatest hindrance to their introduction that a manufacturer cannot successfully change from half-elliptics to cantilever springs without re-designing the chassis. The centering of the rear support of the frame at one point for each spring, instead of at the two points which the half-elliptic affords, furnishes an argument against the cantilever, as well as against the full-elliptic, if it means the need of strengthening the frame for the support of load and driving-stresses. In the case of open pleasure cars the margin of plain beam strength in the reaches is perhaps usually sufficient to cover the new demands without change of dimensions, so far as vertical stresses are concerned, but twists of the frame as well as whip and roll must be figured with; and the additional load, both static and dynamic, which the cantilever places on the front axle cannot be ignored. Fig. 11 illustrates roughly the relations which must be considered in changing from one type of spring to another. When the load distribution is to be left unchanged the wheelbase for the vehicle with half-elliptic springs, A, must be shorter than for that with cantilever springs, B, and longer than for that with reversed cantilever springs, C.

The latter type represents, however, as yet a problematic form of construction, and its value lies perhaps mainly in permitting a large vehicle body to be placed on a short wheelbase. Fig. 12 shows, obversely, how load distribution is affected when the wheelbase must remain unchanged. The fiber stresses are also much greater—four times greater at the main pivot—for cantilever springs than for the shackle attachments of half-elliptics, but in pleasure cars this can easily be taken care of by reinforcements.

The differences which appear when vehicle conditions with and without load are compared are indicated by vertical dotted lines in Figs. 11 and 12, on the assumption that without load the center of gravity comes about one-third of the length of the vehicle body behind the front axle and with load twice as far back. If this is the condition which is realized with regard to the frame and load in the vehicle with half-elliptic springs, it is plain that either another condition must be established in this respect when a change is made to cantilever springs, or else the wheelbase relations must be revised with a view to conserving the driving qualities under no-load as well as under full-load conditions; and these considerations also include the matter of the turning-radius of the vehicle, as it is determined mostly by the wheelbase.

On the whole, the change from half-elliptics to cantilevers cannot be made lightly. And it is more difficult for commercial vehicles, by far, than for pleasure cars. The relations of a heavy load to the fiber stresses becomes important, and in order to limit twist, whip and roll and even bending of the frame an extended base of attachment to the running-gear is desirable. For example, in a truck of the type where nine-tenths of the full load is supported on the rear axle, with a very considerable overhang of the frame and with the wheelbase as long as traffic conditions will permit, a change to cantilever springs would be impossible, and reversed cantilevers could only be contemplated in connection with re-building of the chassis.

As speed and comfort are demanded in pleasure cars in higher degree than in the majority of commercial vehicles and all the factors relating to wheelbase and load dis-

(*Continued on page* 875)

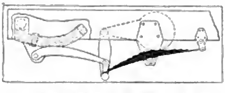
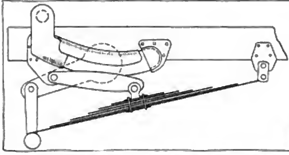


Fig. 13—Diagram indicating the possibility for getting frame and load broadly supported by the use of an air spring in conjunction with cantilever spring and "bobcheck." The air spring and the "bobcheck" are presented as operated from the axle and on the inside of the frame reach



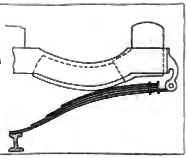
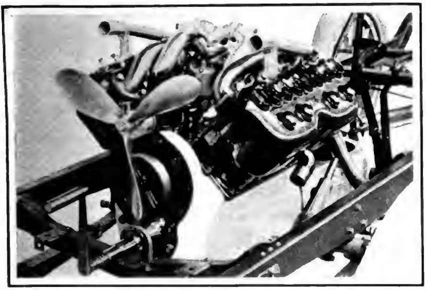


Fig. 14—Diagram of standardized spring system applied to rear axle. Fig. 15—Same applied to front axle, but "bobcheck," which is needed to prevent extension, is omitted by mistake

Hollier Eight Cleverly Designed

High Speed and Flexibility Feature Running—Accessibility of Motor and Refinement of Detail Conspicuous



The accessibility of the Hollier motor is better appreciated in the chassis plan view, but this shows the handy location of carbureter and igniter. Observe the three-blade aeroplane type fan which is driven from the camshaft. Front end of three-point suspension should be noted. The brackets seen on front cross member are for the radiator which is supported from the bottom, instead of the sides, and is thus relieved from frame stresses

IT was a surprise to the automobile industry to learn, early in the spring, that the Lewis Spring & Axle Co., Jackson, Mich., was coming out with an eight-cylinder car to be marketed under its own organization. For some 15 years the concern has been a parts specialist, making motors, springs, axles, gearsets, etc., for the trade, and its factories are really enviably arranged for complete car production. In fact, a well-known low-priced car has been built there for some time, but this is a part of the past, for only the Hollier eight, the name under which the new car will be marketed, is to be built.

Already the production is well under way. In the motor department the new engines are coming through at a lively rate. Axles and frames are being put together in another building of the Lewis group, and some of the chassis have already been through their road test, ready for bodies.

The Hollier is the lowest priced of the eights now on the market, selling at $985 with equipment. Its design is cleverly done and is clear cut. There is not any evidence of some forgotten part having been tacked on after the design was completed. Every unit seems to have been carefully considered and put where it is most advantageous.

The motor is a 3 by 4 1-4-inch V-type which differs in many details from any of the others on the market. In the driving system there is a cone clutch; three-speed, centrally-controlled gearset; inclosed drive shaft, and a compactly-designed floating rear axle. The rear springs are cantilevers, the wheelbase is 112 inches, and steering is on the left. An Apple motor-generator provides the electrical part, an Atwater Kent ignition distributer takes care of the firing, Stromberg carbureter is used, and oiling is commendably well worked out in the use of a pressure system. The standard body is an attractive five-passenger design.

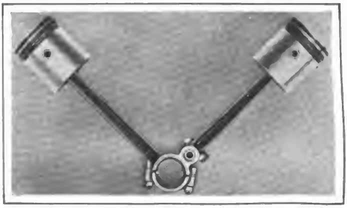
Taking into consideration the many things that have to be fitted to the engine, it is doubtful if a more accessible job could have been produced than the Hollier motor. The only apparatus in the V between the cylinder blocks are the carbureter and the combined breather and oil filler. The manifolds are compactly arranged so as to give easy access to the valve mechanism once the carbureter is out of the way; and the exhaust headers are bowed upwards to give room below them for the fitting of the intake manifolds.

The crankcase is a one-piece type with extreme vertical height to the sides, this promoting rigidity. Below it is the oil base through which the bearings may be reached, and in the center of the top between the cylinder blocks there is a plate which carries the rockers and allows access to the camshaft. The flywheel is not enclosed, but there is a cast-iron yoke passing around it and integrally forming the gearbox.

Unusual Connecting-Rod Design

Internally the engine is particularly noteworthy for the connecting-rod design and for its oiling system. The rods are chrome-vanadium steel forgings, and the attachment to the throw bearing is of the Gnome type; that is the main rod goes around the bearing just as a single rod in a four-cylinder motor would, but it has a knuckle on its side to which the smaller rod attaches by a steel pin in much the same form as a wrist-pin construction.

It is obvious that this form of attachment is very strong, for the driving force on the rod end is in line with the center of the bearing and the knuckle joint. The knuckle is really a part of the bearing portion of the rod end, and this allows it to be shifted over so as to be in direct line with the center line of the rod when the piston is at the top or bottom of its stroke. The main rod proper is 90 degrees from the other rod when in this position, and therefore it does not run upward from the center of its bearing portion but just as far on one side as the knuckle is on the opposite side. This allows the split for the cap to the horizontal. It has the



Simple connecting-rod construction used for Hollier eight further advantage of making it possible to get at the cap bolts from below without trouble, since they are vertical, or nearly so, at all times.

The rod centers are 10 inches apart, and the wrist-pin is clamped in the rod with its bearing in the piston. The pin diameter is 5-8 inch and the length 2 5-8 inches. The crankshaft is a .40 carbon, heat-treated steel forging with three main bearings 1 5-8 inch in diameter of babbitt-lined bronze; the shaft is drilled for oiling by pressure.

Sixteen Cams Are Used

The valves are operated from a single camshaft by drop-forged rocker arms which are assembled on two small shafts mounted on the under side of the crankcase top plate between the cylinder blocks. These shafts, placed end to end, each carry the rockers for two cylinders on each side—eight rockers per shaft. They are so shaped that they fit very compactly in the space allowable, and without adding much weight, permit of straight upward force on the valve stems.

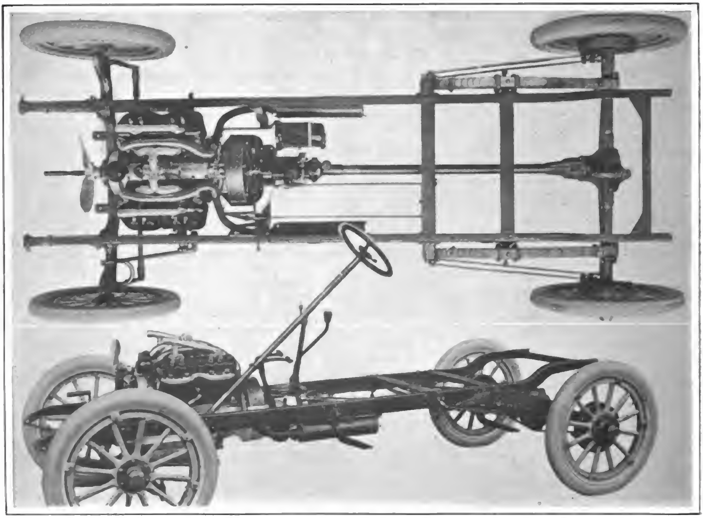
The valves have a clear diameter of 1 3-8 inch and they lift 3-8 inch from their 45 degree seats. Heads are cast iron, welded by the oxyacetylene process to heat treated, carbon steel stems. The camshaft has three bearings in the crankcase, its body being 1 1-8 inches diameter, and it is forged from .17 to .21 carbon steel, which is heat treated, casehardened and ground. The camshaft drive is by helical gearing inclosed at the front. The crankshaft gear is of steel, while that on the camshaft is cast iron, this being the best practice for minimum wear and noise elimination. As an illustration of the far-sightedness of the Lewis engineer, holes have been provided in these gears for the admission of draw bolts, making it much easier and safer to remove them from their shafts than if a cold chisel and hammer had to be resorted to.

High-Pressure Lubrication

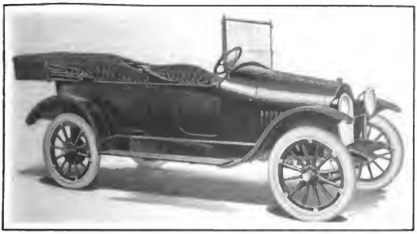
The lubrication system is remarkably simple for the results that are obtained. It was demonstrated to the representative of THE AUTOMOBILE that in ordinary running a pressure of from 10 to 40 pounds per square inch is used. There can be no doubt that wear is reduced to the minimum with such a pressure, allowing the bearings to really ride upon a film of oil at all times. A simple gear pump, located at the rear center of the crankcase and driven by the rear end of the camshaft, does the work. It draws the oil from the 3-quart oil base through to a strainer, and then pumps it under a varying pressure proportionate to the engine speed and within the limits above mentioned.

It is forced direct to the three main bearings, from which points it goes through the drilled crankshaft webs to the connecting-rod bearings. The pressure gauge on the instrument board indicates the pressure, and the only external piping is that to and from this gauge. One reason why it is possible to get the pressure as high as this in the Hollier motor is that the pump is of very generous proportions as compared with the engine size. In a demonstration run at high speed, the 40-pound gauge was bested, the indicator extending above the 40 mark, probably to about 45 pounds, this being at a car speed of about 50 miles an hour.

Coming to the electrical equipment, the Atwater Kent distributer works most satisfactorily in its position at the front, its drive being a part of the timing gear assembly. It con-



Chassis of Hollier eight, showing clean lines, construction of brakes and attachment of cantilever rear springs



Hollier eight-cylinder, five-passenger touring car which sells for $985

sists simply of mating bevel gears, which drive the vertical distributer shaft from the horizontal shaft.

The Apple motor-generator unit is mounted on the right arm of the yoke which goes around the flywheel. In this position it is out of the way as far as the engine is concerned, but is easily reached through the front floor boards of the car. It is the Apple A-25 type of the 12-6-volt design and is driven through the mainshaft in the gearset by a 1-inch Whitney silent chain. The chain centers are adjustable to take up any slack and the whole drive runs in a completely-inclosed compartment in the supporting arm just ahead of the gearbox. The same cover which goes over the gears covers the top of this chain housing, making it very easy to get at if necessary.

An interesting feature of the engine design is the timing gear housing at the front. This not only performs its main function of enclosing the gears, but it acts as a mounting for the propeller type of aluminum fan and also for the fan driving pulley, as well as the support for the front end of the motor and the mounting of the starting crank. Thus by removing this assembly, the engine is readily stripped of several of its important features. It makes a simple assembly proposition, as well as a neat design.

Special Features of Transmission

In the gearset, the gears are 5-8-inch face, and are chrome-vanadium steel forgings, heat treated. The teeth are 7 pitch, and they have a 17-degree pressure angle. The teeth are generated instead of being milled and a special lapping machine has been provided for grinding and polishing—the making of efficient gearing is by no means new to the Lewis shops, as already pointed out. The method used for making the gears is conducive to silent and accurate running, since proper meshing is assured.

Back of the gearset, the drive is through a 3.5 per cent. nickel steel universal joint to the drive shaft which is of ample proportions. This is enclosed within a torsion tube connecting conventionally to the rear axle housing. This latter is of the single ball-bearing, floating type, with solid swaged tubes pressed into a malleable housing. The driving gears have a 5-pitch and 1-inch face, with 20 degrees pressure angle and corrected tooth form, making for maximum of silence, it is said. The differential is of the regular four-pinion type with the driving gear a .20 carbon steel forging and the pinion a 3.5 per cent. nickel-steel part. The differential has Hyatt rollers for side bearings, and it is provided with ball thrust. The pinion bearings are New Departures, while in the wheels Gurneys are employed.

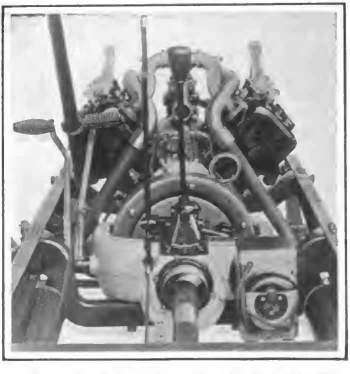
Tapered Axle Shafts

Like the drive shaft, the axle shafts are of chrome-vanadium steel and 1 3-8-inch mean diameter. The construction of these axle shafts is unusual in that they are tapered to give them ample strength at the drive end. In fact, the small end would be amply large to carry the load, but the taper adds an even greater factor of strength. The driveshaft and propeller shaft ends are six-splined, no square holes being used. This construction is very commendable. Brakes, operating in the usual way on the wheel drums are 12 inches in diameter, and are Thermoid lined. Both service and emergency sets are internal expanding on the inner surface of the drums.

The rear axle standard gear ratio is 4 to 1 which gives a great deal of flexibility to the car under driving conditions. The cantilever rear springs are long enough to give easy riding qualities and are attached to the axle in such manner as to allow each leaf to do its full share of work. Instead of clipping the end of the spring to the axle both the longest and the second longest leaves have eyes at the rear end and these are secured to the axle by a pair of shackle bolts passing through lugs on the axle end. Front springs are the usual half-elliptic and the steering gear is normal, though it is perhaps a little more substantial than usual for a car of this price class.

40-Horsepower at 2,000 R.P.M.

As regards performance, the Hollier will undoubtedly make a mark for itself. In test, it has proven its ability to go faster than 60 miles an hour, and in demonstration THE AUTOMOBILE representative was shown a speed of 35 miles an hour in second gear, while the car would throttle down to 3 miles an hour on high in smooth going. The engine readily handles the car, and attains 40 horsepower at 2,000 r.p.m. As regards gasoline consumption, it has shown its ability to go 12 miles on a gallon in ordinary country road work, up hill and down. Taken all in all, the car is an excellent example of what may be accomplished in the design of a low-priced eight.



The internal cone clutch is rendered accessible by the open type of transmission attachment. Apple motor generator is also well placed and wiring to battery is short. Observe spherical inclosure of universal

High-Speed Motor in 1916 Marion Six

Neat Layout, Careful Detail and High-Class Equipment Are Characteristics of New Chassis

MOVED from Indianapolis to Jackson, Mich., the Marion car will henceforward be made in the same factory as the Imperial, a new concern, the Mutual Motors Co., having taken over the old Imperial plant. It is understood that the Imperial four-cylinder and the Marion six will be the only two models made, but the factory is of a size sufficient to permit of a large output. Considering that the price is only $1,250 the Marion six is a particularly well finished and well equipped job, containing a good deal more real engineering than the average of assembled chassis.

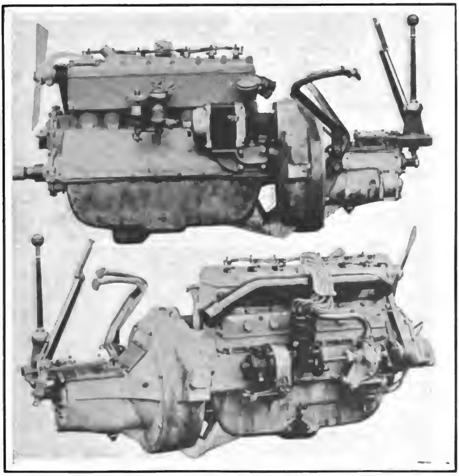
Small Motor Gives High Power

The engine used is a high-speed one of 3-inch bore and 5-inch stroke and thus has a capacity of 212 cubic inches. From this comparatively small volume it is stated that no less than 56 horsepower is obtained at 3,000 r.p.m., 31 horsepower at 1,500 revolutions and 22 horsepower at 1,000, these being quoted as average dynamometer readings. As can be seen from the illustrations, the motor is neat in appearance and has a detachable head, whereby access to the valves is obtained. The latter are on the right side of the cylinder block and very accessible, while the push rod mechanism can also be removed completely without trouble. In the illustration a pair of supplementary cover plates can be seen, attached by studs and nuts beneath the finger-nut-secured valve inspection cover plates. It is the lower plates that carry the push rods.

In the same view is also shown the manner in which the large water pump is driven through a substantial leather coupling and in turn drives the Westinghouse generator through a duplicate leather connection.

Latest Westinghouse Electrical System

This generator is the very latest type of combined generator and igniter. It is noticeable that the generator is very small and light, which is a feature of the system of regulation employed. For this is a constant voltage machine with vibrator regulation. This little machine can give a very large charging current when such is needed. Turning to the other side of the motor, the starting layout is seen, the Bendix drive being employed to connect the starting motor with the flywheel. It should be observed that the motor is well out of the way, although it is placed high enough to be itself well protected. When in the chassis it lies close to the steering gear.



Motor of 1916 Marion six, showing detachable cylinder head, which gives access to the valves. Note the supplementary cover plates attached by studs and nuts beneath the valve inspection cover plates. The lower plates carry the push rods. Mounting of electrical units is also shown

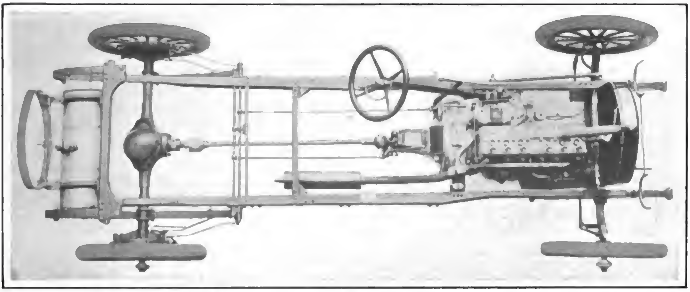
This second view of the motor also shows a distinctive point in its design, namely the bridge piece which is used to connect the bottom of the crankcase to the flywheel housing. The aeroplane type of two blade fan and the newest Stromberg carbureter are also details made clear.

Simple Lubrication

The trough system of splash lubrication is used, there being a vane pump on the rear end of the camshaft which sends oil to the dip troughs, to the helical timing gears and to ducts which feed the main crankshaft bearings, of which there are three. The fact that the upper half of the crankcase is integral with the cylinders allows the bearing support to be exceptionally rigid, so discouraging any tendency to crankshaft distortion or whip. Owing to the use of cast iron, however, the oil leads must be separate and are carried externally.

Special care is taken with the pistons, which are cast iron, machined both inside and out, so that it shall be possible to insure their even weight. Only two piston rings are employed, these being concentric, these aids to high speed being assisted by the valves which have a clear diameter of 1 5-16 inch and a lift of 5-16 inch.

It is noticeable that the Warner gearset is small externally, but this is not obtained by any reduction in the

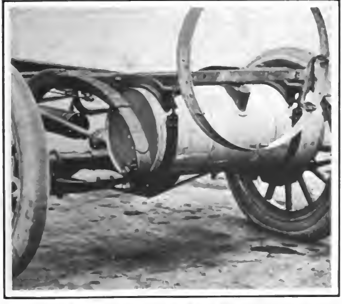


Chassis layout of the Marion six for 1916, showing mounting of power plant and electrical units. Note compact gearset and double-jointed driveshaft

dimensions of the gears themselves; it is simply due to the fact that there is no wasted space. There are, of course, three speeds. The clutch is also of Warner make with six disks of steel on the driven member and five with Raybestos facing on the flywheel member. There is a handy adjustment for setting back the clutch pedal to compensate for wear in the striking thrusts which is discernible in the motor illustrations.

The propeller shaft is a double-jointed or open type, but a feature in its design which is unusual is the location of the sliding joint at the front end. Both universals are similar in detail but that on the bevel pinion shaft is keyed and locked in place, while the front one is free to slide on a square ended shaft. As is usual with this kind of propelling member, there is no torque stay, the springs being utilized to resist the stress. This much-discussed principle undoubtedly is far less easy to criticise—or perhaps one might say is seen at its best—when the motor speed is high. It is the coming of the high-speed engine with its even torque that has led to the European popularity of the so-called Hotchkiss drive.

Also, on the Marion six the rear springs are long enough and wide enough to take care of any amount of torsional stress. They are hung beneath the axle and supplied with self-lubricating shackle bolt bushings packed with a graphite compound that makes additional lubrication unnecessary and renders squeaking extremely improbable. Bushings of the same sort are, of course, also used for the front springs.



Rear view of Marion six chassis, showing internal type of spare tire carrier. Note that gasoline gauge is integral with the filler cap socket, simplifying construction and minimizing probability of leaks

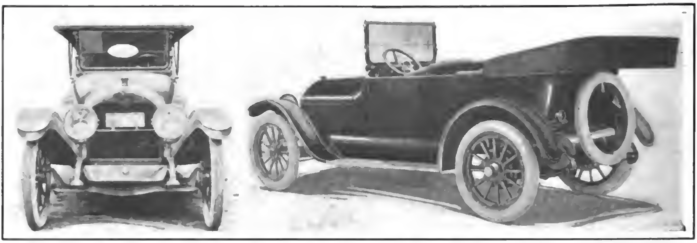
In the rear axle spiral bevels are used, cut by the Brown Lipe Chapin Co., and these, with the differential, can be removed from the axle housing by simply taking off the cover plate and then removing four bolts. The center portion of the axle is a casting and the sleeves steel tubes to which the brake brackets are attached. The brakes follow standard practice, but it is worthy of comment that the adjustments are particularly accessible and the external service brake has an adjustment for setting it concentric with the drum in addition to the usual means for taking up wear. Rattle in the connections is unlikely because of the straightness of the pull rods and the small number of parts necessary for the layout.

On the front axle it is claimed that the swivels are stronger than usual for a car of this weight and their lubrication is well cared for by the large grease cups and properly arranged grooves to carry the lubricant to the points where it is needed; it should be noticed that the drag link is perfectly straight, a feature which, by removing springiness, usually makes for steady steering.

Body Comfort Notable

The body fitted is a steel construction with very smooth lines and is just a nice size for five passengers, being supplied with ample leg room but not too long a floor to the tonneau. As long as there is room for a passenger of a little over the average height to stretch his legs, a rather short tonneau certainly is less draughty and more comfortable than one which is extremely long. Also it is always an advantage not to sit too far back over the rear axle, and in the Marion a very happy mean is struck. Concealed hinges, deep upholstery and a top which lies low when folded are other conspicuous body features. With respect to the top, this is leather and has a cover of the same material. Other equipment includes a Stewart speedometer driven from the front end of the driveshaft, a ventilating windshield to which the one person top attaches, a vibrator horn with button in center of steering wheel and all other usual kit and accessories. Tires are 33 by 4 inches.

A detail which should be noticed is the tire carrier which



Front view and side view of the new Marion design which has been brought out for the season of 1916

is internal instead of external, as is usual. This supports the demountable rims on a ring, similar to the bonding rim of the road wheel, so that the tires do not rest against anything whatever and cannot, therefore, chafe. The valve and a single cleat hold the spare tire and its rim secure and rattle proof, while detachment is the work of an instant only.

In the same view which shows this carrier the round gasoline tank may be seen and it can be observed that the gasoline gauge is made integral with the filler cap socket. This does away with one hole in the tank and is both a simplification and a rank preventative, for the smaller the number of holes cut in a tank and the less the number of joints to be made, the less must be the opportunity for severe bumping to produce a crack anywhere. A Stewart vacuum feed is used to lift the fuel from the tank to the carbureter.

Altogether the impression given by the Marion is of a well designed, comfortable, roomy vehicle of light weight and ample power. It is an automobile with a distinct individuality.

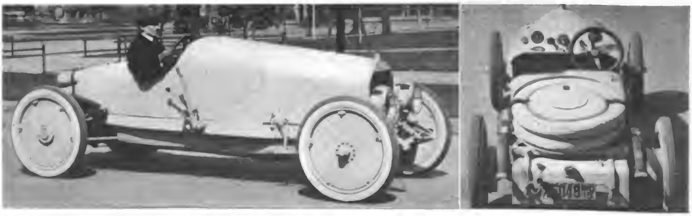
A Rebuilt Vanderbilt Cup Racer

IT is always interesting to know what becomes of the old racing cars which have made famous records in past contests. A good example of what can be done with one of the old racing chassis is shown in the accompanying illustration. This car is now the property of W. O. Streller of the Irvin Robbins Co., Indianapolis, Ind. It is built on the Marmon chassis which Joe Dawson drove in the Vanderbilt Cup Race in 1911 on Long Island. This was the race that Dawson lost by 30 seconds, due to his stopping for several minutes to ascertain the injury to a spectator who ran upon the track in front of his machine and was struck.

Practically all the work upon the car is of special design, giving a body and chassis which is unusual in many respects. The specifications include a 4.5 by 6.5 motor with a 2-inch carbureter, 2.5-inch valves, Bosch magneto, three-speeds forward, geared 2.3 to 1 on high. The wheelbase is 120 inches. An added touch is given by a full equipment of dash instruments mounted in a cowlboard, including a 100-mile speedometer, electric clock, Presto primer, etc. The gasoline feed system is the Stewart-Warner vacuum.

It is very difficult to estimate exactly how much a job of this kind could be done for, as the price of the original chassis will, of course, be the determining factor and this will vary greatly. Then the cost of overhauling the chassis would vary with every car. As regards body work, however, the cost of this work would be in the neighborhood of $400, including the building of the body, installation, trimming and painting and the metal disks for the wheels. A unique feature of the body is that it is altogether metal with the joints welded with acetylene.

The owner states that the ex-racer makes an excellent road car, and, although it is never run more than 45 to 50 miles per hour, it holds the road excellently and the high speed can be accomplished with comparative safety. It is claimed that a maximum speed of 95 miles per hour is possible with the car.



Side and rear views of the Marmon rebuilt car which practically won the Vanderbilt cup race in 1911

The AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, May 13, 1915 No. 19

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico -One Year, $3.00
Other Countries in Postal Union, including Canada - - - - - - - - -One Year, 5.00
To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

The Truck Convention

THE truck convention at Detroit, the first under the auspices of the National Automobile Chamber of Commerce, was a success. Men of the highest caliber in the truck field were in attendance to discuss the various problems that confront the industry, and to give others the benefit of their experience.

Those who attended the convention, who became acquainted with their brother manufacturers and who listened to the words of wisdom from men who have through their success proven that their theories are correctly realized that they would have made a great mistake not to have come. It may have taken them away from their duties at the factories for a couple of days, but the enthusiasm, the general wealth of valuable information and the real good will which they enjoyed from all the rest made them feel that they were cashing in on the investment of time.

The sessions were attended by representatives of about seventy-five truck manufacturers and the pity is that all in the business could not have been there. Certain it is that more of them would have come had they realized just what real inside information and benefit they could get from the other fellow.

To some extent it was a conscience party. They told their troubles to the gathering, and solutions to their problems were offered by others who had been through the same mill. The new maker cannot help but benefit from the experience of his older competitor; the old maker, often times fallen into a rut, can get a new perspective from the younger concern.

The National Automobile Chamber of Commerce is doing its part. It is lending its valuable assistance to the furtherance of the truck industry, but it cannot mother that industry. It is growing and must rely upon itself through the energetic support of all in the business. Another convention has been decided upon for the fall. Let us hope the shortsighted makers who did not avail themselves of the opportunity to learn of the secrets of the other fellow's success will turn out in force then.

Let them swell the attendance at the next meeting to triple what it was at the Detroit gathering. Let them make the 200 delegates look like a mere handful as compared with the number at the fall convention.

Common Sense About Bearings

THE case for ball bearings versus roller bearings or roller against ball has been argued for more years than measure the existence of the automobile industry, and the battle still rages as fiercely as ever. Yet the engineer who uses these bearings knows quite well that both types have their good and bad points, that there are good and bad kinds of the one just as there are better and worse sorts of the other. Theory is a very dangerous thing when it is applied to mechanisms of such extraordinary delicacy as modern anti-friction bearings, because there is still much in their behavior that no theories have yet been found to explain; nor does it follow that either ball or roller is necessarily superior in practice, even supposing it could be proved that it is superior in theory.

To the engineer the only thing of any value is accumulated experience, and as most automobile engineers have plenty of data concerning both types of bearing it is to be expected that they will continue to use balls where they regard them as most satisfactory and rollers for other parts of the same chassis. There is good reason to suppose that while a car can be designed to use all ball or all roller bearings the present practice of using both, according to the particular sort of service needed is a thoroughly sound procedure. To Europe belongs the honor of making the first good ball bearings and to America that of producing the first rollers equally satisfactory. America can now take care of herself in the former respect, and Europe will soon be able to produce roller bearings in quantity. On the introduction of good roller bearings into England the automobile men soon found their applicability and are using them increasingly. Conversely, the American engineer is using more ball bearings as the supply increases; so one is forced to the conclusion that, argue as you may, there must be sound basis in fact for both types and that both types will continue in use. Each type has virtues peculiar to itself and each has also faults inherent with its principle, so that for some uses the ball bearing is preferable, when all things are considered, and for other parts the roller suits conditions best. Nor is it possible to draw a definite line between their spheres.

New Willys-Knight Under $1,200

J. H. McDuffee to Boost Sales and Conduct Dealers' Educational Campaign

TOLEDO, O., May 11—*Special Telegram*—A Willys-Knight car to sell for less than $1,200 will be brought out shortly by the Willys-Knight interests of the Willys-Overland Co. This model will be a new car throughout and will be the first Knight-engine car to be marketed under $1,400.

Joseph H. McDuffee has been appointed general representative for the Willys-Knight interests of the company and will devote his entire time and attention to promoting the sales of the new car.

McDuffee will call upon every Willys-Overland distributor in the United States and through personal contact with the 4,000 or more dealers will promote a campaign of education relative to the mechanical merits and technical features of Knight engine construction.

The decision to produce such a car and the appointment of Mr. McDuffee to the duties of familiarizing the dealers who will market the output with the Knight "reasons—why" is the latest business stroke of John N. Willys who is rapidly building an organization made up entirely of the real business men of the industry. Mr. McDuffee managed the first automobile retail store in America in New York during 1898 and has been continuously identified with the retail end of the industry ever since.

404 Cars Shipped May 10

The plans for Willys-Overland and Willys-Knight sales campaigns are staggering in their proportions and the public is warranted in expecting President Willys to further sensationalize the industry. Four hundred and four Overland cars were shipped May 10, which surpasses the greatest single previous Overland day's shipment by nearly 100 cars. The present week will exceed 1,800 cars shipped.

Page Takes Mitchell—Houpt Now Hudson Agent

NEW YORK CITY, May 11—Several changes of importance have been made in the dealership situation in this city. Carl H. Page has formed the Carl H. Page Motors Co. and has taken over the Mitchell agency, until now held by Harry S. Houpt, Inc. Houpt, in turn, has taken the Hudson agency, until now held by the A. Elliott Ranney Co. General Manager S. S. Toback of the Ranney company, which is one of the best equipped dealerships in the metropolis, declines to state what his company plans to do.

Page, who will cover New York and Philadelphia, with headquarters at West 59th street and Broadway, formerly was the Chalmers dealer here until the agency became a branch. He has lately been connected with the Owen magnetic-drive car, made by Ray M. Owen, who recently bought an interest in the Houpt company.

Jeffery, Lewin and Meriheina Saved from Lusitania

NEW YORK CITY, May 11—Charles T. Jeffery, president of the Thomas B. Jeffery Co., Guy F. Lewin, who recently closed for the representation in London of several American cars, and William Meriheina, bound for South Africa in the interests of the General Motors Export Co., were rescued when the Lusitania was sunk last Friday.

Mr. Jeffery was on his way to England in connection with contracts with the allied nations for war trucks. Meriheina was recently appointed South African service representative of the General Motors Export Co. and was bound for that country, where he was to devote his time chiefly to the demonstration of the ignition and self-starting features on the company's cars. Prior to his appointment, Meriheina had been with the New York City Buick branch for the past 5 years.

Pietrantoni, of Porto Rico, in New York

NEW YORK CITY, May 10—R. M. Pietrantoni, of San Juan, Porto Rico, member of Pietrantoni & Sojo, a large automobile house in Porto Rico, is now in this city.

Humphrey Chalmers—Owen a Director

DETROIT, MICH., May 7—S. H. Humphrey, recently appointed works manager of the Chalmers Motor Co., has been elected vice-president in charge of manufacturing. Percy Owen, general sales manager of the company, was elected a member of the board of directors. The company has appointed L. F. Johnson as assistant district supervisor, with headquarters in Atlanta, Ga. Mr. Johnson was formerly a district manager for the Willys-Overland Co., Toledo, O.

Laycock Sails for England

NEW YORK CITY, May 10—Arthur M. Laycock, chief engineer of the Sheldon Axle & Spring Co., Wilkes-Barre, Pa., sailed for England Saturday to represent his company in connection with business affairs. Mr. Laycock has spent considerable time abroad during the past 6 months.

S. G. V. Assets To Be Sold May 27

Receiver's Petition for Order To Sell Granted—Industry's Prosperity One Reason

READING, PA., May 7—The assets of the S. G. V. Co., of this city, will be sold at public sale on Thursday, May 27, at 1:30 p.m., and thereafter from day to day until all the property is sold. Judge G. A. Endlich has granted the petition of R. E. Graham, receiver for the company, for an order to sell the assets.

Mr. Graham states that he has been unable to sell the plant. In asking for an order of sale he states that at this time there is an improvement in the condition of the automobile trade and that he thinks it to the best interests of the creditors and stockholders that the assets be sold at public sale, especially in view of the fact that the daily rental of the building in which the business is being conducted is in excess of $50.

Maxwell Preferred Placed on 7 Per Cent. Basis

NEW YORK CITY, May 12—The directors of the Maxwell Motors Co. yesterday declared an initial quarterly dividend of 1 3-4 per cent. on the first preferred and an additional payment of 3-4 of 1 per cent. on account of accumulated dividends. The dividends are payable July 1, to stock of record June 10. Transfer books do not close.

The company has outstanding $12,279,332 first preferred 7 per cent. cumulative stock, $10,127,467 6 per cent. non-cumulative second preferred stock, and $12,778,057 common stock. The first preferred stock has been cumulative since January 1, 1913, at the 7 per cent. rate.

It is estimated that the net balance of earnings for the current year will amount to about $3,000,000 compared with $1,505,000 in the 1914 fiscal year.

18 Paige Stockholders Get $17,500 Monthly Dividend

DETROIT, MICH., May 11—Eighteen stockholders of the Paige-Detroit Motor Co., this city, have received $17,500, their monthly dividend, which is at the rate of an annual dividend of $210,000 on a capital of $250,000. It is reported that earnings for March and April are sufficient to pay all dividends for the remainder of the present year.

Mackenzie, London Publisher, Here

NEW YORK CITY, May 12—John Mackenzie, a London publisher of automobile and motorcycle magazines, is at present in this country investigating manufacturing conditions.

Packard's April Sales $3,047,811

33 Per Cent. Gain Over April 1914—Plant To Be Enlarged 5.7 Acres

DETROIT, MICH., May 8—The total sales of passenger cars, trucks and parts of the Packard Motor Car Co. during April totaled $3,047,811, as compared with $2,260,150 in April, 1914. It was the biggest month in the company's history and indications are that May will also be a banner month.

Extensions to the plant of the company either in course of construction or to be started represent a total outlay of more than $200,000, and when completed will provide the concern with 43.7 acres of floor space, as compared with 38, which was the total before the factory expansions were started.

It was decided that in order to manufacture sufficient wheels, a new building, 60 by 393 feet, should be erected. It is now in course of construction, and in addition to the wheel machine and wheel paint departments it will contain improved dry kilns capable of drying the material for 400 wheels daily.

A new six-story building, 60 by 400 feet, which will have special machinery to be used in the machining of chassis parts, will be erected on the site now occupied by one of the original factory buildings, put up 12 years ago. It will be of the flat slab type of reinforced concrete with special two-way reinforcing, and when completed will be one of the most unique factory structures in the country.

A one-story heavy steel structure, 180 by 240 feet, will be added to the truck shops. The roof trusses will be designed to permit heavy overhead trolleys of sufficient strength to carry a completed truck.

The extra pressure on the forge department has required that the manufacturing dies be moved in a building specially built for that purpose. This structure, 26 by 144 feet, is equipped with a complete trolley system for handling the dies, and the storage racks are built of heavy structural steel and arranged in the manner of an amphitheater.

Pittsburgh Model Engine Co. Has High-Speed Six

PITTSBURGH, PA., May 10—The Pittsburgh Model Engine Co., this city, has brought out a six-cylinder, L-head block motor 3 by 5, with a piston displacement of 212 cubic inches and a stroke-bore ratio of 1 2-3 to 1. Light reciprocating parts are a feature and the entire three-point power plant complete with three-speed gearset weighs only 450 pounds, the motor itself weighing but 350, with bell housing.

Compactness is characteristic, the overall length of the cylinder block along the center line of the valves being only 27 inches. Valves, ignition system and water pump are on the left and the carbureter is on the right, being closely connected to the cylinder block so that the gases pass through the water space between the two center cylinders. Valves have 30-degree seats and are 1 5-8 inches in diameter with 1 3-8 clear openings. Crankshaft is a three-bearing type 1 3-4 inches in diameter and camshaft also has three bearings, being 1 inch in section. Cast iron pistons with three eccentric rings actuated by 9-inch connecting-rods, the lower bearing being 1 3-4 inches in diameter and 2 inches long. Timing gears are helically cut and run in oil.

Oiling is an important feature, the standard plunger pump, constant level splash type being used with individual troughs for the connecting-rods and, in addition, the space around the camshaft is filled with oil under pressure, this giving positive lubrication and promoting quietness of operation.

The motor is designed for all makes of single or double unit electric starting and lighting systems and is made with either cone or multiple disk clutch and for magneto or battery coil ignition.

The maker claims that tests show 45 1-2 horsepower at 2,150 r.p.m., 39 horsepower at 1,600 r.p.m. and 26 horsepower at 1,000 r.p.m.

Hupp Turns Down 900 Orders

All 1915 Cars Sold—April Record Month—25% Gain for Fiscal Year

DETROIT, MICH., May 8—During the last 10 days the Hupp Motor Car Co. has turned down nearly 900 orders for its 1915 cars owing to the fact that the entire production has been completed and sold.

The month of April was the biggest April since the organization of the company, being about 15 per cent. better than the corresponding month in 1914, which was a record breaker.

The business for the entire fiscal year will show about 25 per cent. increase over 1914.

At the present time there are about 1,200 men on the payroll.

Simpson Is Manufacturing Manager of Hupp Motor Car Co.

DETROIT, MICH., May 7—Howard Simpson has been appointed manufacturing manager of the Hupp Motor Car Co. He was formerly with the Chalmers Motor Co.

Studebaker Breaks All Records

War Orders Alone Were $17,000,000 in 1914—April Best Month for Car Sales

SOUTH BEND, IND., May 10—Business and profits in the current fiscal year of the Studebaker Corp. are by far the largest in the corporation's history. War orders received late last year were around $17,000,000 and a large part of that business was carried into the current year. During the present year it is reported that additional orders have been received from Great Britain and France for automobiles, wagons and harness, the estimated value of which ranged from $3,000,000 to $5,000,000. Besides domestic business in the current season has been running large.

Never in its history has it had a month to compare with the one just closed. April marks high tide for the automobile, all sales records being smashed.

One interesting fact displayed by the sales sheet of the corporation is the increase of the sales of sixes over fours.

Enlargements of the plants are now being made so that production for the season of 1916 can easily take care of 60,000 machines.

As evidence of the general automobile prosperity, the Chicago branch of the Studebaker Corp. has just closed the biggest month in its history. In April 828 cars were sold in that city alone.

Todd Buys Sta-Rite Parts

DETROIT, MICH., May 11—Charles D. Todd has purchased for $500 the personal property consisting of machinery, etc., of the bankrupt Sta-Rite Corp., Utica, Mich., which made the Sta-Rite carbureter.

Hayes Annual Banquet—Business 25% Better than 1914

DETROIT, MICH., May 10—The second annual banquet given by the Hayes Mfg. Co., to the heads of its different departments, took place at the Hotel Cadillac, with about seventy Hayes men and some invited guests present. D. K. Stephens, factory accountant, presided and among those present were: H. J. Hayes, president; H. L. Bill, general manager; E. D. Emmons, sales manager; E. D. Carrow, treasurer; H. R. Deering, superintendent; C. E. Drum, factory manager; J. J. McClintock, storekeeper; Hal H. Smith, a director; C. E. Colton, former assistant sales manager; F. B. Everitt, former manager body works.

At the present time about 900 men are employed in the Detroit plant and about 350 in Ionia. April business was 25 per cent. ahead of last year's April.

Advertising Opens S. A. Markets

Must Be Constant—Early Sales of American Cars at Exorbitant Prices a Handicap

New York City, May 7—Some of the handicaps which American automobile manufacturers at present endeavoring to develop South American business have to overcome, are brought out by R. C. Tort, a representative of Argentina in this city. Mr. Tort refers to the early sale of American cars in South America when unreasonably high prices were charged for them. He cites cars that sold in this country at $1,250, which were sold in the Argentine at $2,000 and as high as $2,500. There was literally no reason for this added price because the duty of 25 per cent. plus 10 per cent. custom house duties brought the total price up to less than $1,700, but on top of this $800 was added.

One of the difficulties with some American concerns at present working on the South American market is that their advertising campaigns are not consecutive. Mr. Tort cites how necessary it is in the United States to have a constant advertising campaign, and claims that in order to reach the South American market it is necessary to have a similar campaign and to carry in the advertisements the real truth about the vehicles. The characteristics of each car he thinks should be carefully outlined so that buyers will have some material upon which to reason as to the suitability of such a car for them. He cites that today the term "coffey-pot" is heard in parts of Argentine as applied to some of the early American cars that flooded the market there.

The South American buyer, particularly in Argentine, is entirely familiar with a score or more makes of European cars which have been in the country for many years and from these he has obtained his earliest knowledge as to the performance of a car for a given price.

Goodyear Sales Conference To Be Held on Coast

San Francisco, Cal., May 8—With the arrival in San Francisco of F. A. Osterloh, sales manager of the Goodyear Tire & Rubber Co., plans are being arranged to hold the annual Goodyear conference for 1915 here instead of at the Akron factory.

Packard Dealers in Session

Detroit, Mich., May 8—The first two conventions of Packard dealers and distributors were held last week and will continue for the next 5 or 6 weeks. This year the Packard Motor Car Co. has departed from its former custom of having only one general convention. It has been found a better policy to gather only a small number of dealers at a time, a dozen or so, and to have them come from various sections of the country, instead of from the same state or section only. In this way the dealer or distributor can be given better attention and in a more personal way. The representatives who have been here the past week expressed themselves as confident that the automobile business will continue prospering.

Sells 63 Fords in 1 Day

Winnipeg, Man., May 8—The Ford branch in this city recently sold sixty-three cars in a single day. This number represents orders that actually came in for immediate delivery to Manitoba dealers under the local branch. Mr. Malcolmson, branch manager, thought his record of last week of twenty-five sales in 1 day would stand for some time, but it has been eclipsed. Sales in this city during the month of March show an increase of slightly more than 100 per cent. over the same month in 1914.

Melhuish Joins Midgley Tire

Lancaster, O., May 10—W. F. Melhuish, who will be remembered as sales manager of the Royal Tourist and the Croxton-Keeton for several years in the past, is now identified with the Midgley Tire and Rubber Co. as general representative.

Kriedeman Is Superintendent of Standard

Detroit, Mich., May 10—C. C. Kriedeman has been appointed superintendent of the Standard Motor Truck Co., manufacturer of the Standard truck in Detroit.

Bender Goes to Overland

Toledo, O., May 10—John L. Bender, formerly of Timken-Detroit Axle Co., and American Ball Bearing Co., and recently sales manager of Grant-Lees Gear Co., Cleveland, has been appointed distributor of the Overland product in central Pennsylvania. Bender has acted as district manager in central Pennsylvania for the past year. He will take headquarters at Altoona.

Van Speedometer on 1916 King

Detroit, Mich., May 7—The Cutting, Armstrong & Smith Co., Michigan representatives for the Van Sicklen speedometer, have closed a contract with the King Motor Car Co. for its 1916 equipment. The company has received an order from London, England, for forty-five more eights, making 236 cars shipped to London in 6 weeks

7,686 Cal. Registrations in April

Revenue for Less Than 4 Months Is $325,074 Above Total for 1914

Sacramento, Cal., May 7—Automobile registrations in California for the month of April total 7,686 cars, according to the figures issued at the state motor vehicle department. The total, however, is not entirely for new cars but includes the registration of quite a number of old cars on which lax owners had not paid the registration tax.

MAKE	MARCH	APRIL
Ford	2,695	2,669
Studebaker	745	601
Buick	575	532
Overland	720	523
Maxwell	378	381
Dodge	239	237
Cadillac	263	201
Reo		196
Mitchell		125
Hupmobile		118
Chalmers		106
Jeffery		98
Hudson		80
Metz		77
Regal		75
Oakland		70
Kissel Kar		55
Oldsmobile		54
Franklin		53
Locomobile		34
Packard		27
Pierce-Arrow		26

Trading during the closing weeks of April in San Francisco and, in fact, throughout the northern California district was not as brisk as at the opening of the month because of inclement weather. In the southern portion of the state dealers are reporting a good measure of activity, especially in the medium-priced lines.

As the registrations show, the eight-cylinder Cadillac is making a most favorable impression in all parts of the state and the California representative is experiencing difficulty in securing the cars fast enough to make deliveries.

The two Ford assembling plants in California are working to capacity and the cars turned out are being picked up quickly by a metropolitan demand as well as a call from the country districts.

According to an official statement issued by the the state treasurer on April 19, the gross revenue from the 1915 collection of automobile, motorcycle and chauffeur taxes and licenses amounts to $1,663,859.25. This covers a period of 3 months and 19 days. As the receipts of the motor vehicle division during 1914 were $1,338,785.25, the 1915 receipts are already $325,074 in excess of the previous year's returns. This big increase with more than eight months yet to come in, is not due entirely to the greater number of machines registered, but is accounted for largely through the excess licenses collected under the McClure displacement method of rating automobile horsepower.

Texas Wants Light Motor Trucks

Improved Roads Open Big Field—Crop Outlook and Cotton Prices Excellent

AUSTIN, TEX., May 6—One of the satisfactory features of the automobile trade in Texas at this time is the increase in the demand for delivery vehicles of the lighter type. More sales have been made of this class of motor commercial cars during the last 2 months than in any similar period of the history of the trade in this state. The demand is not confined to the larger cities, but extends to all the smaller towns. This is particularly true of the more progressive and growing communities of South and West Texas. The fact that the street paving movement during the last 2 or 3 years has extended to almost every town in the state of 5,000 population and upwards has made the use of the motor delivery vehicle a very desirable feature of many lines of business.

The motor truck trade in Texas is also unusually good and it promises to be still better later on in the year. Crop prospects are excellent. Heavy and timely rains have placed the ground in fine condition for planting. The temporary depression that existed for several weeks during the late fall and early part of winter, due to the drop in cotton prices, is no longer felt to any marked degree, even in the recognized cotton-growing territory of Texas. Practically all of the last year's cotton crop is now out of the hands of the farmers and they received prices ranging from 7 to 9 cents for their product. Money is plentiful and the people as a whole are prosperous.

Auto Parts Reduces Prices on Accessories to Jobbers

PROVIDENCE, R. I., May 8—The Auto Parts Co., this city, has reduced jobbers' prices 50 per cent. on its muffler cut-out, valve stem adjusters and tire grip sets. A reduction of one-third was made on coil box switch keys and 40 per cent. on rear number holders. These prices apply to lots of 100, and in cases where jobbers have stocks on hand the discount on the stock will be given in additional merchandise, but applies only to merchandise bought this year.

Chicago Wants Wheel Tax Back

CHICAGO, ILL., May 11—After fighting for years to have its wheel tax removed Chicago has now decided, after the tax has been declared unconstitutional, that it wants it to be enforced again because of the money coming from the wheel tax being used for street improvements. The Chicago Motor Club in a recent ballot of its members as to whether they were in favor of the wheel tax voted 95 per cent. in favor of an amendment to the present motor vehicle law reinstating the wheel tax in Illinois cities. Four other motoring organizations in this city have passed similar resolutions.

Juergens Goes to Chicago

FREMONT, O., May 10—Theodore Juergens will sever his connection with the Lauth-Juergens Motor Car Co., this city, and go to Chicago, where he will become its selling agent. The plant has a number of orders, including a 100-truck order from Europe.

U. S. L. Committee Extends Time on Payment of Assessments

NEW YORK CITY, May 12—The reorganization committee of the United States Light & Heating Co. has extended the time for payment of assessments, which expired on May 5, for a further period, and announces that to date about 80 per cent. of the 21,131 shares of preferred stock have paid $15 a share assessment and nearly 66 per cent. of the 62,559 shares of common have met the $2.50 a share assessment. The amount received to date on the preferred stock totals about $250,000 and on the common more than $100,000, or a combined total of 74 per cent.

Inness Takes Charge of Chase Philadelphia Branch

PHILADELPHIA, PA., May 8—J. A. Inness, a Chase representative in the earlier days, and who for the past 2 years has been in charge of the motor truck department of the Chicago Pneumatic Tool Co. in the Philadelphia territory, has assumed the management of the Chase Motor Truck Co.'s branch, succeeding A. E. Fisler. Extensive improvements will be made at the Philadelphia branch, a complete service station will be installed and all the territory comprising Eastern Pennsylvania, New Jersey, Delaware, Maryland and District of Columbia will be hereafter served by the Philadelphia Chase organization.

F. B. Porter has been appointed export manager of the company. J. B. Sperry, formerly with the Federal truck and Briggs-Detroiter companies, also has joined the Chase organization.

Russel Factory Additions

DETROIT, MICH., May 12—The Russel Motor Axle Co., North Detroit, recently broke ground for a new concrete building 120 by 30 feet, this being the first of four units of the same size the company proposes to erect.

Employer of Driver Responsible

Court Holds Driver Agent of Baker Co., Though Driving for Car Owner

CLEVELAND, O., May 5—According to a ruling of the Court of Common Pleas of Cuyahoga County, Ohio, a garage owner is held responsible for accidents to the owner of a car, or to third parties who may be injured, in consequence of the carelessness of a hired driver in the employ of the garage.

This decision was handed down in the suit of Jones vs. Baker Motor Vehicle Co., and it appeared from the evidence that Mrs. Jones was the owner of a car which was kept by the Baker company in its garage as a boarder in the usual way. Upon her call the Baker company was in the habit of furnishing her with a driver at a fixed rate per hour, and such driver was instructed by the Baker company to drive as directed by the owner while out with the car. It appeared further that while such an employee of the Baker company was driving Mrs. Jones one evening about dark and in a drizzling rain the electric ran into a dirt wagon standing by the roadside with no light upon it. Mrs. Jones claimed injury as a result of the collision and the court charged the jury that, as a matter of law, the driver of the car was, at the time of the accident, the agent and servant of the Baker company and that if the company had not exercised due care in the selection of a careful driver, or if the driver were negligent, and such negligence caused the accident, the company was liable.

The ruling in the case is the first of its particular kind and is of great importance to the retail branch of the industry in the event it is sustained by the higher courts.

Re-Elect Allis-Chalmers Directors

MILWAUKEE, WIS., May 6—The present directors of the Allis-Chalmers Mfg. Co., this city, were re-elected at the annual meeting of the stockholders at Wilmington, Del.

The directors are: J. H. McClement of New York, chairman; Gen. O. H. Falk, O. C. Fuller, J. D. Mortimer, Gustave Pabst and Fred Vogel, Jr., of Milwaukee; Max Pam and F. O. Wetmore of Chicago; A. W. Butler, Arthur Coppell, C. W. Cox, O. L. Gubelman, R. G. Hutchins, Jr., and W. C. Potter of New York, and J. P. Winchester of Wilmington. Messrs. McClement, Falk, Mortimer, Fuller, Pabst, Vogel, Pam and Wetmore are directors elected by holders of preferred stock and the others are elected by holders of common stock.

40 Cents Per H. P. in California

New Schedule, If Adopted, Will Do Away with Blanket System

SACRAMENTO, CAL., May 7—Unless there is some slip during the present session of the state legislature, the state automobile registration act will be so amended that a fixed registration fee based on 40 cents per horsepower S. A. E. rating will be adopted. Under the present law automobiles are taxed under a blanket rating covering of from 10 to 20, 20 to 30, etc., horsepower. The adoption of this schedule will give California as high a registration fee as any state in the Union.

New Traffic Laws for New Jersey

NEWARK, N. J., May 6—New traffic laws went into effect in New Jersey today. Owners of vehicles, both horse-drawn and motor-driven, together with pedestrians, street cars and bicycles are included within their scope.

The new law was drawn up as a result of a report submitted to Governor Fielder by a special committee appointed by him to consider the subject. This committee was composed of the then motor vehicle commissioner, Job H. Lippincott, chairman; A. V. Hamburg, president of the Board of Trade in Newark, and G. B. Le Barre, commissioner of public safety of Trenton. The new law does away with a mass of conflicting and contradictory local ordinances that were a bane alike to the driver of the automobile and the horse vehicle.

One of the features of the new rules is the legal definition of who has the right-of-way at intersecting streets not operated by traffic officers. The right-of-way at such points is given to the driver of the vehicle on the right. The law also regulates the speed of horse vehicles, trolley cars and other conveyances, but does not attempt to change the present automobile speed, already covered by the motor vehicle act.

Some of the salient features of the regulations applying to all roads concerning stopping, turning, passing and crossing follow:

Headlight Glare Eliminated

Headlight glare is to be eliminated. Dimmers on electric headlights are not sufficient. Particular emphasis is laid in the new rules on the fact that all devices to do away with dazzling headlights must be permanent in their character and must not be under the control of the driver. The rules apply to vehicles, no matter whether in the city or in the country, and irrespective of whether they are licensed in this (New Jersey) or in some neighboring state.

Every driver or operator of any vehicle following any street car, when passing such street car when it is stopped to take on or discharge passengers, shall keep at least 8 feet from the right-hand running board or low step of such car.

It shall be unlawful for any person to hitch or leave standing, or to cause or permit to be hitched or left standing, any animal, or to leave standing any vehicle or animal in or upon any public street within 10 feet of a fire hydrant, unless such animal is in charge of some person capable of driving the same, or unless such vehicle is in charge of some person capable of driving or operating the same.

No vehicle shall stop or stand within the intersection of any cross street, nor within 10 feet of any cross walk or street crossing.

No vehicle shall travel at a greater speed than 6 miles an hour when passing or approaching a schoolhouse, provided signs easily visible have been placed on the highway indicating such approach.

Any person crossing a street at any place other than the crosswalk shall do so at his own risk. Nothing in this regulation, however, shall relieve the drivers of vehicles from being constantly vigilant, exercising all reasonable care to avoid injuring either persons or property.

159 Violations of Pennsylvania Law

HARRISBURG, PA., May 3—A statement of the fines collected for violation of the automobile law in 1914 shows 159 violations in the several counties of the state with total fines collected amounting to $19,853.89. Of this amount $16,242.48 was paid to city, borough or township treasurer, $3,611.41.

The violations and fines collected for each were as follows: Operating when intoxicated, $731; operating without registration, $290; operating without consent of owner, $64.41; failure to sound horn, $1,067; failure to stop when signalled, $30; passing car discharging passengers, $702; failure to display badge, tag or lights, $727; violation of speed limit, $16,242.48.

Leave Cars in Street 30 Minutes

PORTLAND, ORE., May 8—Judge Stevenson, of this city, has handed down the opinion in the municipal court that vehicles may stand in the congested district in one place as often as their drivers may wish, provided the stay is not for more than 30 minutes.

DOVER, DEL., May 8—The Elgin Motor Car Corp. has been incorporated with a capital stock of $1,000,000. The incorporators are: F. R. Hansell, Philadelphia; G. H. B. Martin, S. C. Seymour, Camden, N. J.

Amendment Cuts Pa. License Raise

Change Made To Make Increase Average But 25 Per Cent. Instead of 50

HARRISBURG, PA., May 6—Automobile and commercial vehicle license rates in Pennsylvania will be only increased 25 per cent., according to an amendment to the Lipschutz bill, which has just been passed on second reading.

The amended bill provides for the following fees for pneumatic tire vehicles:

Horsepower	New Rates	Old Rates
Under 20	$6	$5
From 20 to 35	12	10
From 35 to 50	20	15
Over 50	30	20

FOR SOLID TIRE MOTOR VEHICLES

Pounds	New Rates	Old Rates
Under 4,000	$10	$5
From 4,000 to 5,000	15	10
From 5,000 to 10,000	20	15
From 10,000 to 15,000	25	20

New Insurance Rates in Missouri

ST. LOUIS, MO., May 7—As a result of the recently enacted Missouri fire insurance rating law, which prohibits rate-cutting, automobile owners in this state henceforth will have to pay about 50 per cent. more for insurance on their machines. The question of whether automobile fire insurance would come under the provisions of the new rating law, which was in dispute for several weeks, has just been decided in the affirmative by the State Insurance Commissioner.

Thirty-five insurance companies taking auto risks in St. Louis already have filed their rates with the Insurance Commissioner. These rates are the same as most companies have been trying to maintain for two years, but which have not been in force because of the common practice of agents of cutting rates to get the business.

The new rates will be $1.50 per $100 valuation per year on high-priced cars; $1.75 per $100 on medium-priced cars, and $2 per $100 valuation on low-priced cars. The new schedule became effective this week and it is believed that owing to the rigid provisions of the new law for the maintenance of rates no insurance company or agent will attempt rate-cutting.

4,000 New Cars for Colorado in 1915—20% Gain

DENVER, COL., May 3—Colorado promises to show an increase this year of 4,000 cars, or more than 20 per cent., over the 1914 registration, according to an estimate made by Secretary of State Ramer. Last year the total registration, including dealers' cars, was 18,433, and the returns received thus far this year have reached the 18,000 mark. Denver's share of this number is 5,900. On account of heavy snow still blocking some of the mountain passes, the returns from several of the outside counties are coming in rather slow. But the snow is getting out of the way a little faster this year than it did last, and the new system of starting registration December 1 has also helped to bring in a larger proportion of the total registration than the returns showed at this time in 1914. Secretary Ramer has ordered a total of 22,700 license tags for 1915, and states that this number represents a conservative estimate of Colorado's total cars for this year, according to reports from county officials and sales predictions from dealers.

34,000 Cars in Ontario

TORONTO, Ont., May 8.—Nearly 34,000 cars are now registered in Ontario, which seems amazing for only one province of the Dominion. As a matter of fact the Canadian Ford Company's output of 30,000 cars in Ontario for this year alone will be more than half as many as the cars of all makes now in Germany, 57,000, and a third as many as are in France, 90,000. It is surprising to note that there are three times as many cars in use in Ontario as in the entire Russian Empire and twice as many as in Austria. Australian registrations show 15,000 cars owned in that country, which is less than half the number of cars owned in Ontario.

Canada Underwriters Formed

TORONTO, ONT., May 8—Writers of automobile insurance in Canada met in Toronto last week and formed the Automobile Underwriters' Assn., of Canada. Practically all the accident insurance companies were represented. The association proposes to revise the tariff of automobile insurance premiums. J. J. Durance, General Accident Insurance Co., was appointed president of the association, and W. H. Cross, secretary. The association will have offices at Toronto and Montreal.

Automobilists Must Dim Headlights

BALTIMORE, MD., May 8—Cumberland, Md., has issued orders that all motorists must dim the lights on their machines while in the city limits.

Cartercar Men Form New Connections

DETROIT, MICH., May 10—George Reason, manager of the Detroit branch of the Cartercar company ever since it was started about 9 years ago, has taken over the Addison Garage.

L. B. Fast, who had charge of the city sales of the local Cartercar branch, has taken a position with the Oakland Motor Car Co.

Automobile Exhibits at Exposition Occupy 80,000 Square Feet of Space

Accessory Displays Fill 2,000 Square Feet More and 60,000 Feet Held in Reserve—Also 60,000 Feet for Motor Trucks, Latter Is Wholly Unoccupied

SAN FRANCISCO, CAL., May 6—In the Palace of Transportation of the Panama-Pacific Exposition, a 7-acre building, is an automobile exhibit using about 80,000 square feet of space. In addition, there are 2,500 square feet of accessory displays and 3,500 square feet used by the motorcycle interests.

Nearly 60,000 square feet is still held in reserve in the automobile section and there also is a motor truck building, with 60,000 square feet, which is wholly unoccupied.

Blythe H. Henderson, chief of exhibits of the transportation palace, left yesterday for the East to interest gasoline and electric car manufacturers in filling the large amount of reserve space.

Most of the exhibits already installed are from the manufacturers. In a few cases San Francisco dealers are sharing in the expense or are supplying representatives. Several dealers are carrying space outright but hope to be reimbursed partially by the factories later.

All representatives in the exhibits report a fair interest, which they say is above expectations for this early season of the exposition. No sales are closed on the grounds on account of the provision of the space contract which requires a 25 per cent. bonus to the exposition for every transfer of money within the exposition.

The price of space is $1.50 a square foot, which is complete for the year. This pays not only for rental, but for janitor service, lights and a certain amount of decoration of the automobile section of the palace.

This decoration includes relief maps in the upper walls, three of which—the Lincoln Highway, the Meridian Highway and the Trail to Sunset—are done elaborately, from terminus to terminus, a great amount of adjacent country being shown. Ornamental trees also are supplied and an oiled linoleum.

The most ambitious exhibit is by the Ford Motor Co., which has a miniature assembly plant. Eighteen complete cars are put together from 2 until 5 o'clock every afternoon, or at the rate of one every 10 minutes. These are moved along in the assembly processes by a conveyor and finally are driven off under their own power to a parking space outside.

Awards of merit are to be given cars in the exhibits in the fall by a jury of experts to be named later. This jury, to be composed largely of members of the S. A. E., will formulate its own rules. Some judges have already been chosen.

Carnegie Engineering Promoters Held for Mail Fraud

KALAMAZOO, MICH., May 7—United States officers today arrested Robert F. Norwalk, vice-president of the Carnegie Engineering Co., of New York, which is supposed to have been making the Carnegie car, but which, according to the post office authorities, has been using the mails for a fraudulent purpose.

While the vice-president of the company was being arrested here, the president, William J. Bailey, was arrested in New York for the same reason.

In its literature the company advertised the Carnegie car at a price of $595 f.o.b. Pittsburgh, Pa., and it was so worded as to give an impression, it is claimed, that the Carnegie Steel Co., Pittsburgh, was interested in the matter. By the clever wording of the letters and advertising matter, the engineering company, it is claimed, received deposits from a very large number of dealers. Fifty dollars for every car ordered was generally required to show the good faith of the dealer. One dealer in this way made a deposit of $1,250—for fifty cars.

When interviewed by a representative of THE AUTOMOBILE, Bailey, who is out on bail, denied this and stated that his contracts called for demonstrator cars to be ready August 1. This he said would have been done. Kalamazoo agents of the company are now endeavoring to rush a finished car to New York to show at the trial as evidence that the company intended to deliver cars.

The specific instance cited by the government is an intent to defraud the Hudson-Phillips Motor Car Co., St. Louis, Mo.

The capital stock of the Carnegie Engineering Co. is supposed to have been $1,000,000. Claims were made that it had the largest automobile plant in the world, supposedly in Kalamazoo. A local concern received an order to assemble five cars for the company, but last week, so the report goes, the engineering company had to relinquish receipt of several boxes of parts, owing to lack of funds to pay the express company's charges.

17,084 Carloads of Automobiles Shipped in April—N. A. C. C. Meets

Month's Shipments of Cars and Trucks Greatest in History of the Industry—Investigate Jitney Buses—Future Seems Assured—To Encourage Development

DETROIT, MICH., May 5—Automobile shipments for April of this year were 17,084 freight carloads, the greatest number in the history of the industry. This fact was brought out at the meeting of the board of directors of the National Automobile Chamber of Commerce, Inc., held here this morning, and preceding the opening of the truck convention. In giving these record shipment figures to the meeting, the traffic committee reported that this number was an increase of nearly 25 per cent. over April of last year, when 14,122 carloads of motor vehicles were shipped.

In consequence of the shipping activity of the past few months, which has no parallel in the industry's history, Wm. E. Metzger, chairman of the traffic committee, stated that the unprecedented demand for freight cars was being felt by the railroads, which have asked the manufacturers to use every effort to have the special automobile cars returned promptly.

Among other matters, the N. A. C. C. took up the matter of jitney buses and is investigating them. Their future seems assured and they have opened up a new field for commercial cars. Ways and means of encouraging this field and showing up just what the buses will really do were discussed, and such matters as insurance, speed, carrying capacity and other considerations of vital importance to the future of the traffic were referred to a special committee appointed for the purpose.

Various reports of committees on good roads, patents, legislation and commercial vehicles were heard, and special mention was made of the opening up of the Yellowstone Park to automobilists August 1.

The meeting was held here in order to give all an opportunity to attend the truck convention, it ordinarily being held in New York. W. C. Leland presided, and others in attendance were Hugh Chalmers, Alvan Macauley, W. E. Metzger, R. D. Chapin, C. C. Hanch, H. H. Rice, W. T. White, C. W. Churchill, Col. Geo. Pope, Thomas Henderson, and Alfred Reeves.

Dividends Declared

HARTFORD, CONN., May 8—Pratt & Whitney Co., regular quarterly dividend of 1½ per cent., preferred stock; payable May 15. Books closed May 6 and reopen May 17.

Few Changes in Market

NEW YORK CITY, May 10—Market prices last week were steadier with the usual changes. There was a small demand in the metal markets yesterday and a less confident tone among the selling interests. The largest producing interests are still asking 19 cents delivered 30 days for electrolytic copper. Shipments of copper are going forward a little more freely. Tin showed less demand with freer offerings of nearby and future positions. Yesterday the metal was weaker than on Saturday, but of course considerably higher than on Friday. Lead was stronger in tone at the closing on Monday and with a better offering.

The crude rubber market yesterday developed a somewhat better inquiry and was more steady. Manufacturers continued to restrict their purchases to comparatively small lots, but the demand for such quantities showed some increase. Fine Up-River Para quoted at 60 cents after having a short drop to 59 on Friday and Saturday. The market in London is dull with plantation rubber easier. Shipments are coming in regularly from London, Liverpool and Singapore.

The oils and lubricants markets were steady with a moderate demand in all the products. Linseed oil showed a gain this week of 2 cents. The rest of the oils remained unchanged.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Antimony	.33	.34½	.34	.34	.34	.34	+.01
Beams & Channels, 100 lbs.	1.31	1.31	1.31	1.31	1.31	1.31	......
Bessemer Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Copper, Elec., lb.	.18⅝	.18¾	.18¾	.18⅞	.18¾	.18¾	+.00⅛
Copper, Lake, lb.	.19	.19	.19	.19	.19	.19	......
Cottonseed Oil, bbl	6.57	6.50	6.45	6.39	6.30	6.30	—.27
Cyanide Potash, lb.	.23	.23	.23	.23	.23	.23	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	4.15	4.15	4.15	4.15	4.15	4.20	+.05
Linseed Oil	.65	.65	.67	.67	.67	.67	+.02
Open-Hearth Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, refined	.82	.82	.82	.82	.82	.82	......
Rubber, Fine Up-River, Para	.60	.69	.60	.59	.59	.60	......
Silk, raw, Ital	3.90	..	3.90	..	..	3.90	......
Silk, raw, Japan	3.55	..	3.52½	..	..	3.55	......
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	39.25	39.00	39.00	39.50	41.50	40.75	+1.00
Tire scrap	.04¾	.04¾	.05	.05	.05	.05	+.00¼

Goodrich Plans Addition of $1,000,000 Building

AKRON, O., May 8—The B. F. Goodrich Co. contemplates the erection of a $1,000,000 factory building during the present summer. The structure, which will be the last word in factory construction, will be erected on South Main street. Plans for the structure are being prepared by the Osbourn Engineering Co., Cleveland.

It is planned to use a portion of the building for a warehouse until a later date, when it will be made into a factory proper with machinery installed. The Goodrich company recently purchased a strip of ground along the canal near the present factory, and at that time it was rumored that a large addition to the plant would be erected.

Continental Motor Plans—Addition to Muskegon Plant

MUSKEGON, MICH., May 10—The Continental Motor Mfg. Co. is planning the erection of a new three-story building on North Terrace street, the new building to be used for crating and packing purposes. The addition will be the largest the company has built in a number of years.

Buick to Enlarge Plant

FLINT, MICH., May 10—The Buick Motor Co. was given a permit last week for a two-and-one-half-story factory addition which is to cost $22,500.

Ford to Build 47,813 Cars Per Month to Aug. 1

DETROIT, MICH., May 10—Between August 1, 1914, and April 1, 1915, that is during 9 months of the fiscal year of the Ford Motor Co., agents throughout the country have received 156,561 complete cars, which is at the rate of 17,395 per month. This means that during the remaining 3 months of the fiscal year the company must build 143,439 cars, or an average of 47,813 per month, in order to complete the 300,000 cars to be made in the fiscal year. This is quite likely to be accomplished inasmuch as during

April the production was 46,510 cars. In addition to the 156,561 cars complete cars shipped to the agents, the various assembling plants throughout the country have assembled about 40,000 cars during the period of August 1, 1914, to April 1, 1915.

Mansfield Tire Expands

MANSFIELD, O., May 10—The Mansfield Tire and Rubber Co. is working night and day. The work of getting the new plant at Columbiana, O., ready for operation is being rushed and it is hoped in that way to relieve the congestion at the Mansfield plant.

At a recent meeting of the directors of the company, it was decided to erect a four-story addition to the southeast of the present structure. The addition will be 100 by 41 feet with a completed basement. A lot of new machinery has also been purchased which will be installed as soon as possible.

Princess Enlarges Plant—1916 Car Ready

DETROIT, MICH., May 8—The Princess Motor Car Co., this city, has recently added 5,000 square feet of floorspace to its plant. The force of twelve men is to be gradually increased and it is expected that ten cars a day will be made by the end of this month. Recently the company completed its first 1916 model, known as the Princess 30, which is listed at $695. An order for sixty-five model C cars, at $495, was received recently from a dealer in Belfast, Ireland, and filled at once.

War Rumors Affect Market Issues

Heavy Liquidation Follows Sinking of Lusitania—Few Gains Reported

NEW YORK CITY, May 8—Automobile securities followed a downward course last week on account of international questions. The market received a bad shock from news of the sinking of the Lusitania. There was a rush to sell long stocks, especially in stocks which led the recent rise. Prices are certain to move irregularly until the direct and indirect effects of the disaster can be more clearly diagnosed.

Ajax-Grieb, Firestone, Goodyear, Willys-Overland, J. I. Case and Chalmers issues were the only ones to show gains for the week. The largest rises were in tire issues, Ajax-Grieb and Firestone common, going up 15 and 20 points respectively. Chalmers common went up 3 points. The rest were 1-point gains.

Studebaker's loss was 10 points. General Motors was one of the issues that did not recover. Before the decline started it was selling at 143 3-4, compared with 144 1-8, the closing price on Thursday. The last sale was 138. Goodrich advanced early on Friday, but in the afternoon the price declined from 48 1-2 to 39 3-4. Its recovery was 3 1-4 points.

Detroit quotations showed a sympathetic decline, the drops, however, being on a smaller scale than those in the local exchange. Regal preferred in the inactive stocks showed a 5-point gain, the largest. Chalmers common and preferred went up 1-2 and 1-point respectively.

Puritan Machine Buys Crescent

DETROIT, MICH., May 10—The Puritan Machine Co., Detroit, has made its sixty-fourth purchase of the parts of automobile manufacturers. The sixty-fourth purchase is that of the Crescent Motor Car Co., Cincinnati, O. The sixty-third purchase was that of the Carthage Motor Car Co., Carthage, O.

Speedwell Plant Sold

DAYTON, O., May 6—The plant of the Speedwell Motor Car Co., which was placed in the hands of a receiver on March 1, has been sold to the W. M. Pattison Supply Co. The plant was offered, it was reported, at $150,000. The Speedwell assets were purchased by the Puritan Machine Co., Detroit, Mich., in April.

$600 Offer for Church-Field

DETROIT, MICH., May 8—The Union Trust Co., assignee for the Church-Field Motor Co., Sibley, Mich., has been offered $600 for the remaining assets. Permission has been asked Judge Murphy to accept the offer.

Nelson with McGraw

EAST PALESTINE, O., May 10—R. G. Nelson, formerly manager of the Nordyke & Marmon Co., Chicago branch, is now with the sales department of the McGraw Tire and Rubber Co., this city.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	215	..	300	..	+15
Ajax-Grieb Rubber Co. pfd	99	..	101	..	+1
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	80½	82½	81	87	+1
Chalmers Motor Company com	80	86	93	96	+3
Chalmers Motor Company pfd	90	91½	94	98	—1
Electric Storage Battery Co	..	..	51	52	—1
Firestone Tire & Rubber Co. com	285	290	485	..	+20
Firestone Tire & Rubber Co. pfd	106	109	110	112½	..
General Motors Company com	78	80	138	140	—5
General Motors Company pfd	90	92	97	99	—4
B. F. Goodrich Company com	25¼	26	43	44	—7
B. F. Goodrich Company pfd	89¾	90½	101½	103	— ½
Goodyear Tire & Rubber Co. com	173	178	245	255	—17
Goodyear Tire & Rubber Co. pfd	97	98½	105	106½	+ ½
Gray & Davis Inc. pfd	93	102½	..	..	..
International Motor Co. com	..	5	10	12	—3½
International Motor Co. pfd	..	15	25	30	—4
Kelly-Springfield Tire Co. com	..	..	116	129	—19
Kelly-Springfield Tire Co. 1st pfd	..	..	83	86	..
Kelly-Springfield Tire Co. 2nd pfd	..	..	130	140	..
Maxwell Motor Company com	8¼	9¼	46½	47½	—5½
Maxwell Motor Company 1st pfd	39½	40½	81	83	—3
Maxwell Motor Company 2nd pfd	14½	15½	38	39	—2
Miller Rubber Company com	..	..	186	188	..
Miller Rubber Company pfd	..	..	104	105	..
New Departure Mfg. Co. com	103	..	..	..	..
New Departure Mfg. Co. pfd	94	98	..	..	..
Packard Motor Car Co. com	103	..	105	..	..
Packard Motor Car Co. pfd	94	98	95	100	—4
Peerless Motor Car Co. com	18	25	20	22	..
Peerless Motor Car Co. pfd	..	70	..	55	..
Portage Rubber Co. com	..	30	35	38	..
Portage Rubber Co. pfd	..	85	85	88	..
*Reo Motor Truck Company	8½	9½	14½	16	..
*Reo Motor Car Company	24	27	31	33	—1
Splitdorf Electric Co., pfd	..	50	..	..	..
Stewart-Warner Speed. Corp. com	48½	50	68	69	—1½
Stewart-Warner Speed. Corp. pfd	98½	99½	103	105	..
Studebaker Corporation com	32½	33	66	67	—10
Studebaker Corporation pfd	87	89	101	103	..
Swinehart Tire & Rubber Co	60	65	80	90	—1
Texas Company	140	142	129	131	—8
U. S. Rubber Co. com	57	57¾	60	62	—10
U. S. Rubber Co. pfd	101	102	106	107½	—2
Vacuum Oil Company	218	222	213	215	—3
White Company pfd	107	110	103	108	..
Willys-Overland Co. com	64	66	117	119	+1
Willys-Overland Co. pfd	88	92	100	102	..

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
ACTIVE STOCKS					
Chalmers Motor Co. com	84	..	..	95	+ ½
Chalmers Motor Co. pfd	90¾	92½	93	98	+1
Continental Motor Co. com	150	180	170	185	..
Continental Motor Co. pfd	..	80	82	85½	..
General Motors Co. com	78	80	136	144	—6½
General Motors Co. pfd	90	92	98	100	—2
Maxwell Motor Co. com	8¼	9¼	45	49	—6½
Maxwell Motor Co. 1st pfd	39	40	80	82½	—3½
Maxwell Motor Co. 2nd pfd	14½	15	36	38½	—4
Packard Motor Car Co. com	103	..	103	..	..
Packard Motor Car Co. pfd	94	98	97	100½	+2
*Reo Motor Car Co	25½	26	31	32½	..
*Reo Motor Truck Co	8½	9½	..	15¾	+ ¼
Studebaker Corp. com	..	..	66	70	—10½
Studebaker Corp. pfd	..	..	100	102	—1
INACTIVE STOCKS					
*Atlas Drop Forge Co	..	21	..	26	..
Ford Motor Co. of Canada	..	560	700	..	..
Kelsey Wheel Co	..	195	195	..	..
*W. K. Prudden Co	..	21	19½	21	+ ½
Regal Motor Car Co. pfd	..	35	..	25	+5
BONDS					
General Motors, notes 6's, 1915	101	102	..	..	..
Packard Motor Co. 5's, 1916	95	98½	98½	..	..

---

*Par value $10, all others $100 par value.

Annunciators for Tacoma

Speedway Is Now Three-Quarters Completed — Eight Entries for July 4 and 5

TACOMA, WASH., May 10—George D. Dunn, secretary of the Tacoma Speedway Assn., states that work on the track is progressing nicely with practically three-fourths completed. The entire planking will be finished about May 20. An innovation the Tacoma Association will try out is the installation of annunciators to announce to the spectators instead of the ordinary method of having a man talk incoherently through a megaphone. The scheme involves a megaphone with a diaphragm in each section of the grandstand and at four points in the parking spaces, making seventeen in all. These will run to four telephones which will be so arranged that they can all be spoken into by one man. Thus, at any time during the races, announcement of the positions of the cars and other interesting events can be quickly conveyed to all parts of the track.

Entries are as follows:

Bob Burman	Peugeot
Earl Cooper	Stutz
Eddie Pullen	Mercer
Guy Ruckstell	Mercer
Joe Thomas	Mercer
Dave Lewis	Stutz
Wilbur De Alene	Car unnamed
Jim Parson	Parsons' Special

Three Briscoe Racing Cars

JACKSON, MICH., May 12—The Briscoe Motor Co. is going to enter the racing field with three specially built cars which they hope to have completed in July and to enter them in track events during the fall. Two of the cars will be built to meet the 300 cubic inches piston displacement and the third will be a free-for-all type. These cars will embody some of the standard Briscoe features of construction but in general will be racing creations.

Entry Blanks for Elgin

CHICAGO, ILL., May 8—Entry blanks for the annual Elgin road races, scheduled this year for August 20 and 21, have been sent out by George Ballou, chairman of the contest board of the Chicago Automobile Club, which will co-operate with the Elgin Road Racing Assn. in the promotion of the events.

The prize money for the two races, each 301 miles in distance, will total $6,000 as last year, and the purse for each event will be $3,000. The race for the Chicago Automobile Club cup will be run Friday and the contest for the Elgin trophy Saturday.

For this year's speed carnival the piston displacement of the competing cars has been reduced. The Elgin trophy race, formerly a free-for-all, will be for 450-cubic inch cars and the C.A.C. cup event is limited to machines that cube 300 inches instead of 450 inches as formerly.

The contract for the joint promotion of the races was signed yesterday. The course has been greatly improved since last season, having been sacrificed and rolled and about 400 wagonloads of boulders removed.

Eight-Cylinder Romano Stars on Portland Track

PORTLAND, ORE., May 8—The Rose City Speedway was the scene of the first race meet in the Northwest on May 1 and 2 and a record for its 1-mile circular dirt track was established by Charles Latta, of Seattle, when he sent the eight-cylinder Romano across the final lap in 9 minutes and 11 seconds after the start of the race.

Another Seattle car, a Velie, driven by Fred Barsby, won the 10-mile Oregon vs. Washington event for class B cars in 10 minutes 15 seconds, and the 10-mile free-for-all for class B cars in 10 minutes 13 seconds.

Only three cars entered the Portland special event—F. V. Forbes' Buick, Billy Smith's Marmon, and C. N. Bankhead's Pope Special. Forbes won, covering the 15 miles in 16 minutes and 15 seconds.

Lightning tire changes in the pits, mishaps and near-accidents on curves and the masterly driving on the part of Jim Parsons, a hard luck loser, furnished the thrills at the second day's races.

So far as the winnings were concerned, Schneider's Special gobbled up the majority of the events by winning the two class A events for 10 and 40 miles, respectively, and Fred Barsby fortified the superiority he had asserted over the class B cars on the previous day by winning the Oregon vs. Washington free-for-all.

Upwards of 3,000 enthusiasts were in attendance at the two days of racing. The meet was held under the management of the Northwest Automobile Assn. The track was pronounced to be in the best possible condition by H. L. Keats, A. A. A. representative in Oregon.

More Sunbeams for Chicago

CHICAGO, ILL., May 8—Two additional Sunbeam entries, to be driven by Harry Grant and Carl Limberg, were received today for the 500-mile race to be run over the new Chicago speedway June 19. They are the same six-cylinder cars that have been nominated at Indianapolis and are owned by the Fortuna Racing Team, Inc., of New York, which purchased them recently from William Zeigler.

Two other Sunbeams have been named for the Chicago race. They are backed by the Sunbeam factory and in charge of Porporato, the Italian driver, who will campaign them in America this season.

The Illinois Central railroad this week began work on a $75,000 terminal station at the entrance of the local speedway. The company anticipates handling a crowd of 75,000 persons in a little more than 2 hours. In a conference with David F. Reid, president of the speedway association, representatives of other railroads agreed to support the project and to run special trains to and from Chicago on the day of the race.

Two officials already have been selected for the inaugural classic on the new track. Harry Vissering, president of the Chicago Automobile Club in 1914, will be referee, and Fred J. Wagner, starter.

Automobile Parade for San Francisco

SAN FRANCISCO, CAL., April 29—One of the results of the organization of the Transportation Club among the automobile men and other exhibitors in the Palace of Transportation of the Panama-Pacific exposition, is a parade planned for Transportation day, May 21.

The club was inspired by the automobile men. The parade committee is dominated by them. The governing idea of the parade is the evolution of transportation and all varieties are to be shown, with the jitney bus as the culmination of the development.

Name Stutz and Peugeot Drivers for Indianapolis

INDIANAPOLIS, IND., May 11—The Stutz Motor Car Co. has named the drivers of its three cars in the coming 500-mile race on May 29. They are Gil Anderson, Earl Cooper, Howard Wilcox and John Aitken.

Caleb Bragg and George Babcock have been named to complete the Peugeot team with Resta, already nominated. Both Babcock and Galvin have arrived in the city and have started practicing.

Chassagne and Porporato, Sunbeam drivers, are on their way to this country. Coatalen, who was originally scheduled to drive, was unable to get away because of war business.

John De Palma has practically finished rebuilding Rene Thomas' Delage and is now putting the car through its initial track trials. Many of the cars have been out for practice. Rickenbacher, in the Maxwell, made a lap in 1:35 or nearly 95 miles per hour.

A controversy has arisen as a result of the Burman and Harroun entries. It seems that Harroun intends to court disqualification for his Harroun special, on the ground that it is really a Maxwell, and, therefore, ineligible under the rule that "no more than three cars of any one make may start in any race." Burman has changed the name of his car from Burman Special to Burman Peugeot.

San Francisco Jitney Men and City Authorities in Complete Accord

Even in Passage of Exceedingly Strict Regulating Ordinance—Association, with 1,300 Members, Organized Along Union Lines—Jitneys Cut Trolley Revenue

SAN FRANCISCO, CAL., May 6—The jitney situation is unique in this city, for the reason that there is complete harmony between jitney association and city government, even in the passage of an ordinance that would be regarded as too stringent in some places.

Here is a city that may be regarded as the jitney metropolis. Certainly there are many more cars in operation here, with a sturdier controlling body, than elsewhere in the country.

A Break Threatened

For its favorable attitude toward this ordinance, the jitney organization has had to face the actuality of a second association, whose twenty-two members are warring against the regulating measure, which has passed the board of supervisors and now awaits the mayor's signature, which he has indicated that he will sign.

The San Francisco Jitney Bus Assn., with about 1,300 members, has been organized along union lines by union organizers and probably is one of the strongest jitney associations in the country. The membership roll is growing constantly and card No. 1,650 has been passed. However, it is said that more than 300 have dropped out since the association organized in January. A constant check is kept on members by two business managers, or walking delegates, who are out on the routes every day.

Charles N. Black, vice-president and general manager of the United Railroads of San Francisco, advises the representative of THE AUTOMOBILE that:

"Our gross receipts are approximately 10 per cent. less than during the corresponding period last year. The principal lines affected are those operating from the ferry out Market street, which is the Broadway of San Francisco.

"It is difficult to state how much our securities have been affected by this competition, as our stock is not quoted on any of the exchanges. The 4 per cent. bonds, which is the largest bond issue of this company outstanding, were selling on January 1, when the jitneys first put in an appearance in large numbers in San Francisco, at approximately 53. At the present time they are quoted at from 49 to 50.

Trolley Development Stopped

"We have not laid off any men as yet but we are not extending any lines, or buying any new rolling stock and we have no plans along these lines at the present time. We have made several checks on the jitney buses and at the present time there are in the neighborhood of 550 operating in San Francisco. Their average receipts are between $6 and $7 per day."

Some Average $8 a Day

This estimate of average receipts was reiterated by many jitney men. A few take in as much as $8 on an average. A scant half dozen exceed $8, according to their claims, and these boast of a secret system whereby they augment their earnings. They run on regular jitney routes during rush hours; take care of the 10-cent exposition trips during other regular intervals; and at all other times are in the cheap taxi service.

The friendly relations between the jitney men and the city administration are best shown by a recent contract for several day's hire of twenty-five jitneys, paid for by the city. These jitneys were driven through the streets bearing signs asking citizens to vote for the water bonds. When 250 members of the Native Sons lodge wanted to be driven to a barbecue at San Mateo last week, following Native Sons day at the exposition, they bargained for fifty jitneys.

"Most of the jitney men are union mechanics and laborers, out of jobs, and small business men," said Thomas Doyle, secretary of the association. He was one of the pioneers in San Francisco and helped with D. J. Alberga, elected president on April 26, to found the association with about 260 members at the start.

Harvest of Early Days

"Those first days were our harvest," smiled Mr. Doyle. "People were ashamed to give us a nickel then. Ten cents was the common fare, even though we had 5 cents painted on the front of the car. Many quarters were given, too, and our passengers were very polite, taking care to close doors and help us all they could. They are still just as friendly but the service has become so common that a nickel is the established price. I am sorry that we did not start out as dime buses. The extra nickel would have helped to tide us over during this early experimental period, when so many of us are making just a living wage. I believe the public would have paid a dime as readily as a nickel. Then we could have cut down to a nickel later when we had our costs figured out."

The rate of membership to the association is $5 initiation fee. For members admitted during the month of January, dues of $1 a year are charged during 1915; during February, $2; March, $3; April, $4, and May, $5, the maximum.

The association has gone on record against the Cogswell measure which has passed one house of the Legislature and by which jitneys will be taxed $12.50 a seat a year. This has already been amended to provide that should an operator decide to retire from business before the year is out, he will be given a rebate on the amount of tax he has paid.

The city ordinance, however, is approved in the hope that it will remove the irresponsible jitney man from the service and keep off the streets on Saturdays and Sundays the flood of school boys in their fathers' cars, who take the cream of the heavy week-end exposition business.

The ordinance provides for a $10,000 bond, insuring one victim injured or killed in the total sum of $5,000; two or more $10,000, "irrespective of the financial responsibility or any act or omission of said jitney bus owner or lessee."

Insurance the Big Question

Insurance was the big question in discussions between jitney men and the board of supervisors until the Pacific Casualty Co. drew up its policy. Now the jitney men have a policy which meets the city's requirements and also gives the operators $1,000 property protection. This costs $96 a year to association men, payable $24 down and $8 a month. The $24 pays for 3 months in advance and the jitney man can cancel at any time by failing to meet his monthly premium.

This insurance practically is an association affair, as non-members must pay cash and a larger premium and be subjected to an examination. The requirements of the city, the insurance company and the jitney association entirely interlock.

The ordinance further provides for permit fees as follows: $10 per year for a bus seating five passengers or less; $15 for more than five passengers and less than eight; $25 for more than seven and less than sixteen; $40 for more than fifteen. All permit fees are payable in advance.

Requirements for Drivers

The driver has to have 30 days' experience driving on the streets of San Francisco, must have a physical examination and pass an oral examination as to traffic laws. The number of the permit must be displayed in figures at least 3 inches high and 1-2 inch wide on the right side of the body. The driver must wear a badge.

Jitney drivers are not to drink or

smoke when on duty and the car must be washed and cleaned at least once a week, and swept out daily, or oftener when required in writing by the Board of Health. Brakes must be tested daily. Policemen and firemen are to ride free, when seats are vacant. The ordinance is to take effect within 10 days after being signed by the mayor. The police commission is given entire control and may make emergency changes in routes and regulations. It is provided that if any part of the ordinance shall be declared unconstitutional that all of the balance shall be in force.

Among a group of about twenty members of the jitney association, it was agreed that the tire expense of a Ford in daily operation over an average route would be between $15 and $18 a month.

Work on Car an Hour a Day

It is the practice of nearly all jitney men to lay off an hour or 2 in mid-afternoon, during which they work on the car. This time is figured as a part of the time the car is in service.

Gasoline and oil are obtained from the Monarch and Standard Oil companies at rates specially conceded to members of the association, it is said.

A book of coupons entitling the holder to $5 worth of purchases is sold by the Monarch Oil Co. for $4.60. Holders of these coupon books then get gas at 9 1-2 to 9 3-4 cents a gallon while the rest of the city is paying 10 1-2 cents. Some of the better fixed jitney men buy their gasoline in drums. It is said that from 6 to 9 1-2 gallons are used a day in a Ford jitney during 14 hours of service. San Francisco is a very hilly city, with some unusually steep grades on main streets.

One driver, who has a 5-mile run, reports that his gross receipts hover close to $6 daily, of which he pays out about $2 for supplies and parts and earns about $4 a day for himself. He is saving his money and believes he will be able to buy another car when his present Ford wears out. He does not drive on rainy days.

Another man who drives only at night, as he has a job in a garage in the day time, has had to pay $5 for a city vehicle license, $1 for a city driver's license, $2 for a state chauffeur's permit and $10 for a state license for his Ford.

Another Driver Reports

"My buses average $4 earnings a day over and above the cost of fuel and supplies. Some people pay $2 50 a day for drivers. That is the common practice. I won't say what I pay, for that would be giving away one of the basic features of my system. They work in 10-hour shifts, 7 days a week. I never drive, except when one of the men wants to get off. During parts of the day I check my two cars as they go by and see if they need anything.

"I expect to stay in this jitney business. I have a little money and it won't take much to swing this. My system is working fine. A definite amount is laid aside each week to cover half of the cost of a new car in 6 months. By that time I expect to be able to sell my old car at at least half its value when new. My new insurance policy covers smash-ups. So I am thoroughly protected, I feel."

The San Francisco Jitney Bus Assn. maintains a starter, day and night at the ferry, or ferry station, to see that the cars are kept running.

"We have made a few individual sales of new cars," said one of the local dealers, "Installment payment terms are often requested, but of course cash is the only basis. We sold one car to a tailor who had never been in an automobile before. He invested nearly all of his savings and then started to learn. He must have been in too much of a hurry to learn and collect jitney fares. In a week he came to us trembling and said that he was frightened to death when he was at the wheel and begged for his money back. We gave it to him."

Several automobile clearing houses and second-hand departments of large agencies, it is said, are selling cars to jitney men on liberal terms.

Trolley President Loses Fight to Run Jitneys

BELVIDERE, ILL., May 8—At a meeting of the Belvidere city council, the offer of B. J. Arnold, of Elgin, to operate jitney buses in place of a street railway system, was voted down. Arnold owns the Belvidere street car system but declares that it is a losing proposition. He agreed to operate the buses as often as the citizens thought necessary and tie up the street cars. When the city council declined to consider his proposition, he filed a petition with the Public Utilities Commission, asking that he be released from his contract with the city of Belvidere.

Developments in Ohio

COLUMBUS, O., May 8—The second stage of the jitney bus development in Ohio has arrived and this is proving even more interesting than the first. The city council of Youngstown, O., is now wrestling with the problem. The ordinance which is pending in the council is drastic and considerable opposition has developed.

In Ashtabula, O., the ordinance recently enacted by the city council was declared unconstitutional by Acting Police Judge Ullman in the first case which came up in his court. H. B. Pierce, a driver, was arrested for operating a jitney bus without the license which costs $100. The defense contended that the license was prohibitive. Immediately upon the decision of the court all of the jitney buses which had stopped operation started business at once. It is said the case will be appealed to the higher courts by the city solicitor.

In Columbus the jitney is developing in a limited degree. A. A. Phillips has purchased four cars which will be used to establish a service from Broad and High streets to Alum creek. Cars will be operated on an 8-minute schedule.

The Jitney Co., of Portsmouth, O., has been incorporated with a capital of $1,000.

Railways Cut Rates to Meet Jitney Competition

VANCOUVER, B. C., May 8—To meet the jitney competition, the B. C. electric railway has announced a cut in fares, and henceforth will allow eight tickets for 25 cents; these tickets will not be good for transfer. When transfers are wanted the fares will be five cents straight. B. C. interests control all the street railways in the province.

TACOMA, WASH., May 6—Announcement has been made by the Puget Sound Electric Co. that another reduction in fare will be made between Tacoma and Puyallup, to 10 cents each way, which is a reduction of 25 per cent. This was decided upon on account of the large amount of business being taken away from the company by the suburban auto buses and jitneys.

Mass. Jitney Bill Defeated

BOSTON, MASS., May 10—The jitney bus bill was overwhelmingly defeated in the House. It required the licensing of all jitneys, and required deposit of a bond for $5,000 for all vehicles of this type carrying passengers for hire.

Jitney Cop the Latest

ST. LOUIS, MO., May 7—The jitney bus in St. Louis has brought into being the jitney cop. The board of police commissioners has appointed a squad of policemen whose sole duty is to keep the jitney buses on the move. This squad is in addition to the regular traffic policemen at all of the downtown intersections.

More Freak Ordinances Proposed in Philadelphia

PHILADELPHIA, PA., May 8—An ordinance has been introduced into the select council which if enacted will practically legislate every jitney out of business. The ordinance, which was framed by Councilman Hutt and has been referred to the law committee for action, provides that each jitney must pay a license fee of $75 a year, each driver an individual license fee of $1, each bus owner must file a $5,000 indemnity bond against accident or failure to comply with the regulations. In addition, every driver must be furnished with an identification card, each car must be registered with the police department, special traffic rules must be adopted, buses must run at regular times over regularly established routes. The routes to be followed must be filed with the police department and any deviation from the regular route costs 50 cents for each change. Overcrowding is forbidden, the police to judge the carrying capacity of the bus.

The Philadelphia Jitney Assn. is up in arms against the drastic provisions of the proposed ordinance. While the association favors a tax and an indemnity bond, it has proposed that they be fixed at $15 and $1,000 or $2,000 respectively and will seek to have the lower amounts substituted. The association now has a membership of 432.

Another bus ordinance has been introduced into councils granting permission to the Midway company to run automobile buses on Broad street, Market street, Girard avenue and the Parkway, and providing an annual license fee of $50 for each bus.

The Practicability of Using the Same Spring Elements for All Motor Vehicles

(*Continued from page 856*)

tribution affect the riding qualities and security, the minor difficulties in applying cantilever springs to a given pleasure car design which was not intended for them in the first place may perhaps equal in importance the more obvious difficulties which apply to heavy vehicles with variable load, and it may be claimed as an all-around advantage of the special form of cantilever springs described as an alternative element in the standardized system that it is more readily interchangeable with half-elliptics, because it affects wheelbase, frame strength, twist, whip and roll in lesser degree than the ordinary cantilever spring. The air spring affords a broad support in the frame, or the support can be divided between the air spring and an ordinary but shortened cantilever spring with fixed fulcrum, on the plan loosely indicated in Fig. 13. By the arrangement of Fig. 14—which of course could be greatly improved by having the frame designed specially for the reception of the air spring—the frame support comes only slightly in advance of the point where it would come with half-elliptics and the same wheelbase. The difference is further reducer by the possibility for using a shortened leaf spring, the air spring supplying the flexibility needed. The drive can evidently be taken through the spring, and its lever, with this and kindred designs, if desired.

"Rocker" Spring vs. Cantilever

As the term "cantilever spring" is not under any circumstances quite appropriate mechanically and the use of a yielding and movable fulcrum involves new properties and new relations to the vehicle design in general, the writer designates the type which has these features as a "rocker spring," this term being short and explanatory. The rocking action not only produces the same properties for which cantilever springs are favorably known but also contributes largely to the progressive resistance to flexion which is the most important characteristic of the proposed combination of an air spring with either a rocker spring or a half-elliptic spring.

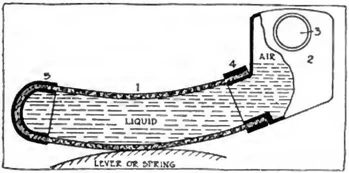


Fig. 16—Diagram of "Liquid-Air" Spring Element, for giving both range and flexibility to short and stiff leaf springs

The "Liquid-Air" Spring

The practicability of the air spring for all sorts of motor vehicles constitutes perhaps the principal point on which practical constructors may be inclined to have serious doubts. The advantages of the elongated and curved form of the flexible portion of the air spring have already been referred to in article XII. It remains to be explained that the means contemplated by the writer for the purpose of keeping an air spring which includes a flexible element from gradually losing its tension by diosmosis, or plain leakage, through the flexible fabric, consists in filling the flexible portion with a liquid instead of with air and joining it to a metallic portion containing air under pressure. Fig. 16 shows the principle. The curved and flexible tube 1, which in the vehicle is mounted with its concave side against a rigid backing on the outside or the inside of the vehicle frame, is very firmly secured to the air chamber 2 by a clamping device 4 and is closed at its other end by metallic cups 5. From the air chamber on one side of the frame a metal tube 3 may lead to the corresponding air chamber on the other side of the vehicle, and the inflation valve may be located in this tube or at the top of the air chamber, as in Fig. 15. The liquid may be water or water thickened with glycerine or, if the flexible tube is made accordingly, it may be tar.

The use of a liquid has several advantages besides that of preventing the air from coming in contact with the fabric and penetrating it. It reduces the air volume for a given bulk of the device and thereby renders it possible to get a strongly progressive tension under increasing load or shock, and coupled with the high tension a relatively slow reaction, as a small quantity of air cannot expand as fast against a given resistance as a larger quantity of the same tension. When the tube is strongly flexed a portion of the liquid which is forced into the air chamber has to pass through the compressed portion of the tube, and this action amounts to damping of the spring action and reaction for especially sharp shocks. Fig. 14 shows a rear mounting and Fig. 15 a front mounting of the "liquid-air spring," as it might be termed, in connection with the "rocker spring" and the "bobcheck." The air chamber at the rear in Fig. 14 is supposed to be connected by a tubular transverse with one on the other side of the vehicle. It may be noted that a flexible tube of, say, 3 inch outside and 2 inch inside diameter can be arranged, on the plan indicated in the sketches, to resist the lever which acts against it for a vertical distance considerably in excess of these dimensions, by reason of the progressive movement of the middle of the fulcrum.

Factory Miscellany

Warner Gear to Add—The Warner Gear Co., Muncie, Ind., will receive bids shortly for a reinforced concrete, two-story, 50 by 97-foot addition to its plant.

Auto Crank Shaft Co. Adds—The Auto Crank Shaft Co., Detroit, Mich., has enlarged the plant on Piquette avenue. A one-story structure, 60 by 120 feet, is now in course of construction.

Detroit Pattern Works Moves—The City Pattern Works, of which Vaughan Reid is president, moved April 24 from its location at 93-95 Catherine street to larger quarters at 73 Shelby street, Detroit, Mich.

Spoke Factory for Waverly—W. O. Nelson, W. B. Hillman and A. W. Lucas will establish a spoke factory at Waverly, Tenn., making a specialty of automobile spokes. They will also put in a planing mill.

Mt. Pleasant Co. Enlarging Plant—The Mt. Pleasant Motor Co., Mt. Pleasant, Mich., which started in business last year to make the M. P. cars, is enlarging its plant. The capital stock of the company is to be increased.

Wheel Factory at Owen Sound—A factory will be built at Owen Sound, Ont., for the manufacture of wheels for automobiles, trucks and all motor vehicles. F. W. Harrison, P. S. Patterson and others are interested.

Buys Land for Automobile Plant—P. A. Seeker, of Mariner City, Mich., recently purchased 3 acres of land just east of London, Ont., for the erection of a $65,000 automobile factory. Some fifty hands will be employed at the start.

To Build Automobile Accessories—Cleveland, O., capitalists have arranged with the Niagara Radiator & Boiler Co., North Tonawanda, N. Y., to operate a plant for the manufacture of automobile accessories in connection with the local factory.

Falls Machine Busy—The Falls Machine Co., Sheboygan Falls, Wis., has increased its working force by nearly 150 men during the last 2 weeks and is working on a night schedule. Shipments of thirty to forty-five motors are going forward daily.

Republic Truck Erects Temporary Shed—A temporary shed, 195 by 60 feet, is being erected by the Republic Motor Truck Co., Alma, Mich., to be used as a warehouse for trucks. It is likely that at some later date a permanent brick building will be erected, the company being in need of larger quarters.

York Body Plant Damaged by Fire—Fire destroyed a portion of the plant of the York Wagon Gear Co., York, Pa., engaged in the manufacture of wagon and automobile bodies, entailing a loss of $10,000. The fire originated in the drafting room and many valuable patterns were destroyed.

Monitor Moves Quarters—The Cummins Auto Sales Co., Columbus, O., has moved from the quarters it formerly occupied on North Fourth street, to a five-story factory at 400 Mt. Vernon avenue. The entire structure is used by the concern for the manufacture of the Monitor four-cylinder cars.

Mich. Auto Dash Plant Burned—The plant of the Michigan Auto Dash Co., Milford, Mich., which is owned by the Detroit Auto Dash Co., was recently burned, causing a loss estimated at $30,000. Officials of the Detroit Auto Dash Co. say that a new plant, 44 by 202 feet, will be built at once. The real cause of the fire has not yet been determined. The plant was turning out about 1,000 automobile dashes a day with a force of about twenty men. When the new plant is completed more men will be employed and the production increased to 1,500 dashes a day. The concern also makes running boards for automobiles.

Marathon Tire Plant Nearly Completed—The Marathon Tire & Rubber Co., Cuyahoga Falls, O., is rushing to completion its factory, which will be four stories with a basement and having a capacity large enough to permit the employment of 350 employees. The building will be of steel and brick with maple floors, modern and sanitary in every detail. It will be built in three sections, two of which are now being hurried to completion. When finished the building will be 300 feet long, 196 feet wide and 96 feet high. It will cost $100,000. William Ridge, of Akron, O., president, announces that he expects to be in the building ready for business within 2 months.

The Automobile Calendar

May 15-16	Vancouver, Wash., Track Races; Northwest Automobile Assn.
May 15-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17	Spokane, Wash., Show, Davenport Hotel.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 18-19	Boston, Mass., annual meeting of the American Automobile Assn.
May 25-26	New York City, National Assn. of Manufacturers' Convention, Waldorf Astoria.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind., H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
May 29	Philadelphia, Pa., Stone Harbor Memorial Day Run from Philadelphia.
May 29-30	Seattle, Wash., Track Races; Northwest Automobile Assn.
June 3	New York City, 11th Annual Automobile Outing for Orphans, Orphans' Auto Day Assn. of N. Y.
June 7-11	San Francisco, Cal., National Electric Light Assn.
June 9	Galesburg, Ill., 100-Mile Race, Galesburg District Fair Assn.
June 11-12	Effingham, Ill., Hillclimb and Fuel Economy Test, Salt Creek Hill, Effingham Automobile Club.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
July 5	Visalia, Cal., Road Race, Tulare Co. Auto. Assn.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Races.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race, F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 13	Oakland, Cal., Pan American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 1-2	Trenton, N. J., Track Races, Inter-State Fair.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show, Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show, Coliseum.

The Week in

the Industry

Heath Heads Singer N. Y. Sales—J. K. Heath, Jr., has been appointed sales manager of the Singer Motor Co. branch in New York City. He was formerly connected with Simplex company in Boston in the capacity of salesman.

Turner Sales Manager of Air-in-Al Co.—W. M. Turner, formerly sales manager for Paige cars in New York City, has been appointed sales manager of the Woodbridge Chemical Co., the distributor in Air-in-Al, and has established salesrooms in the U. S. Rubber Bldg. The product is a puncture preventive for automobile tires.

Neal and Deane Head New Chicago Branches—Two new automobile branches have been established in Chicago, Ill., namely, the Abbott-Detroit and the Lozier. The first branch will be managed by B. B. Neal and will be located at 2436-2438 South Michigan avenue; the second will be managed by J. R. Deane, located at 918 Michigan avenue, Chicago.

Garage

Seattle's New Garage — Construction has commenced on a $20,000 two-story brick and concrete garage at Seventh avenue and Westlake avenue, Seattle, Wash., known as Times Square, and will be leased for 5 years to the Westlake Garage Co.

New Garage to Be Detroit's Largest—What is said to be the largest and most complete garage in Detroit is the one of the Detroit Athletic Club, to be erected upon a plot of ground 120 by 100 feet on Randolph street opposite the club. It will be a six-story building having 72,000 square feet of floor space. The frontage will be of white stone and will correspond in appearance to the frontage of the athletic club. On the ground floor there will be the offices, an automobile supply and accessory department and a taxi and limousine department for the exclusive use of members. On the top floor will be a most complete repair shop and an electric charging equipment. The other floors will be used to store and take care of cars. A company known as the D. A. C. Garage has been incorporated with a capital stock of $30,000 to look after the garage business. J. H. Thompson, of the Thompson Auto Co.; John Kelsey and W. E. Metzger are the incorporators. Mr. Thompson has been appointed president and general manager of the garage.

Motor Men in New Roles

Prasp Heads Oregon Oakland—The Oregon Oakland Motor Co., Portland Ore., with F. W. Prasp, president, and E. D. Van Dersal, vice-president and general manager, has been established.

Sinclair Gets New Job—H. J. Sinclair has been appointed manager of the Boston branch of J. C. Tucker, Chase agent in New England. He was for 3 years with the Peerless forces.

Eckert Succeeds Sells—Hayes Eckert has been appointed San Francisco manager of the Earl C. Anthony, Inc., California distributors of the Chalmers and Grant cars, succeeding E. N. Sells.

Cuniff Savage Tire Advertising Mgr.—L. J. Cuniff, of the advertising department of the M. Rumely Co., Laporte, Ind., left the service of that company May 1 to become advertising manager of the Savage Tire Co., San Diego, Cal.

Pope Lozier Factory Representative—H. W. Pope, formerly a Lozier dealer in Omaha, Neb., has been appointed direct factory representative in the states of Iowa, South Dakota, North Dakota and Nebraska. His headquarters will be in Omaha.

Smith Is New Manager—R. E. Smith, formerly of Providence, R. I., has been appointed manager of the Worcester branch of the United States Tire Co., succeeding J. R. Whitmyer, who resigned recently to accept another position.

Page Goes to Portland—P. W. Page, for some years with the B. F. Goodrich Tire & Rubber Co., Cincinnati, O., has been appointed manager of the company's branch at Portland, Me., succeeding S. E. Westcott, who has become a traveling salesman for the branch.

Frederick in Business—W. A. Frederick has organized a company and opened salesrooms at 293 Northampton street, Boston, for the Frederick Quick Service Rim that comprises an extra rim and tire to be clamped outside a wheel whose tire is punctured, and so avoid the delay in pumping up the tire until the day's work is over.

Gardham Resigns—Joseph Gardham, a veteran of the Detroit automobile field, who entered the manufacturing end in 1899 with the Olds Motor Works, and passed from that company to the employ of W. E. Metzger and the Wayne company, has resigned as chief inspector of the Hudson Motor Car Co., a position he has filled for 2½ years.

McGrath Starts Co.—E. A. McGrath, who was identified with one of the Boston agencies handling the Palmer Singer some time ago, has gone into business for himself, having formed the Premier Auto Repair Co. that is furnishing commercial bodies for Ford chassis. He has opened quarters on Northampton street, Boston.

Webb Atlanta Studebaker Mgr.—A. C. Webb, well known in the racing field as a driver of the Pope-Toledo racing cars, and for many years engaged in the fire engine business, has been appointed manager of the Atlanta (Ga.) branch of the Studebaker Corp., Detroit, Mich., after having served for about 3 months as commercial car manager of the company's New York field.

Leverton Chalmers Superintendent—A. C. Leverton has been appointed general superintendent of the Chalmers Motor Co., Detroit, Mich. During the last 2 1-2 years Leverton was with the Cartercar Co., Pontiac, Mich., as factory manager. Before going to Pontiac he was during 4 1-2 years with the old Brush company as superintendent and also as factory manager. L. F. Johnson, formerly connected with the Willys-Overland Co., has become district sales manager of the Chalmers company and is in charge of Southeastern territory.

Dealer

Detroit Agents Move—Cutting, Armstrong & Smith, automobile manufacturers' agents, have moved to new quarters at 799 Woodward avenue, Detroit, Mich.

New Detroit Electrical Supply Co.—The Detroit-Pittsburg Electric Specialties Co., Detroit, Mich., has started in business at 997 Woodward avenue. The company handles all kinds of electrical supplies.

Vanguard Windshield's Detroit Branch—The Vanguard Mfg. Co., Detroit, Mich., which makes windshields, has opened a branch at 807 Woodward avenue where the new Ford windshield selling at $7.50 is on display.

New Philadelphia Simplex and Dodge Station—The Thornton-Fuller Automobile Co. has taken title to the property at 312 and 314 South 24th street, Philadelphia, Pa., and after extensive alterations will occupy it as a service station for the Simplex and the Dodge cars.

Automobile Agencies Recently Established

Alabama

Gadsden	Chandler	Gadsden Hdw. & S. Co.

Arkansas

Little Rock	Premier	C. L. Omohundro
Little Rock	Chandler	G. L. Omohundro
Pine Bluff	Oldsmobile	J. F. Rutherford

Arizona

Douglas	Chandler	Southern Arizona Auto Co.
Kingman	Maxwell	W. G. Wagner
Phoenix	Mitchell	Oscar Irvin
Thatcher	Maxwell	Thatcher Imp. & Mer. Co

Canada

Fredericton	Saxon	J. Stewart Neill
Montreal	Hupmobile	Jack O Brien Automobile Co
Toronto	Saxon	Automobile & Supply Co., Ltd.
Underwood	Saxon	Simon Roppel
Vancouver Island	King	Thomas Plimley
Vancouver	King	A. S. French
Vancouver	Hupmobile	Begg Motor Co.
Vancouver	Saxon	Hofmeister Bros., Ltd.

California

El Centro	Maxwell	A. I. Luce
El Monte	Maxwell	El Monte Garage
Fresno	Oldsmobile	Neuderaur Motor Car Co.
Hollywood	Maxwell	C. F. Little
Hollywood	Pullman	Hollywood Mission Garage
Live Oak	Studebaker	Live Oak Garage Co.
Long Beach	Metz	Wm. P. West
Long Beach	Detroiter	B. Gunsul
Long Beach	Pullman	Schilling & Evans
Los Angeles	Commerce	H. G. Pendell
Los Angeles	Premier	Smith Bros
Monrovia	Metz	A. T. Badillo
Monrovia	Reo	A. T. Badillo
Newman	Oldsmobile	Simon Newman Co.
Oxnard	Kissel	J. L. Milligan
Pasadena	Oldsmobile	Oldsmobile Sales Co.
Pasadena	Pathfinder	H. L. Nelson
Pomona	Maxwell	F. E. Booth
Rialto	Metz	A. W. Cramp
Redondo	Pullman	Marshal Craig
Santa Ana	Maxwell	C. B. Perry
San Bernardino	Maxwell	Conqueror Mfg. Co.
San Bernardino	Trumbull	F. W. Lockwood
San Jacinto	Maxwell	Stuart & Smith
San Pedro	Metz	A. L. Drake
Venturo	Studebaker	J. E. Stuart

Colorado

Avon	Apperson	G. C. Nottingham
Berthoud	Chevrolet	J. V. Sans
Berthoud	Monroe	J. V. Sans
Boulder	Apperson	Avery Auto Co.
Boulder	Metz	J. A. Outhier
Briggsdale	Metz	A. McDowell
Brush	Apperson	A. H. Frerichs
Canon City	Dodge	Canon City Auto Co.
Craig	Cartercar	E. Gust
Craig	Metz	E. Gust
Colorado Springs	Metz	E. J. Walsh
Colorado Springs	Pilot	W. W. Price
Denver	Chalmers	Platt-Fawcett Motor Co.
Denver	Dort	J. S. Morrison Auto Co.
Denver	Hupmobile	J. S. Morrison Auto Co.
Denver	White	Dean M. Gillespie
Eads	Chevrolet	R. W. Wansted
Eads	Monroe	R. W. Wansted
Fairplay	Apperson	H. Bergstrand
Flagler	Cartercar	L. Clark
Flagler	Metz	L. Clark
Ft. Collins	Metz	L. W. Van Dyke
Ft. Lupton	Metz	E. Lewis
Fraser	Detroiter	F. H. Harrison
Fruita	Detroiter	L. D. Nelson
Genoa	Cartercar	W. P. Jones
Genoa	Metz	W. P. Jones
Grand Junction	Saxon	Western Slope Auto Co.
Greeley	Apperson	Dan Straight
Greeley	Oldsmobile	Straight & Son
Greeley	Metz	F. P. Meeker
Greeley	Cartercar	F. P. Meeker
Greeley	Detroiter	S. P. Massey
Haxtun	Metz	T. Sharp
Hillrose	Metz	J. E. Boillot
Holyoke	Chevrolet	J. A. Peterson
Holyoke	Monroe	J. S. Peterson
Idaho Springs	Chevrolet	Emmet F. Galligan
Idaho Springs	Monroe	Emmet F. Galligan
Iliff	Metz	W. F. Alexander
Lamar	Chevrolet	J. G. Tretz
Lamar	Monroe	J. G. Tretz
Longmont	Detroiter	D. J. Benson Auto Co.
Loveland	Chevrolet	B. Rarie
Loveland	Monroe	B. Rarie
Mattison	Metz	K. Koontz
Meeker	Chevrolet	H. Gordon
Meeker	Monroe	H. Gordon
Montrose	Pilot	John Hodges
Monte Vista	Metz	L. A. Bond
Nucla	Detroiter	M. W. Winter
Pueblo	Chevrolet	Knebel Automobile Co.
Pueblo	Detroiter	Dick Brigg
Pueblo	Metz	F. S. Hamilton
Pueblo	Monroe	Knebel Automobile Co.
Pueblo	Pilot	E. J. Crockett
Rawlins	Chevrolet	M. M. Rubner
Rawlins	Haynes	M. M. Rubner
Rawlins	Monroe	M. M. Rubner
Rifle	Metz	J. B. Ruple
Rocky Ford	Metz	J. C. Cartwright
Saguache	Metz	J. J. Keller
Senda	Metz	C. C. Whiteaker
Steamboat Springs	Chevrolet	L. L. Brown
Sterling	Metz	Ideal Auto & Machine Co.
Steamboat Springs	Monroe	L. L. Brown
Windsor	Chevrolet	Kinfred & Evans
Windsor	Monroe	Kinfred & Evans

Connecticut

Bridgeport	Premier	Fairfield Auto Co

Georgia

Albany	Studebaker	S. B. Brown Co.
Tate	Studebaker	H. V. Atwood

Idaho

Kuna	Premier	R. T. Walbank
Pocatello	Saxon	Holt Auto & S. Co.

Illinois

Alton	Chandler	Alton Auto Co.
Byron	Oldsmobile	L. D. Marshall
Cairo	Saxon	Cairo Motor Co.
Cairo	Studebaker	Illinois Auto Co.
Champaign	Premier	H. H. Harris, Jr.
Chicago	Chandler	Harvey Taxicab Co.
Chicago	Monarch	Crown Motors Co.
Chicago	Premier	Western States Automobile Co.
Elburn	Oldsmobile	Shannon St. Garage
Elgin	Chandler	A. F. Lutcher
Fairfield	Saxon	H. O. Brockett
Fairfield	Studebaker	Wilson & Bestow
Freeport	Moline	G. W. Brokhausen Auto Co.
Forreston	Moline	Abels & Korf
Galesburg	Chandler	A. H. Schwank
Kankakee	Oldsmobile	Kankakee Motor Car Co.
Libertyville	Moline	Ree Motor Co.
Manito	Moline	L. Heckman
Marion	Saxon	Marion Saxon Co.
Mesaco	Chandler	Paul E. Coil
Monroe Center	Chandler	Atchison & Hildebrand
Niantic	Moline	H. O. Bruce
Oakwood	Moline	H. W. Neel
Orion	Moline	Rohrbach & Keel
Peoria	Monarch	Inch Bros. & Hackshaw
Rockford	Moline	Lundstrom Bros
Somonauk	Moline	Wm. B. Dobler
Staunton	Chandler	C. Blackwell
Sterling	Chandler	I. Hoppler
Sycamore	Oldsmobile	E. A. Little
Taheran	Chandler	E. P. Benscote
Tuscola	Pilot	F. Wilson

Indiana

Akron	Saxon	K. Gast Co.
Brookston	Studebaker	M. E. Bennett
Fort Wayne	Premier	C. O. Rose
Indianapolis	Moline	Detroit Elec. Sales Co.
La Porte	Saxon	Henry Bros. & Sharp
Plymouth	Saxon	F. H. Kuhn
Rochester	Oldsmobile	F. Stinson
Silver Lake	Pilot	W. C. Lotz
Terre Haute	Oldsmobile	Cole Auto Co.
Vevay	Studebaker	H. B. Dupraz
Vincennes	Saxon	Johnson Auto Co
Winamac	Saxon	E. Zellers

Iowa

Avoca	Moline	Pratt & Jensen
Beloit	Chandler	O. L. Logan
Cherokee	Franklin	E. J. Lauer
Clare	Chandler	Donahue & Donahue
Clarion	Chandler	J. T. Jenson
Council Bluffs	Monarch	C. A. Morgan
Denison	Chandler	Louis M. Coon
Des Moines	Chandler	Des Moines Jeffery Co.
Dubuque	Franklin	Byrne Brothers
Jewell	Chandler	Iver Iverson
Kноsuth	Chandler	Freimuth Auto Co
Lake Mills	Chandler	Winnebago Auto Co.
Manchester	Premier	M. D. Arnold
Monmouth	Moline	H. R. Miller
Neola	Chandler	T. W. McDermot
Nugent	Chandler	L. F. Richardson
Osage	Studebaker	Gardner Motor Co.
Rock Rapids	Studebaker	Holliday Bros. & Smock
Spencer	Chandler	Hurd Auto Co.
Victor	Moline	G. P. Mohr
Waterloo	Moline	C. Bisler
Wellsburg	Premier	Koolman Auto Co.
Wilton Junction	Moline	H. P. Mason

Kansas

Atchison	Herff-Brooks	F. R. Beck
Burrton	Herff-Brooks	J. E. Dundon
Centralia	Hollier	Walt Auto Co.
Emporia	Herff-Brooks	Strube Motor Co.
Haddam	Herff-Brooks	E. W. Shearburn
Hays	Herff-Brooks	A. Herl
Larned	Hollier	Young & Co.
Lawrence	Herff-Brooks	C. W. Smith
Lehigh	Herff-Brooks	Lehigh Land Co.
Olmitz	Herff-Brooks	Hickey & Galiardt
Ottawa	Herff-Brooks	Lathrop Hardware Co.
Salina	Herff-Brooks	W. B. McCall
Stafford	Herff-Brooks	Fritzmeier & Hewit
Topeka	Herff-Brooks	Mills Implement Co.
Wichita	Herff-Brooks	Heskett & Myers

Kentucky

Carrollton	Case	C. Deweese
Covington	Case	Hansen Hdwe. Co.
Elizabethtown	Case	A. H. Miller Imp. Co.
Glasgow	Case	Bradford Bros.
Helena Sta.	Case	E. G. Davis
Henderson	Case	J. O. Clore & Son
Hodgenville	Case	D. E. Patterson
Lebanon	Case	Rubel-Able Hdwe. Co.
Lewisport	Case	J. B. Taylor
Hopkinsville	Case	T. J. Metcalfe
Lawrenceburg	Case	Mahan & McAfee
Liberty	Case	Young & Rule
Paducah	Chandler	H. A. Potter Supply Co.
Princeton	Case	E. L. Pickering
Providence	Case	J. F. Montgomery
Richmond	Chandler	Citizens Garage
Smiths Grove	Case	Wright Bros.
Springfield	Case	McClure & Mays
Springfield	Hudson	Hagan Brothers
Waverley	Case	J. C. Wolfin
Winchester	Saxon	J. O. Tyler

Maine

Augusta	Saxon	Arsenal St. Garage
Bangor	Chandler	A. A. Richardson
Kennebunk	Oldsmobile	F. X. Lord
Oldtown	Chandler	Oldtown Motor Co.
Portland	Oldsmobile	W. V. Worcester & W. H. Alexander
Presque Isle	Saxon	A. J. Brown
Skowhegan	Saxon	A. B. Borden

Maryland

Baltimore	Regal	Regal Auto Co
Hagerstown	Oldsmobile	C. E. Shenk

Massachusetts

Boston	Pilot	Hayes Johnson Co
Boston	Saxon	M. Ross Maddocks Co., Inc.
Boston	Waverly	F. E. Wing
Fitchburg	Saxon	Lemire Bros. Garage
Hudson	Saxon	F. B. Dawe
Lawrence	Saxon	A. J. Mills
Manchester	Winton	H. W. Edgar
Quincy	Reo	T. W. Hodgkinson
Springfield	Briscoe	Philbrook Motor Car Co
Springfield	King	Bennett Motor Car Co.
Taunton	Saxon	H. C. Perry
Wakefield	Ford	J. A. Steele
Webster	Saxon	Ryan & Ryan
Williamsburg	Saxon	R. F. Burke
Worcester	Metz	Metz Motor Car Co
Worcester	Oakland	R. L. Greene
Worcester	Saxon	New England Supply Co.

Michigan

Albion	Regal	Rex Mock
Alma	Chandler	G. W. Moore
Baldwin	R-C-H	Cashion & Fisher
Battle Creek	Chandler	Heyser-Finlay Motor Co.
Battle Creek	Chandler	Heyser-Finlay Motor Co.
Benton Harbor	Oldsmobile	Crary Mch. Wks.
Big Rapids	Saxon	Phelps & Ferris
Brodhead	Buick	Eggen & Bertness
Brodhead	Dodge	Eggen & Bertness
Brodhead	Moon	Eggen & Bertness
Caseville	Oldsmobile	W. E. Watterworth
Charlevoix	Ford	B. Brown
Cheboygan	Chandler	Schulz Bros.
Chetek	Buick	F. A. Richards
Chetek	Ford	F. A. Richards
Chetek	Paige	F. A. Richards
Clio	Studebaker	R. R. Knight
Cohoctah	Saxon	F. E. Lott
Colon	Saxon	C. F. Hafer
Detroit	Marmon	W. H. Brear
Detroit	Monarch	W. R. Bamford
Delavan	Studebaker	H. Jones
Dowagiac	Chandler	Nelson & Neff
Dowagiac	Premier	Richey & Baker
Dowagiac	Saxon	Carl Luke
East Troy	Dodge	Krueger & Peterson
Escanaba	Chandler	Gust Larsen
Fond du Lac	Buick	Fond du Lac Auto Co.
Fond du Lac	Cadillac	Fond du Lac Auto Co.
Gaylord	Ford	Chalker & Murray
Grafton	Oldsmobile	Clausing & Krans
Grand Rapids	Hollier	Smith-Allen Co.
Grand Rapids	Mitchell	Western Michigan Motor Co.
Grand Rapids	Regal	J. E. Daly
Grand Rapids	Scripps-Booth	G. S. Thwing & Co
Grand Rapids	Westcott	S. A. Dwight
Hart	Hupmobile	Kent Garage
Holly	Grant	J. R. Inskeep
Houghton	Coey Jr	Legris Bros.
Jefferson	Overland	Klitz-Beck Auto Sales Co.
Kalamazoo	Chandler	G. Boyles
Lakeview	Oldsmobile	G. Johnson
Manistique	Oldsmobile	Wm. S. Howe
Manistee	Paige	National Garage
Marlette	Chandler	W. D. Matthews
Marquette	Marmon	Cloverland Auto Co.
Mason	Ford	D. G. Barr
Monroe	Saxon	Jaeger Brothers
Mt. Clemens	Monarch	D. W. Wallace
Munising	Kissel	E. A. Oulette
Newaygo	Overland	Newaygo Garage
Ontonagon	Dodge	Cox-Scott H'dware Co.
Owosso	Chandler	Richard Ferris
Redford	Oldsmobile	F. M. David
Romulus	Monarch	C. L. Rutter
Saginaw	Franklin	F. H. Witters
Seymour	Ford	August Brandt Auto Co.
Sussex	Overland	A. Russell
Three Rivers	Auburn	Slote & Godshalk
Waukesha	Studebaker	G. Savage
Ypsilanti	Monarch	Cook Powell Auto Sales Co.

Minnesota

Cloquet	Oldsmobile	Cloquet Auto & S. Co.
Duluth	Stearns	Minnesota Auto Co
Minneapolis	Moline	A. M. Choate Auto Co.

Mississippi

Natchez	Saxon	Stewart & Feltus

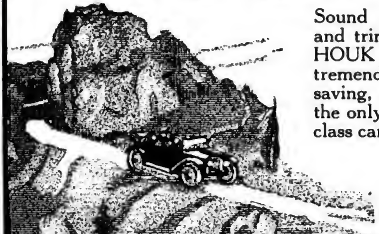
Missouri

Hannibal	Monarch	Empire Motor Co
Kansas City	Hollier	Gate City Motor Co
Mt. Vernon	Herff-Brooks	J. W. Qualls
St. Genevieve	Studebaker	St. Genevieve Imp. & Auto Co
St. Joseph	Herff-Brooks	H. A. Hall
St. Louis	Premier	Frye Motor Car Co.

Montana

Billings	Chandler	L. W. Swords
Lewiston	Chandler	Wright-Landt & Iverson Co.
Lewiston	Franklin	F. E. Doran

HOUK
DETACHABLE
WIRE WHEELS



Sound mechanical construction and trim appearance characterize HOUK WIRE WHEELS. Their tremendous strength, their tire saving, their trueness make them the only wheels worthy of a high-class car.

Houk Manufacturing Company
1700 Elmwood Avenue
BUFFALO, NEW YORK

Overland

SIX
$1475
F.O.B. TOLEDO

Why Our Pri[illegible]So Much Less

We are the largest [illegible] nufacturer in the world producing Sixes.

This means we save at e[illegible]nt where other manufacturers cannot.

That is why we can offer a Six having—
—a longer wheelbase
—the most up-to-date 45 horsepower en bloc motor
—larger tires
—comfortable seven passenger seating capacity
—high tension magneto ignition
—the finest bright French finish, long grain hand-buffed leather upholstery
—*for less money than any other manufacturer in the business.*

Get your Overland Six *now.*
We can make immediate deliveries.
Catalogue on request. Please address Dept. 329.

"MADE IN U. S. A."

The Willys-Overland Co., Toledo, Ohio

Other models $795 to $1600. All prices f. o. b. Toledo

Setting for 500-Mile Race

Automotive Industries

MAGAZINE LOAN COLLECTION

The AUTOMOBILE

Vol. XXXII
No. 20

NEW YORK, MAY 20, 1915

Ten cents a copy
Three dollars a year

cw

Carnegie
West
Branch

Ch

The Chalme
under the ey
—in the Ch
not a motor
transmission
parts somew

Chalmers Motor Com
Detroit, Michigan U.S.

Quality First

"Let your next
car be a
Chalmers"

"The New T oroughbred"

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

LOAN COLLECTION

BOSSERT

SHEET METAL PARTS

The strength of the Bossert organization is behind every contract we sign.

Brains, money and experience have developed a modern plant, equipped it with the most advanced machinery in the world and made possible the production of pressed steel and metal parts to fill the most exacting requirements.

Whatever your design—whatever the quality—whatever the quantity it will be made according to specifications and

Delivered on the agreed date

"The Bossert Way" is as important to you as it is to us.

The Bossert Company
UTICA,
New York

Vol. XXXII New York—Thursday, May 20, 1915—Chicago No. 20

The Automobile

Setting for the 500-Mile Race

Meeting the 300-Cubic-Inch Limit—Entries Represent Culmination of Racing Development—American Cars Have Made Big Strides in Past 12 Months

By A. Ludlow Clayden

THE thing which will be watched with the greatest interest in the coming 500-mile race at Indianapolis Speedway is the bunch of new American cars in which there is to be found the best work that has ever been done in this country. It is the first time that American automobile engineers have devoted their closest attention to the job of producing high-speed motors for high-speed cars and they have had the aggregate experience of all the world upon which to draw.

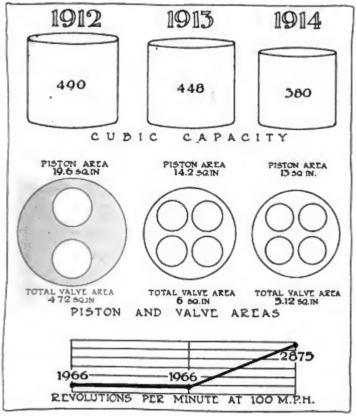


Chart showing the trends in piston displacement, valve-to-piston area and rotative speeds

There is no reason why one or more of these cars should not be able to do as well or better than the best European jobs, for as much skill and as much care have been incorporated in them. Certainly the American manufacturers have never before given so much time and money in their efforts to win what will be the most important automobile race held this year in any part of the world. Whether he be laboring in a factory or with the armies in the field, there is hardly a follower of the sport of motor racing whose thoughts will not turn to the Hoosier city and who will not be eager to hear the result. An American success this year would gain far more for the reputation of American automobile engineering than it could ever have before, and it may be doubted whether such a chance will ever occur again.

During the past 4 years a great change has occurred in the general character of racing automobiles. Before that time the usual idea was to employ the biggest motor possible and to gear it high, obtaining power by high compression and vigor of each individual explosion. Then, as race after race in Europe and America came to be put upon a motor-capacity basis, engineers found that even higher track speed was to be had from smaller motors turning at high speeds. We have seen the limit of cubic capacity at Indianapolis shrink from 600 cubic inches in 1911 and in 1912 to 450 in 1913 and 1914; now, this year, it is 300 cubic inches only. In these 4 years the winners' speeds were 74.8, 78.7, 75.9, and 82.5, so one can see that the big reduction from 600 cubic inches to 450 had a power-reducing effect the first year it came into force, but that last year the smaller motor was capable of higher speed than the best performance of the 600 cubic inch car.

Great Progress in American Motors

It was said last year by the Peugeot engineers that they had found great difficulty in getting more power per cubic inch in their cars for the French grand prix than they had

Performance of Motors in Indianapolis Winning Cars

GEAR	CAR	Number of Cylinders	Bore and Stroke	Cubic Capacity	Piston Area, Square Inches	Area of Valve, Square Inches	Ratio Piston Area, Valve Area	Piston Speed Feet per Minute at 100 M.P.H.	Revs. per Minute at 100 M.P.H.	Cubic Feet Gas Used per Mile	Gas Speed Through Valve at 100 M.P.H. Ft. per Second	Gear Ratio	Winner's Speed, M.P.H.
1912 Limit 600 Cu. In.	National	4	5x6.25	490	19.6	2.36 2 valves per cylinder	$\frac{1}{8.3}$	1022	1966	325	142	2 to 1	78.7
1913 Limit 450 Cu. In.	Peugeot	4	4.25x7.87	448	11.2	1.5 4 valves per cylinder	$\frac{1}{9.5}$	1307	1966	305	207	2 to 1	75.9
1914 Limit 450 Cu. In.	Delage	4	4.1x7.12	380	13	1.28 4 valves per cylinder	$\frac{1}{10}$	1701	2875	379	281	3 to 1	82.47

obtained in 1913, and the cars which ran last year were very little faster on the straightaways than those which had competed in the great French classic in 1913. At Indianapolis this year we shall see the two fastests cars from Lyons in De Palma's Mercedes and Resta's Peugeot, but they will probably be no faster than they were 12 months ago. Among the native machines, however, there are many of designs at least as good as and perhaps better than these year-old European cars, for American engineers have been busy while their European confrères have been idle through force of circumstances.

How High-Speed Motor Gets Power

At the foot of this page is a table giving the main characteristics of the motors used at Indianapolis in 1912, 1913 and 1914. In it there is a column giving the cubic feet of gas used per mile and, looking at this, it is easy to see whence came the power which enabled a car with a motor of 380 cubic inches to eclipse the speeds got from much larger engines in previous years, for the ultimate measure of the power of a motor is, of course, its ability to burn combustible gas. The greater the quantity of gas mixture it can inhale and explode per minute the greater will be the power it gives out.

It should be explained that the ability of the different motors to use gas is estimated by determining the number of motor revolutions per mile run; which is fixed by tire size and gear ratio; and multiplying the revolutions by the capacity of the motor in cubic feet. This does not give the *actual* figure for the gas used, as this depends upon many details of design, but it does represent the theoretical best possible performance in true proportion. Probably if there were any method of measuring the real consumption of gas we should find that the better mechanical detail of the 1914 winner made its position still better than the figures given suggest it to have been.

Gas Speed Increased 100 per Cent.

Figuring on a basis of 100 miles per hour, which was attained frequently during the races at Indianapolis, we find that the piston speeds are roughly in the proportion 10-13-17 for the last 3 years—an increase of 70 per cent. in 2 years, and figuring the gas velocities at maximum valve lift the speed of mixture rushing in rose from 142 feet per second to 284 feet, an increase of exactly 100 per cent. Here again the probability is that the valves of the 1914 winner remained open longer than that of the 1912 car, so the average velocity during the whole time the intake valve was open is probably not so much greater on the newer car as these figures show. Still they suffice to point the moral that we can burn more fuel and so have a larger number of thermal units of energy at our command with a little, high-speed motor than with a large one running at two-thirds the speed.

This year it is almost safe to expect that we shall see higher crankshaft speeds, higher gas speeds, greater displacement per mile and a higher average speed for the winning car, unless the condition of the track or some such extraneous cause shall occur to prevent the full power of the motors being available. As speeds are reached that compel the driver to shut off for the bends, it is not so much the possible *maximum* speed which counts as the rapidity of *acceleration*, and other things besides crankshaft speed and valve areas enter into this.

$\text{Acceleration} = \frac{\text{Power}}{\text{Weight}}$

Acceleration, the rapidity with which speed of motion can be imparted to a body, depends upon the mass of the body, the resistance offered to its motion and the force available to move it. Taking resistance to motion first we can reduce the rolling resistance of the car by care to see that every bearing in the wheels and transmission is in perfect state, that only the best of bearings are used and the best of lubricants. The most important external resistance is that of the atmosphere and this is cut down by the modern style of bodywork, the streamline seating and sometimes the tapering tail used universally in track racing in Europe, and to be found upon the Peugeot which Resta will drive this year. In general the value of the tail is debatable, for though the theory behind its use is sound there are other effects due to the weight and the effect of side wind. But there is general agreement as to the help obtained by a smooth and streamline midships section and a hood which tapers neatly to the seats.

When all these things have had attention we can come to the question of mass to be moved. For a fixed amount of power and other things equal, as they say in the text books, we shall get a quicker acceleration as we reduce the weight of the car. The car as a whole possesses inertia, and force is needed to change its speed of motion, the less the weight the less the inertia. So we gain the idea that it is an advantage to build the car as light as possible.

However, it is not only the mass of the car as a whole that matters, for besides the inertia effect of the complete vehicle, every part within it that has a rotary motion has an individual inertia. It requires force to accelerate the flywheel, the clutch, the road wheels and even the gears and shafts. So there is a powerful incentive to cut down every part, first, because of its own inertia, and, second, because of its part in making up the total weight. Thus one reason for using six-cylinder cars for racing is because they do not need so heavy a flywheel.

Special Materials Reduce Weight

A conspicuous feature of the majority of the racing motors made specially for the 1915 contest is the use of the new high tensile aluminum alloys. For pistons, connecting rods, and even for chassis frames in some instances, one finds steel and iron replaced by one or other of the light metals which have practically the same strength. These materials are not cheap; mostly they are very costly indeed, and some of them are difficult to work, but the saving in weight which they permit is worth both time and trouble.

Cooling a Difficult Problem

After care for the internal freedom of the motor we come to the cooling, and it may be that this is the most difficult part of the whole business, because we have to prevent the gradual heating up of such parts as valves after long hours of work. It might be thought that a motor which will cool itself efficiently for half an hour at full speed on a warm day ought to be proof against overheating for runs of days or even weeks, that failure when it came would be through something wearing out and not through a part becoming too hot. But experience of racing shows that parts, which have stood up for hours of practice spins at maximum speed but of short duration when considered singly, will fail when called upon to operate hour after hour without a rest. Notable among such parts are valves, valve springs and spark plugs, others being pistons and even cylinders.

It is known that an air-cooled motor cycle can always be made to suffer from overheating if it is run at maximum speed for long enough. This is because it gains heat from within just a little bit faster than it can dissipate it to the atmosphere. Now, if we imagine a part of a motor like a valve which is not cooled by direct contact with the water it may work perfectly at 250 degrees but fail at 350. Suppose that the amount of heat it can dissipate through the guide and seating is exactly equal to the heat it gains per minute when the motor is running at a certain power, if we speed up a little it will be getting more heat put into it than it can get rid of. It may be only a very little more, so that in a half hour its temperature will rise perhaps to 280 degrees, still below the danger point, but if the speed is maintained long enough the critical 350 degrees can be reached and failure becomes probable. These figures are, of course, only taken to illustrate the idea.

The reason for explaining this point is that the absence of steam at the radiator does not prove the cooling to be sufficient, we might easily so design an engine that some internal part would burn up with the cylinder jackets dead cold. These troubles with details like valves and plugs were encountered on the old style racing cars because materials failed through repeated stressing and the plug trouble was almost completely cured by better construction of that vital detail. Then, when we began to burn much more gas per minute in a much smaller motor, the heat trouble showed up and it is the most serious one that now faces the designer of modern racing machines.

Overhead Valves Advantageous

Every racing car to win an important event in Europe during the last two years has had overhead valves, and the majority of these cars have had four valves per cylinder. This is because the overhead construction gives a better shaped combustion space, a more free outlet for the gas past the valves and allows the use of a slightly higher compression. Also, and this is possibly important in view of the heating trouble dealt with in the last paragraph, it is more easy or less difficult properly to cool the valves and spark plug when the side pocket is removed.

The reason for using four small valves instead of two large ones is that they weigh less for a given area of opening. If we have heavy valves of large diameter it is necessary to use very strong springs and this puts heavy stresses on every part of the motor. It loads the push rods, cams and camshaft and the valve itself can be injured by the terrific impact as it shuts on its seating time after time at high speed. The amount of power absorbed by the valves and their operating mechanism is quite considerable and it needs much less to move two little valves than one large one, while trouble with bearings, timing gears and push rods is avoided. If we were still using big motors there would no doubt be engines with six or eight valves per cylinder, for the multiple valve idea has been a complete success. Opinions as to the best way to operate overhead valves differ a good deal, but the one which will reduce the weight of rockers or push rods to the minimum is generally preferred and this calls for an overhead camshaft or even two camshafts side by side on top of the motor as used by Peugeot.

Multi-Point Ignition Popular

It is generally conceded that there is advantage in the use of two magnetos and two sets of spark plugs, while some motors in successful racing cars have had four plugs per cylinder. Not only do the two plugs give quicker burning of the charge, but there is always the chance that one will continue in operation if the other fails. Apart from this, and the use of highly special spark plugs, there is little in a racing ignition system that differs from those in ordinary use.

Carburetion Troubles

The effect of high gas speeds and the very rapid opening and closing of the valves has been to make necessary a variety of changes in carbureter construction with the idea of obtaining a better gas. It is now a matter of history how that old veteran of carburetion, Claudel of Paris, just prior to the French grand prix, which was contested at Dieppe in 1912, evolved a new kind of carbureter which enabled a greatly increased power to be obtained from almost any sort of motor. The new instruments were made by hand for all the French cars and the English Sunbeams, while Monsieur Claudel himself superintended the tuning up of practically each of these engines.

The results were amazing, but it was then thought that the effect was obtained more by the skill of the man than the excellence of the carbureter. Later this proved to be untrue, for it was found possible to make the carbureter in quantity, and last year in Europe there was scarcely a car used in racing that had not either a regular Claudel carbureter or a "special" type of carbureter, made on the new Claudel principle. It is well known that in some of the French races carbureters bearing various names were all the same inside, Claudels with some other name on the float chamber lid.

The essence of this carbureter is a "jet" composed of a series of thin concentric tubes pierced with small holes. Air and gasoline are both drawn to the inside of these tubes through the narrow spaces which separate one from another, and there they intermingle so closely that there emerges from the little holes in the outer tube a thick rich gas and not a liquid spray at all. Much the same principle is involved in the well-known Zenith double jet, and in a variety of other carbureters. What Claudel did was to carry the thing a stage beyond what had ever been thought possible before. His racing carbureter has, however, a drawback, in that it cannot be fitted to any motor without a deal of experiment and trial to get just the right number and size of minute holes in the little battery of tubes.

It may, perhaps, be supposed that in the old kind of slow

Final Positions of Six-Cylinder Cars in Previous 500-Mile Races

1911		1912		1913		1914	
Marmon	6	National	4	Peugeot	4	Delage	4
Lozier	4	Fiat	4	Mercer	4	Peugeot	4
Fiat	4	Mercer	4	Stutz	4	Delage	4
Mercedes	4	Stutz	4	Sunbeam	6	Peugeot	4
Marmon	4	Schacht	4	Mercedes	4	Stutz	4
Simplex	4	Stutz	4	Grey Fox	4	Excelsior	6
National	4	White	6	Mercedes	4	Sunbeam	6
Amplex	4	Lozier	4	Case	4	Beaver Bullet	4
Knox	6	National	4	Mason	4	Maxwell	4
Jackson	4	Knox	6	Tulsa	4	Duesenberg	4

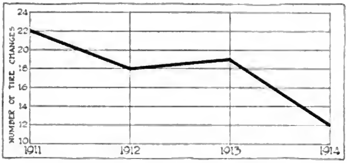


Chart showing the increasing durability of tires in the 500-mile race as determined by the number of tire changes made by the three leading cars for the years of 1911, 1912, 1913 and 1914

speed motor and in the ordinary touring car motor of today, gasoline which issues from the jet in the form of a liquid spray has time to mingle with the air and form a good homogeneous gas while it is passing through the intake passages and being compressed in the cylinder, but that above certain speeds there is not a sufficiently long period from the time the gasoline emerges from the jet to the moment it is fired. Thus very delicate sorts of carbureters which divide the gasoline with almost molecular fineness are able to improve the power by increasing the amount of gasoline which can be burnt in the motor. With gasoline subdivided insufficiently quite a measurable proportion can, under certain circumstances, be either not burnt at all and passed to the exhaust as unexploded vapor, or be burnt inefficiently after the exhaust valve has opened.

It would be possible to go on at great length elaborating the things which have to be considered in building a racing machine, but enough has been said to indicate the immense amount of time, brain effort and labor which goes to the winning of a race, quite apart from the skill and experience of the driver, who often is no engineer, and depends upon others to provide the machine which his daring can steer to victory.

Position of the Six

This year there will be very few six-cylinder cars in the great event. Though a six won the first 500-mile contest in 1911, and still holds the speedway record for an American-built car, four cylinders have usually proved best for racing; more especially, perhaps, as the allowable piston displacement has been restricted. Vibration, which is the bugbear of the four-cylinder, high-efficiency touring car, does not matter within reasonable limits on a racing machine, and also the use of excessively light, albeit costly, pistons and connecting rods reduces the characteristic vibration of the four to something very small indeed. In a six the greater number of pistons means more wall friction, the greater number of crankshaft bearings also tends to cut down the mechanical efficiency of the motor and the weight is usually greater than that of an equal sized four, despite the lighter flywheel. Lubrication is easier in a four and the carburetion of a six is so difficult a problem that two carbureters have been used on most racing machines of this type. Incidentally two carbureters are not uncommon on four-cylinder cars for high speed work, as was explained in the recent series of articles in THE AUTOMOBILE by S. Gerster, who discussed the mechanics of high speed motor design in accurate calculations.

Sixes Scarce for 1915

The table shows the positions taken by six-cylinder cars in previous 500-mile races at Indianapolis and the Grant's Sunbeam which took seventh place last year will be competing again, and its sister vehicle will be beside it with Limberg at the wheel. So far as is known at the time of writing, these will be the only six-cylinder cars in the race, so it will be especially interesting to see how they perform.

Chassis Keeps Pace with Motor

Lightness and Greater Durability Due to Advance in Manufacture

By J. Edward Schipper

CHASSIS development, so far as the racing cars designed for speedway work are concerned, has been proceeding along well-defined lines during the last four years. As a result of this several marked trends may be noted which almost parallel the developments of passenger cars. As may be expected, the cutting of piston displacements from 600 cubic inches to one-half that quantity is sure to cause some definite relative alterations in the design of the chassis. The small, high-speed, light-weight motor, designed to produce the most efficiency from the smallest possible piston displacement, is characteristic of the entire car. Therefore, it is not surprising that we find such factors as wheelbase dropping steadily at the same time. The winner of the Indianapolis sweepstakes in 1911 drove a car with a wheelbase of 116 inches. In 1912 the winner had a 110-inch wheelbase; in 1913, 108, and in 1914, 104. That this trend is almost sure to be continued is evidenced by the number of cars in the race this year, which are of shorter wheelbase than last year's winner.

Special Materials Reduce Weight

With a smaller motor, a shorter wheelbase and a general tendency all along the line towards lightness, it is not surprising that the well-defined trends towards lighter materials of greater strength per unit of sectional area should be marked. The wheelbases which, when taken in connection with the motor, are a positive indication of at least the general features of design, are not only less for the cars which happen to cross the line before their competitors, but are also less for the other cars in the races. That this development is noticeable throughout the entire past 4 years is brought out by the fact that while the car which ran second in 1911 had a wheelbase of 124 inches, the car which finished second best in 1914 was the little 3-liter Peugeot with a wheelbase of approximately 25 per cent. less. Again, the car which finished second in 1912 was 17 inches shorter than the 1911 second. The car which finished second in 1913 was 5 inches shorter than the 1912 second best car. In 1914 the first and third cars had wheelbases of 104 inches, which was the first time that cars of this length were used in an Indianapolis race.

Lightness Aids Tire Durability

One of the natural conclusions to be drawn from the fact that the cars are generally lighter and shorter is that tires would suffer less for this reason. While it has always been stated that the driver and his methods have as much to do with the life of the tires in a contest of this kind as anything else, nevertheless, omitting the personal factor for the time being, the number of tire changes should gradually become less as the weights decrease. It is true that average speeds have become higher, and hence, if the weight were neglected, the tire changes would show an increase. However, in spite of the increase in speeds tire life has held its own.

In the 1911 race the number of tire changes for the first three cars to finish was twenty-two. In 1912 it was eighteen. In 1913 it was nineteen and in 1914 it was twelve. More than once it has been the stopping for tires which has lost the race for one of the competitors, and the fact that in the last four years the number of tire changes for the first three cars has dropped almost 50 per cent. shows that this relative lightness, which probably in actual pounds would not show up to a very large extent, has had its influence.

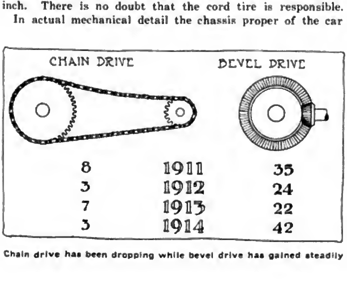
Wire Wheel and Cord Tire Run Cool

The credit for the good tire showing has often been given by authorities to the use of cord tires and to the use of wire wheels. Undoubtedly these two factors have had great influence. With the cord tire inflations do not have to be as high as with the fabric type and consequently internal stresses on the tire, due to the great change in temperature after being in use for a short time at the high speeds, are not as great. The shock-absorbing qualities of the tire are no doubt aided by the lower inflation, and the cord construction itself is one which is calculated to give excellent results under the condition of racing temperatures. On the other hand some of the fabric tires have shown up in recent contests to such a remarkable degree that the choice of one or the other type is a mooted point.

The cooling influence of the wire wheel is granted on practically all sides. The conductivity of the all-metal construction is naturally much higher than the wood type, and aided by the blast of air created at the high racing speeds, there is no doubt but what the use of this type of wheel has its influence on the tires. Another great advantage, of course, of the wire wheel is in its quick-detachable feature which permits tire changes to be made constantly at speeds of 30 to 45 seconds per change. The wire wheel is, therefore, a racing desirability because of its promotion of fewer and quicker tire changes. Even in the 1914 race it was estimated that the casings destroyed represented an investment of $14,000, as during this race 138 shoes were used, and many of these were specially constructed at a cost much higher than that of the average tire.

Inflation Pressures Falling

The lesson learned on tire inflations has also been a governing factor in determining the pressure in recent races. In 1911 inflations of 80 pounds were the usual condition. In the race of 1914 the winning Delage had a tire inflation of 4 kilograms per square centimeter, which figures out to be about 57 pounds per square inch. The tires used were 35 by 5 front and 35 by 6 rear. The Sunbeam, driven by Chassagne, had 34 by 4.5 tires inflated to only 65 pounds. Others carried inflations as low as 37 pounds. To realize the final pressures which are in the tires, even though they are inflated to this relatively low pressure at the start of the race, it is only necessary to be close enough to the track to catch the odor of burning rubber, which pervades the air. It is estimated that the tires reach a final pressure of over 100 pounds per square inch. There is no doubt that the cord tire is responsible.



Chain drive has been dropping while bevel drive has gained steadily

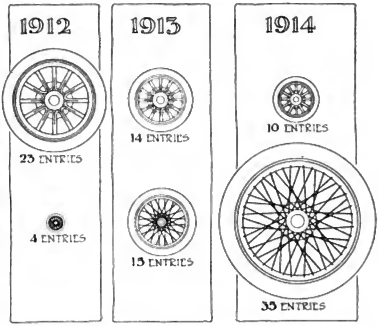


Diagram showing the relative increase in popularity of the detachable wire wheel for racing cars as represented at the Indianapolis race

In actual mechanical detail the chassis proper of the car has varied far less than the source of power. There have been very few trends which are of sufficient importance to be significant in design. Perhaps in the use of materials the greatest change may be noted. With the improvement in the art of heat-treating and alloying steels it has been possible to cut down the sizes of some of the parts and give a stronger result with less weight. The use of tubular members has also been a great factor in the development of the racing car.

Specifically the falling off of the chain drive racer is perhaps the most significant feature of chassis design. It is one of the points which show how closely racing and touring practice are affiliated. In the race of 1911 no restriction was placed on the use of chains for driving purposes, but they are now allowed only if covered. In 1911 18.5 per cent. of all the entries had chain drive, in 1912 this had dropped to 11.1, and in 1914 it had fallen off to 6.6.

Cleaning Up the Outside

One of the features which have a great deal more importance than would be evidenced at first sight is the general cleaning up of the exterior lines of the racers. It is probably the competition of the foreign car which has forced American racing car builders into line on this point. When the speed crown was wrested from the Americans in 1913 by a European contender, one of the first reasons assigned to the greater speed of the invading machine was the cleaner lines of the latter. As a result of this the American cars of 1914 were much better appearing jobs than the cars of 1913 and 1912. Greater attention was paid to the entrance and tail lines of the cars than in any previous race in this country. The importance of having a tapering end on the car is also being recognized, and although many disadvantages have been claimed against its use by some of the more conservative drivers it has gained a foothold.

Freak designs and radical departures from standard practice are not as frequent now as they were in the earlier days of racing, when the Vanderbilt was the classic which focused all the eyes of motordom on the Long Island course. As far as the chassis part of the car is concerned it is worked out fairly well along conservative lines, which have proven successful in the touring field. There is not a big variation in fundamental principles between the touring car chassis and that which is suitable for racing.

Entries Vary Greatly in Displacement

Wide Variety from 117 to 299 Cubic Inches Shows Period of Transition in Design —Many Dark Horses in this Year's Race

WHILE the annual crop of dark horses promises to be as large as ever at the Indianapolis Race this year, the clouds have lifted sufficiently for a fairly good perspective of the 1915 entries.

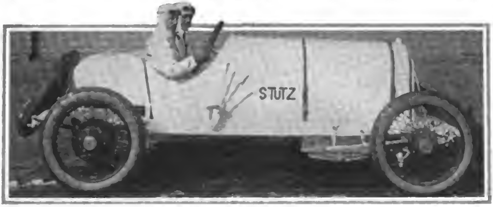
A study of the entry list shows that we are in a transitory stage. The day of the monstrous racing machine has passed and we are now going perhaps to what may be called the other extreme, the entries having a piston displacement as low as 117 cubic inches. On the other hand, we have some of the older cars which have been driven in the last Grand Prix race of France which are exactly similar in design to the Indianapolis Race of last year. It is, therefore, expected that this race will be the greatest event, as far as showing up the respective merits of the light high-speed design and the heavier, more powerful care is concerned, that has ever occurred.

Two Peugeot Types Entered

A good example of the uncertainty which still pervades racing circles as to what is really the ideal car for such a grind as the 500-mile Hoosier event is in the Peugeot cars. There are three of these entered, one of which is the 4.5 liter car driven by Boillot in the last Grand Prix race of France. The cylinder dimensions of this car are 92 millimeters by 169 millimeters, or 3.62 by 6.64 inches, giving a piston displacement of 274 cubic inches. The motor design is similar to the car which was in last year's event and this year Dario Resta will pilot it.

The other two Peugeot entries are of the new school of high-speed engine design. They are what are known as 3-liter cars in France. The dimensions are 78 by 156 millimeters or 3.07 by 6.13 inches. The piston displacement is 183 cubic inches. These cars are almost exactly the same as that driven by Duray last year. This car finished second and was the sensation of the race, as no one thought that a car with such a small piston displacement had much chance with the racing machines which were designed to fall just beneath the 300-cubic inch displacement limit. The two cars this year are to be driven by George Babcock and Caleb Bragg.

The performance of the two little Peugeots will be watched with great interest this year. The motor develops 92 horsepower at 2,870 r.p.m. In other words, 1 horsepower is developed for every 2 cubic inches of cylinder volume. Great lightness and compactness are features which have been made pre-eminent points throughout the design. The cylinders are the shortest possible block castings, having four valves to the cylinder mounted in the head and inclined 30 degrees to the vertical. The camshafts are overhead in order to cut down weight due to long rods in the operating mechanism. The pistons are machined out of solid B. N. D. steel, which is used largely throughout the car in such places as the connecting-rods, gearbox, shafts, axle and driveshaft. The car will probably be geared 2 to 1 and will have a total weight with oil and water of about 1,760 pounds.

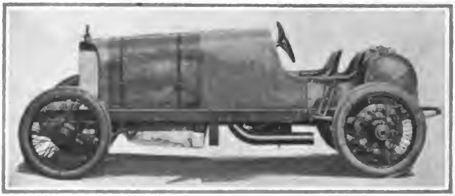


Stutz side view, one of the three special racing machines entered by this company

Mercedes driven by De Palma, an example of the attention which is paid to wind resistance

Sunbeam Sixes and Fours

The Sunbeams are also in two kinds; both old and new. There are two six-cylinder Sunbeams which are the old models which have made a long racing campaign during the last year and one half. These have been purchased by the Fortuna Racing Team, Inc., from William Ziegler, Jr., and entered in the Indianapolis Race in a form which is somewhat modified from what they were originally. In addition, there are two four-cylinder Sunbeams which are new as compared with the others, having been built for the last French Grand Prix at Lyons. The sixes have 3 by 6 motors giving a piston displacement of 278 cubic inches. They are said to be capable of 110 miles per hour geared 2.75 to 1. In rebuilding these cars they have been fitted with two carbureters each, and are now capable of turning



Two views of Porter-Knight, the sleeve-valve racing machine which is characterized by an extremely narrow body

up to 3,000 r.p.m. An auxiliary cooling system for the valves has been put in with a separate outlet to the radiator for the purpose of keeping the valveheads cool. Spicer universal joints have also been added in place of the original design.

The new four-cylinder Sunbeams have 3.7 by 6.2 inch motors with piston displacement of 271 cubic inches. They have two camshafts arranged directly over the valves which are located in the cylinder head. To each cylinder there are four valves, giving 16 valves in all, and the camshafts are driven by a train of spur gears contained in a case at the front end of the cylinder blocks. The crankshaft runs on ball bearings and is a built-up design in two halves. The Sunbeam-type piston with perforated skirts is used, the material of which they are made being steel. Unlike many other racing cars a differential is used and this car, like the six, is said to have a straight-away speed of 110 miles per hour.

Bugatti Piston Displacement Decreased

Barney Oldfield's Bugatti is not the same car as was at Indianapolis last year. It has a smaller displacement and differs from practically every other entry in having chain drive. Last year's car had 305 cubic inches piston displacement and hence is oversized for the Indianapolis Race. The White factory has built a new crankshaft with a 3-16 shorter crank throw, bringing the motor to 298 cubic inches piston displacement. A new front axle and body has also been built for the car. With the remodeled specifications, the bore of this motor is now 4 inches and the stroke 5.937. The wheelbase is 111 inches, and the tires 32 by 4.5. A dry plate disk clutch is used and a four-speed gearset. It is estimated that the car will weigh in the neighborhood of 1,800 pounds when ready for the race. One of the features of this car which make it different from standard design is that the tread is different in front and rear. The front tread is 51 inches and the rear 49 by 5 inches.

This car is one in which multiple valves are used. There are twelve of these overhead, operated by an inclosed valve gear. The motor throughout is a very accessible job and one which is notable for the fineness of its material. The entire cylinder head is detachable.

Duesenberg Has Two-Bearing Crankshaft

Three Duesenbergs are entered this year. These are all of similar design. The motor has the predominating racing characteristic of having its valves in the head. It is a four-cylinder block design, with very close coupled cylinders to produce a short motor and at the same time allow ample water space between the units. The motor is 3 63-64 inches bore by 6-inch stroke giving a piston displacement just under the limit of 299 cubic inches. The crankshaft is carried on two bearings and has a diameter of 2.25 inches. It is made of chrome-nickel steel and the bearing lengths are respectively 4 and 4.5 inches for the front and rear. Connecting-rods are also of chrome-nickel steel giving maximum strength with maximum lightness. To maintain the same strength throughout, the lower end bearing caps are held in place by four 7-16-inch vanadium bolts.

Standard tread of 56 inches will be used on the racing cars and the wheels will be 33 by 4.5 front and 33 by 5 rear. The gearset is mounted directly on the rear axle. When in racing trim, the equipment consists of quick detachable large hub-type wire wheels, with Timken bearings. The gearbox has New Departure ball bearings. This car will use left drive and will have semi-elliptic springs all around.

The Emden, a new car for this year, built especially for the speed grind

Special Knight Cars

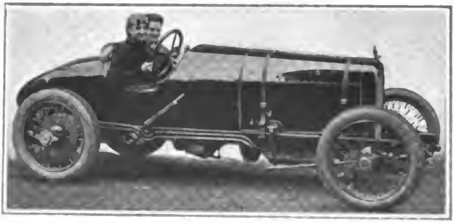
Three cars which will be followed with unusual interest are the Porter-Knight entries. As described in THE AUTOMOBILE for May 6, these are specially designed Knight cars intended entirely for racing. The changes made from ordinary Knight practice in these designs include the use of two eccentric shafts instead of one; the use of an auxiliary exhaust port close to the lower end of the valve sleeve; large port areas and a shorter valve sleeve stroke. It is stated that by making these changes it is possible to run these motors up to as high as 5,000 r.p.m. in the testing room. The horsepower curve shows that with the new features of design, 122-horsepower is developed at 3,950 r.p.m. In a word, this is a racing creation weighing 1,910 pounds with a four-cylinder 3.75 by 6.125 motor having a piston displacement of 270 cubic inches or well under the 300 limit for Indianapolis.

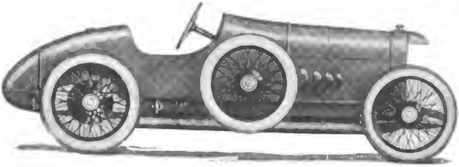
The racing chassis is built with a 110-inch wheelbase, 56-inch tread, 32 by 4 front tires and 33 by 4.5 rear. While no attempt has been made to adhere to what are popularly known as stream lines, wind resistance has been cut down by the use of an extremely narrow body. Weight reduction has been accomplished by the use of chrome-vanadium steel, air-hardened steel and magnalium, a magnesium-aluminum alloy. In addition to this the use of hollow parts has also resulted in a saving. The propeller shaft is one example of this. An unusual feature is the use of a four-speed gearbox which weighs but 90 pounds including the brake drum, which is mounted on the rear. In a word it has been designed throughout with speed and lightness as the primary ideas. The speed is gained by the use of the high-powered motor and narrow body and the lightness by the use of extremely fine material.

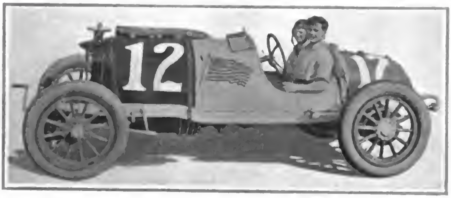
New Mercers Entered

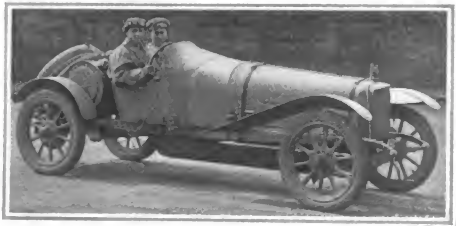
Great interest attaches to the Mercer entries this year, because of the fact that in last year's race the new designed Mercers were eliminated in the trials and the only ones to compete were the older jobs driven by Wishart and Bragg. The Mercer for this year has a smaller bore and longer stroke than that of 1914, these dimensions being 3.75 by 6.75. All three cars are the same, having piston displacement of 298 cubic inches, bringing them just below the 300 limit which has been set by the race authorities.

It was Eddy Pullen who suffered the disappointment last year of being elimi-









Top—One of the three new Mercer cars especially designed for the Indianapolis race

Upper Middle—The Mulford special, a car built and driven by the racing driver

Lower Middle—Side view of the Duesenberg which has been re-designed for this year's race

Bottom—One of the new four-cylinder Sunbeams entered for this year

Right—Front view of the four-cylinder Sunbeam in racing trim nated in the trial event and he has been selected to drive one of the three entries along with Ruckstell and Nikrent. These are all shaft-driven cars having gear ratios of 3.1 to 1 with 32 by 4 1-2 tires of Goodrich Silvertown cord make. The wheels are Rudge-Whitworth wire and the cars are equipped with Hartford shock absorbers, Bosch magnetos and Zenith carbureter.

Maxwells Have Offset Valves

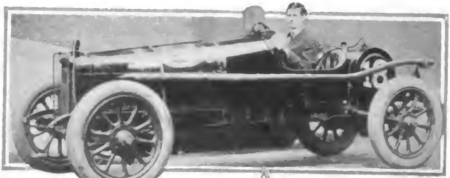
The Maxwell cars have been fully described in THE AUTOMOBILE for March 25. Three of these are entered to be driven by Carlson, Rickenbacher and one undecided. Generally speaking, they are similar to the Maxwell racers which have been campaigning about the country this year but are cut down to bring them within the 300-cubic inch limit. They are now 3.75 by 6.75 inches, giving a piston displacement of 298.2 cubic inches. The motors are off-set overhead valve design with overhead camshafts. The crankshaft is a counterbalanced design made in two halves, the counterbalance weights displacing the flywheel. The crankshaft is carried on three ball bearings. The cylinders are block cast with a detachable head and the intake and exhaust passages are on opposite sides of the motor. The cars weigh but 2,075 pounds, which is largely due to a liberal use of aluminum alloy. An unusual feature is the use of a windshield to reduce eye strain on the drivers.

The Harroun special is practically identical with the Maxwells. It was built in the same shop and is practically the same in exterior appearance.

Mulford Uses Offset Crankshaft

The Mulford special which was designed by Ralph Mulford who will drive it has a four-cylinder motor with 3 11-16 bore and 7-inch stroke, giving a displacement of 299 cubic inches. The unusual feature of the motor is that it is said to be the only one ever built with an offset crankshaft and having two camshafts and only three timing gears. Special attention has been paid to the oiling and

(Continued on page 919)



Top—Six-cylinder Sunbeam driven by Limberg with tank mounted behind seat

Upper Middle—Six-cylinder Sunbeam to be driven by Harry Grant with tank mounted at rear of frame

Lower Middle—Cornelian, the smallest car of the race, with 117 cubic inches displacement

Bottom—Maxwell, the only car in the race to be equipped with a windshield

Left—Front view of Maxwell. Note small area of wind-resisting surface

$1,250	$2,000	$3,000	$3,000
50	54	57	73

How Many Cylinders?

What Is Ideal Size for Cylinder? Comparison of Motor Size with Passengers Carried and Price of Car Suggests That Twelve Has Legitimate Field—A New Way of Comparing Eights and Sixes

By A. Ludlow Clayden

IT has been suggested several times that there is an ideal size for the individual cylinders of an automobile engine. Some have chosen definite proportions such as 3 inches by 5 inches or 4 inches by 6 inches, as being ideal bores and strokes, but such choice appears to have been based upon particular experiences. By making some debatable assumptions to start with it seems possible to attack this subject from a new angle; to consider it on a broader basis than has been done before. The writer realizes that there is much in the following that is subject for discussion but examination of collected data and the modern trend in multiplicity of cylinders does certainly suggest that there are good reasons for the idea that *all things considered* there is a definite maximum size of cylinder beyond which it does not pay to go.

What Is Ideal Cylinder Volume?

Turning to collected data to provide us with a starting point for making out a case for one or another type of motor, let us take the tables in THE AUTOMOBILE of December 31, 1914, and extract the cylinder displacement per passenger for the different classes of car therein specified. We then find that the average piston displacement per passenger, neglecting roadster and closed body types and considering only touring cars, is:

1. For cars costing less than $1,250, 50 cubic inches per passenger.
2. For cars costing less than $2,000, 54 cubic inches per passenger.
3. For cars costing less than $3,000, 57 cubic inches per passenger.
4. For cars costing more than $3,000, 73 cubic inches per passenger.

These are only rough round figure averages, but they serve to indicate the general trend.

Now there are two important things which vary in these cars, the total cylinder volume and the number of passengers carried; so if we assume that there ought to be a definite number of cubic inches of motor for each passenger the size of the motor varies according to whether the body is designed for five, six or seven passengers. In each class we find bodies of these three capacities so the clearest way to examine the problem along this line is to tabulate car capacity and motor size together with possible number of cylinders to provide this total displacement, as is done at the foot of this page.

Of course the cars in class 1 are mostly fours, those in class 2 are practically half and half fours and sixes; and the eight here makes its appearance. Class 3 is principally sixes but has a fair sprinkling of fours, and class 4 contains no eights and only one or two fours.

Let us see what are the respective cylinder sizes. For a five-passenger four-cylinder touring car in class 1 we want 250 cubic inches or 62 cubic inches in each single cylinder.

In Class 2 we want 270 cubic inches for five seats and 378 for seven passengers.

Supposing the smaller motor to be a four, we get a size of 67 cubic inches per cylinder, and if the seven-passenger is supposed to be a six we get 63 cubic inches or practically the same sized cylinder as that of the four-cylinder motor used in Class 1.

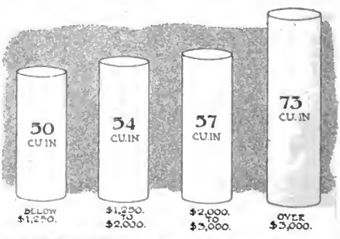
The average passenger capacity of Class 3 is just six passengers, as fives and sevens balance, so the motor needs to be of 342 cubic inches. For a five-passenger six, we should find the size per cylinder was only 47 cubic inches and 71 cubic inches for a five-passenger four, while seven passengers would call for a six-cylinder motor with cylinders of 66 cubic inches each, or a four-cylinder with 99 cubic inch cylinders.

Coming to Class 4, which includes all the really high-priced cars we find a sudden leap to 511 cubic inches for seven passengers, or 85 cubic inches per cylinder of a six-cylinder motor. It is easy to see that a four-cylinder for this load and to keep the same proportion would require huge dimensions since a capacity of 128 cubic inches per cylinder calls for a gigantic bore and stroke.

Advantages of Moderate Size

Again let it be emphasized that these figures are only expressed in round numbers and are far from decimally accurate, but they certainly suggest that the higher the price of the car the greater the power demanded per unit of load.

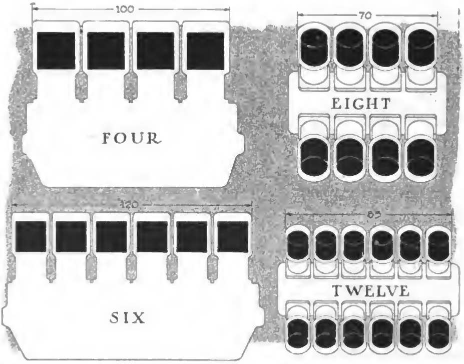
The buyer of a high-priced car expects more than this, though. He wants greater flexibility, top speed power that is, and greater smoothness and quietness. It needs no calcu-



Average piston displacement per passenger of touring cars in four price classes lations then to see why the four-cylinder motor is dead so far as large cars are concerned, for the stresses set up by reciprocating parts vary with *multiples* of their dimensions.

The European engineer, accustomed to light, high-speed, four-cylinder motors, has for years regarded this type as final, at least within the limits of ordinary mechanical finality. With the eight-cylinder motor hardly any experiment has been made in Europe, and in recent years no manufacturer whatever has applied the principles of modern high-speed motor construction to any engine with more than six cylinders.

As recently as 5 years ago there were made many attempts in Europe, to produce small sixes of proportions round about 3 by 4.5-inch bore and stroke, but they were mostly failures and the European makers generally turned to the refinement of the high-speed four; that is to say they increased the power obtainable from small fours instead of retaining the same power per cubic inch of displacement and adding cylinders.



Relative sizes of four, six, eight and twelve-cylinder motors having the same total piston displacement

Meanwhile, in America manufacturers were likewise not satisfied with the somewhat vibratory fours which were then the rule, but instead of following the European lead they struck out a line for themselves and developed the inexpensive six with a large capacity and not a very high power per unit of volume. Taxation by horsepower practically prevented the use of large motors abroad, and the road conditions suit a small, light car better than a large and heavy one, which is the exact opposite of the American case.

Yet it is not solely on account of taxation that it has become an axiom in Europe that one cannot make a satisfactory job of a four-cylinder motor which greatly exceeds 4 liters or just about 250 cubic inches in capacity. Proportions of stroke and bore have little to do with the matter, since the long-stroke motor needs a higher piston speed and multiplies stresses that way.

A car with a motor of this size should carry five passengers over good European roads at a maximum of about 65 miles per hour and climb a grade of about 7 to 8 per cent. on high gear. This would give insufficient ability for ploughing through sandy roads and taking small grades thereon without much gear shifting to suit the conditions of this country, so we have the alternatives of adding to the cylinders or dropping the gear ratio; which means that the speed capacity is impaired.

Effect of Cylinder Size on Number

Just for a moment let us suppose that the European idea as to the useful limit of size per cylinder is about correct and apply this size to the classes of cars dealt with above. This shows us at once that the limiting size just suits a five-passenger car in class 1, as it gives the requisite size of motor to apportion 50 cubic inches to each passenger. In classes 2 and 3 the four is a little overlarge and the six comes well within the limit, but when we get to class four the cylinder size for six cylinders and seven passengers is well outside the limit.

Now, it should be added that this European idea is distinctly on the high side as compared with recent French and British average practice, for in this the most popular kind of large four has cylinders of only 52 cubic inches, 10 cubic inches smaller than the 62 cubic inch cylinders which make a 4 liter four.

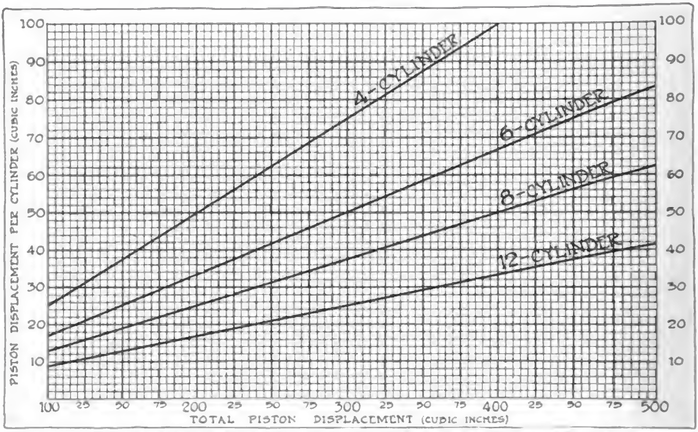
Effect Of High Speed

There is no doubt at all that the smoothest and highest efficiency motors made as an ordinary European manufacturing proposition are between 40 and 50 cubic inches capacity per cylinder. There are many larger than this, but experience shows that it means careful work to balance pistons and connecting-rods, and expensive heavy crankshafts if the much desired smoothness is to be obtained from the larger engines.

Here let it be said that this argument does not imply that the high-speed four has no place on American roads. Far from it in fact; for when a car of limited seating capacity and intrinsically light weight is wanted and this is the

Comparison of Cylinder Volumes Required for Cars of Different Price Classification and Passenger Capacity

	Class 1 to— $1,250			Class 2 to— $2,000			Class 3 to— $3,000			Class 4 over— $3,000		
Number of Passengers	5	6	7	5	6	7	5	6	7	5	6	7
Total Cylinder Volume in cubic inches	250	300	350	270	324	378	285	342	399	365	438	511
Volume per cylinder for 4 cylinders	62	75	87	67	81	94	71	85	100	91	109	128
Volume per cylinder for 6 cylinders	42	50	58	45	54	63	47	57	66	61	73	85
Volume per cylinder for 8 cylinders	31	37	44	34	40	47	36	43	50	46	55	64
Volume per cylinder for 12 cylinders	21	25	29	22	27	31	24	29	33	30	36	43



Curves illustrating the increase in piston displacement per cylinder with increase in the total displacement of four, six, eight and twelve-cylinder motors

cheapest sort of car to run; then the high-speed motor will give a better speed capacity to the car and better top-speed performance. Yet again, higher speed and lower gearing means smaller impulses and less torque variation, which also means smoothness in running, especially in running slowly.

Six Cylinders Costly

At first all went well with the six-cylinder development in this country, but when manufacturers sought to improve the quietness and smoothness of their motors they soon found that a refined six was a most expensive sort of engine to build. Also it is a heavy type of motor unless a great deal of care is taken in its design and manufacture, because its length calls for immense strength to maintain rigidity. The larger the cylinder bore the more difficult does it become to make the crankshaft and crankcase of absolute rigidity, and if they are not rigid there will be unpleasing vibration at certain speeds.

Yet again, although the torque of the six is a great deal better than that of a four, the large engines, which have become the rule are run at such slow speeds on high gear that the individual impulse from each cylinder on say a 4 by 6 motor, can be felt very distinctly. If we increase the number of cylinders, this effect can be avoided, the reciprocating parts can become lighter, the stresses can be reduced, the amount of metal needed to maintain rigidity is less and the cost is probably reduced a little, it is not increased in any case.

Are Eight Sufficient?

So if we argue the advantages of small cylinders the only way to apply them to the big, heavy car is to use more than four and even more than six. There is no need to go into the pros and cons of six versus eight as a manufacturing proposition, or to discuss the advantages of short crankshafts, etc., for that has been done so many times already, but if we apply the limited cylinder theory to the big cars we shall find that even eight cylinders are hardly enough. Take the seven-passenger car of class 4, and practically all cars in this class *are* seven seated, and it is observable that the total capacity called for is 511 cubic inches.

With six cylinders we are above 60 cubic inches per cylinder by no less than 25 cubic inches or nearly 50 per cent. With eight cylinders we are still outside as the value per cylinder becomes nearly 64, but with twelve cylinders we come well inside with 42.5 cubic inches. Now this size is almost exactly that of one cylinder of a 3-liter (183-cubic inch) four-cylinder motor, and of all sizes made in Europe this is the most popular and has given the very best all round results.

Twelve-Cylinder Rational

Thus it is rational to anticipate not only the appearance of twelve-cylinder motors for driving large cars, but rational to try to develop them. Take for example the weak spot of the six-cylinder motor which is, of course, the crankshaft. It is now well-known that the eight-cylinder V motor is extremely easy on the crankpin bushings and that the maximum bending moment on the center bearing of the crank is also less than double that due to either set of four, which make up the engine, by a considerable amount, while it is hugely less than the stress which would be present in a four of equal total capacity.

Similarly with the twelve, as compared to the six, the crankshaft bending moment is very small by comparison with the cylinder volume of the engine and the stresses on the lower end connecting-rod bearings are also very light.

Further, although the torque of the eight is so good that even a sixteen-cylinder motor could hardly better it within the limits of human perception, it still does possess that undesirable transverse vibration when the cylinders are set at 90 degrees and compound vibrations if any other angle is chosen. These vibrations are small and not of much account as they are less in amplitude than the usual torsional and flexure vibrations found in the average six, but the twelve has no vibrations whatever either transverse or compound, whether the angle between the cylinder center lines be 90 or 60 or any other number of degrees. Because either of the two blocks of six which make up a V twelve are in themselves balanced quite perfectly. We are left, in considering the twelve, with only one possibility, and this is the chance of torsional crankshaft deformation.

It is easy to see that the order of firing might have a considerable effect upon this point, but remembering that we can get all the power needed for the very largest car with cylinders of quite small size individually, it is hardly to be expected that torsional oscillations would prove difficult to eliminate. It means that the shaft must be stiffer.

Twelve Can Be Narrow Motor

Just here has been mentioned without comment another advantage of twelve cylinders as compared with eight, for large motors, this being the ability to set them at a narrow angle and so do away with the great width which might be a trouble on a large eight. On the very big car one needs a hood of reasonable length to prevent the appearance becoming squat, and with cylinders of 3 or 3.5 inches diameter the length necessary would be imperceptibly more if any more, than that required for an eight of equivalent total volume. Width however is a very different matter, for the twelve would be many inches narrower.

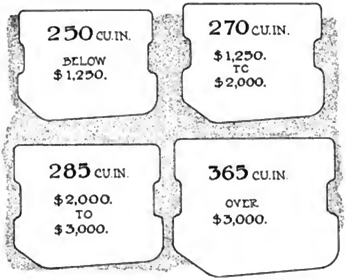
Thus far the conclusion is that as long as very high power is required for large cars the twelve-cylinder is a perfectly rational development along the sound engineering lines of common sense and experience, and there is also room for eights, sixes and fours, according to the power required. This might be qualified by saying that it would seem reasonable also to anticipate a good deal of close running on pro and con between eights and sixes, the final result being to eliminate one or the other.

Now it is time to turn to the other side of the picture and examine the disadvantages of the twelve. There is the obvious one of complexity and the thought of twenty-four push rods and twenty-four valves is, at first, certainly alarming. Let it not be forgotten, however that the kind of man who buys a car of 80 or 90 brake horsepower is not likely to allow himself to trouble about such things so long as he obtains satisfaction while the adjustments are correct. Nor is the task of valve grinding double that of the six, because the valves are so much smaller, so the cost of a clean and tune up in the repair shop ought not to be much more.

Twelve Costly To Build

From the manufacturer's viewpoint the case is less easy to argue, and there is hardly any doubt that the cost will be greater than that of either a six or an eight of equal total volume. It might not be so very much greater but it is difficult to imagine that it could be the same. Of course, if we accept the contention that the eight is cheaper than the six of equal size, then we ought to take the manufacturing problem as twelve versus eight and cut out the six. Doing this we find a certainly more costly crankshaft and crankcase, 50 per cent. more cylinder bores, 50 per cent. more valves, push rods, cams, etc. Only a trifle is saved by the smaller size of these parts so a fair guess at the difference between six and eight would be from 30 to 40 per cent. in favor of the eight. It does not follow, by any means that this precludes the use of twelves, however, because there are still plenty of people willing to pay for a large and expensive car.

Where this question of manufacturing cost does come in is when we consider the possibility of a cheap twelve with minute cylinders. Suppose we started to lay out a twelve-cylinder motor to suit the power demanded by class 2, for example; that is to have a capacity per passenger of 54 cubic inches. Assume, if you like, a six-passenger car giving a total of 324 cubic inches. This means 45 cubic inches per cylinder for an eight or just about the convenient size, but the twelve would have cylinders of only 27 cubic inches capacity. This we could get with a bore and stroke 2 7-8 by 4 inches or 3 by 3 7-8 inches roughly, which suggests that the valve parts might easily become inconveniently small and the clearances inside the crankcase likewise troublesome. This is only theory, and experience with a type of motor as yet to be created might very possibly cause the theory to be confounded on this point. It is, however, obvious enough that a tiny twelve of this character would cost considerably more to build than an eight 3 3-8 by 5 inches which would give about the same total capacity.



Comparison of average total piston displacement of touring cars in the four price classes

If we assume that a car in class 2 is sufficiently provided with power when the motor is chosen on a five-passenger basis, or with a total volume of 270 cubic inches, the case for the eight becomes greatly strengthened.

Thus it is not to be expected that the introduction of a few twelves will be followed by a boom in that type of motor. It has been the purpose of this article to examine the case for different numbers of cylinders and it has been shown that there is at least one good engineering reason for the appearance of the eight, based on experience of economic limits of individual cylinder size. It also shows that the same reasoning makes an equally good case for the twelve in large sizes, but for the minute twelve or the minute eight there seems no good reason whatever from an engineering point of view.

Amount of Power Needed

While on this subject it is worth touching upon the amount of power obtainable from these different kinds of motor. Within limits of practical manufacture it is usual to find 1 horsepower delivered by each 6 cubic inches of cylinder volume, more or less irrespective of number or size of cylinders. On a good many cheap motors the power is not so great as this and on a sprinkling of others it is greater, but the figure is a fair average. Applying this to the class arrangement we find that cars in class 1 have roughly 8 horsepower per passenger; class 2 has nearly a horsepower more; class 3 a little more still and class 4 no less than 12 horsepower per person. Of course this classification is open to criticism, because the cars are heavier and as the price goes up there is more *car* per passenger as well as more power, but the figures may be useful as indicating roughly what the purchaser expects to get for his money.

The Rostrum

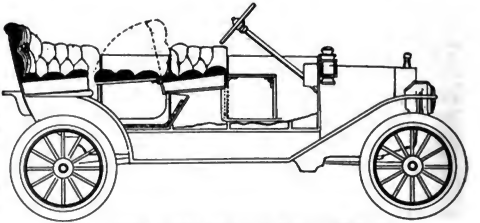


Fig. 1—Front seat folded back to form berth in a touring car

Highest Speed Not Greatest Power

EDITOR THE AUTOMOBILE:—I have a Henderson four-cylinder motorcycle having a motor of 2 5-8 inches by 3 inches bore and stroke which I believe is out of balance. When I purchased the machine new it was geared 4 to 1 and would run very well up to its maximum speed of about 65 miles per hour. This speed would correspond to a motor speed of about 3,120 r.p.m. As the machine would not climb hills very well, I geared it down to 4 1-2 to 1. With this gear the machine would run well up to about 45 miles per hour but above this it would vibrate excessively. This vibration ceased after the machine had been run 3,000 miles, even though the machine was speeded up to 50 miles per hour. The motor was pretty well carbonized at the time and showed a noticeable loss of power but still that vibration had ceased. This winter I gave the engine a thorough overhauling. I noticed that the different pistons with their respective connecting-rods varied as much as 1 1-2 ounces in weight, but not thinking that this variation was excessive, I made no attempt at balancing them.

I find that the motor vibrates just as it did last season when the machine is driven at any speed greater than 40 m.p.h. At 40 m.p.h. the motor is turning over only about 2,130 times per minute. The drive is through a jackshaft, meshing with the crankshaft by means of a bevel gear, and from the jackshaft to the rear wheel by a roller chain.

Will you kindly state what is the trouble? If the motor needs balancing, what is the best method of procedure? How should I balance the crankshaft if it is unbalanced and how am I to determine whether it is out of balance?

When my machine was geared 4 to 1, it was fully as fast as twin cylinder motorcycles of various makes but would not climb hills nearly so well even though these machines were geared a little higher, 3 3-4 to 1. I always had considered that speed was an indication of power but the machine's performance on hills did not bear me out in this. Why is this?

Salt Lake City, Utah. READER.

—There is no doubt that the motor is out of balance and, in a motor of the size you describe, a difference of weight in the different pistons of as much as 1.5 ounces would be sufficient to cause vibration. You would probably find that the motor would run smoother with the pistons and connecting-rods all of the same weight than it does with them varying as much as you mention. The only way which you could balance the crankshaft would be in a Norton running balance machine or some similar device and this you would have to have done for you by the engineers of a plant in which the running balance apparatus is installed. It is probable that in changing the load through rearranging the gear reduction, the crankshaft has become unbalanced.

Regarding the relation of speed and horsepower, there is no definite interrelationship between the two and no rule which states that the maximum horsepower is being exerted at maximum speed. In fact the contrary is the case. The motor may continue to revolve at a greater speed after the power curve has reached its peak. This can be made clear by the study of a characteristic power curve such as is shown in Fig. 2.

Gear Ratios of Representative Cars

Editor THE AUTOMOBILE:—Would thank you to furnish me with the information as to the gear ratios of the following cars on their lower speeds with respect to their high, i. e., considering the direct drive as 1 to 1.

Stutz, Mercer 1914, Mercer 1915, Marmon 41, Simplex, Packard 48.

New York City. SUBSCRIBER.

—The gear ratios of the cars you mention are as follows: Stutz H. C. S., 4 to 1; all other Stutz models, 3.5 to 1; Mercer 1914, 3 to 1; Mercer 1915, 3.5 to 1; Marmon 41, 3.77 to 1; Simplex 38, 2.75 to 1; Simplex 50, 2.13 to 1; Packard 48, 3.93 to 1.

Wants Berth in Ford Car

Editor THE AUTOMOBILE:—Will you please tell me how to convert the front seat of a Ford touring car so as I can make a berth out of same? Would like a cut showing this as I want it to fit out a car for the Panama Exposition.

Savannah, Mo. W. H. BROWN.

—There are two methods by which a Ford car can be transformed into a sleeping car, both of which have been successfully tried by tourists. The first was fully described in an article which appeared in *Motor Print* for August, 1914. With this scheme there is a collapsible mattress which forms a decking of reinforced canvas stretching from the top of the rear seat forward over the top of the front seat. When folded it is but 6 inches in diameter and 6 feet long. It is fastened by straps to the windshield support and to the iron arm that supports the top of the car. Beneath the roll on the running board, the mess equipment and blankets are secured and these keep the mattress from bounding about as the machine is in motion.

The mattress can be made at very little expense. A piece of canvas approximately 10 feet long by 6 feet wide, according to the size of the car, and some strips of tough wood constitute the bill of material. The piece of canvas is folded or doubled back until the piece is about 6 feet long and the width of the car seat on top of the back. The mattress slats, which should be 1.5 inches wide by .5 inch thick and

6 feet long, are placed from 1 to 1.5 inches apart, depending upon the weight they are to support, between the canvas and are securely tacked in place.

At the foot of the mattress a piece must be cut out to fit around the steering wheel. On the Ford car it is not necessary to fix straps to the corners of the mattress to hold it in place, although two straps, one at either back corner, will keep the contrivance from tilting up when crawling into the berth from the end.

The other scheme for making a berth in a Ford car is to alter the design of the front seat so that the back of it can be tilted backwards on a hinge until the bed is formed across the back seat, the back of the front seat and the front seat itself. A heavy blanket can be laid over this improvised berth and very good results obtained. If a longer bed is desired, the lower part of the front seat can be tilted upward on another hinge to provide the extra length.

Inadvisable to Install Pressure Feed

Editor THE AUTOMOBILE:—Is there any possible way in which I can install a pressure feed oiling system on a Cole 6-60 1914 model?

Buffalo, N. Y. A. C. STROHM.

—It might be possible to install this pressure feed but it would not be advisable. In the first place, a great amount of special engineering work would be required and many new parts, such as a hollow crankshaft and the pump itself. This would entail a great outlay of money which would not be justifiable because after the system had been worked out and installed on the motor, the undertaking would, in every sense of the word, be an experiment. The motor used in the Cole car is of Northway manufacture and the oiling system has been carefully worked out and proven to be satisfactory. It is therefore unnecessary to change it as any troubles you may have been having with it are not due to the original design but to some local defect which has come up and which can probably be readily cured in a much more simple way than by altering the entire system.

Text Books Not Up to Starter Art

Editor THE AUTOMOBILE:—Kindly advise me where I can secure some good literature in book form on electric lighting and starting systems. Also storage batteries and their care.

2—Please tell me what make of motor is used on the Pullman Junior car made at York, Pa., and also where it is made?

Baltic, O. PERCY S. GERBER.

—The art of the successful electric lighting and cranking system has advanced so rapidly since its inception 4 years ago as an important factor in automobile design, that there is no book which thoroughly covers the field in either a good analytical or descriptive manner. The same may be said of the storage battery which is used for electric lighting and starting. As regards the care of both the best information and the most carefully compiled data is to be secured from the literature published by the manufacturer. The makers of electric lighting and starting systems and of storage batteries have issued careful instructions and diagrams covering their products in a methodical manner. As for the design of either, insofar as we have record there are no text books which are advanced enough to be said to cover the art in its present stage.

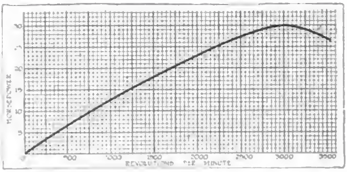


Fig. 2—Typical horsepower curve, showing how power drops off, although r.p.m. increase above the peak point

2—The motor used on the Pullman Junior car is manufactured by Golden, Belknap & Swartz, 1248 Grand River avenue, Detroit, Mich.

Oil Strainer Probably Dirt Covered

Editor THE AUTOMOBILE:—I have a Maxwell-40 which does not get a continual supply of oil. The oil will flow through the oil sight feed for a while and then stop. If the engine is stopped the oil will flow again but not until then. The pump is in good condition. The oil line is clear and there are no air leaks. If you know of any remedy for this, kindly let me know.

2—A short time ago there was printed in THE AUTOMOBILE an item regarding a test made with a Marmon 41, with a substitute for gasoline. I think that rain-water is one of the things used in the substitute. I would like, if possible, a full description of the manufacture and materials used in the making of this substitute.

Rome, N. Y. PAUL GOETZE.

—From the description you give it is very difficult to state exactly what the cause of your trouble is. It may be from several causes, for instance, it may be possible that the pipes leading to the sight feed and motor are clogged and it is suggested that you disconnect all of these pipes and thoroughly clean same. The pump of the Maxwell-40 takes oil from a long tube-like strainer screwed in the bottom on the side of

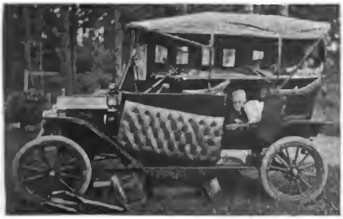


Fig. 3—Ford car provided with a berth formed by a collapsible mattress

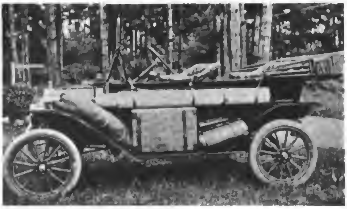


Fig. 4—Showing collapsible mattress and other baggage strapped in position

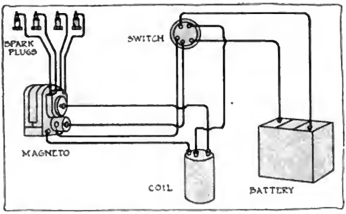


Fig. 5—Wiring diagram of ignition on the Chalmers 1913 model

the case. This often becomes covered with dirt and lint, causing the pump to work badly. It is always necessary to disconnect the oil pump and take out this strainer occasionally and remove all dirt and sediment. It would be a good thing, also, to examine the pump and see if the packing is worn out. If it is, it should be renewed. All the pipes are direct lines and if cleaned and free from trap, the only trouble can be in the pump or strainer. The remedy will therefore be to repair the pump and clean out the strainer.

2—The material to which you refer was known as Zoline and the full details of the process were never made public. The manufacturing cost of the article was shown to be much greater than that of gasoline and hence the project was abandoned.

Valve-in-Head and Rotary-Valve Motors

Editor THE AUTOMOBILE:—Kindly give me the names of firms making valve-in-head motors in four or six-cylinders of the following dimensions: 3-inch bore and over and 4 1-2-inch stroke and over.

2—Are there any rotary valve motors made for the trade other than the one used in Speedwell cars?

New York. O. C. SELZER.

—Concerns using overhead valve motors are the following: Buick, 3.75 by 3.75; 3.75 by 5; Chevrolet, 3.687 by 4; Great Western, 3.75 by 5.75; Grant, 2.875 by 4.25; Franklin, 3.625 by 4; Dorris, 4.375 by 5; Cunningham, 4.75 by 5.75; Interstate, 3.5 by 5; Kearns, 2.875 by 4; Morse, 4.625 by 5; Oldsmobile, 3.5 by 5; Partin Palmer, 3.75 by 5.25; Peter Pan, 2.75 by 4.125.

2—At the present time there are no rotary valve motors on the open market in this country which can be purchased and used in connection with an assembled product.

Wiring Scheme of 1913 Chalmers

Editor THE AUTOMOBILE:—I have just purchased a 1913 model 16 Chalmers four-cylinder touring car and the wiring has been removed and would like to have you give me a sketch of same or tell me where I can obtain one.

Spooner, Wis. J. W. HARMON.

—The Chalmers car uses what is known as a dual ignition system which consists of a magneto which serves as a source of current in regular running, a storage battery which provides the current in starting the car, a transformer coil, a dash kick switch and a single set of four spark plugs. For starting on the switch and for reserve, the storage battery is relied upon, and this furnishes a low-tension current which is transformed into a high-tension current by the spark coil located on the sub-frame. The wiring of these units is shown in Fig. 5. The battery is a 6-volt 40-ampere-hour capacity with a charging rate of 5 amperes. It is contained in a water-tight metal box placed beneath the floor of the tonneau. From the battery the wires run forward inside the left frame to the coil fastened to the sub-frame. The battery should be recharged whenever its voltage drops to 5.4 and should be tested every 2 weeks. The coil is located just beneath the front seat of the sub-frame and the magneto is on the left side of the motor towards the rear.

Financial Status of Chevrolet Company

Editor THE AUTOMOBILE:—Can you give me any information in regard to the organization, capital stock, real investment and bonded indebtedness of the Chevrolet Motor Co.?

2—I have a 1912 car that leaks oil through the holes in the flywheel on the clutch, thereby causing the clutch to slip. Can you suggest any way to fill up the three holes in the flywheel in order to lessen the amount of oil leaking into the clutch, without removing the flywheel from the car and having it soldered or welded?

Allentown, N. J. E. DILATUSH.

—According to the officials of the company, the authorized capital of the Chevrolet Motor Co. is $2,000,000 of common stock and $500,000 of preferred. The stock which has been issued to date consists of $1,323,850 common and $235,100 preferred, or a total capital of $1,558,950.

The net assets of the company after deducting all questionable accounts and after setting up strong reserves for depreciations and to meet any contingencies, are $1,696,553.77. This is drawn from the company's statement of April 1, 1915.

Of the above named net assets $427,707.99 is invested in plants and equipment. The balance of the assets consist of new merchandise in process of manufacture. Cash balance in banks April 1, 1915, was $464,007.21.

The Chevrolet company does not owe any mortgages; has no bank indebtedness of any kind and has discounted all its bills for the past 2 years; it has no bonds out and the business is active and in an exceedingly prosperous condition.

The company paid the regular dividend on its preferred stock on April 25. This dividend on the preferred stock is at the rate of 7 per cent. per annum. The company is not paying a dividend at this time on the common stock as it prefers to build up a surplus and strong reserve for safe expansion of its business and to meet any conditions which may arise in the future.

2—We cannot exactly understand the nature of the trouble as there are no holes in the Chevrolet flywheel through which the oil would be likely to flow. It is possible that your trouble is caused by the felt washer in the rear bearing having become worn. If you will remove the lower half of the crankcase and install a new crankcase gasket and a new felt washer in the rear bearing, being sure not to wrinkle the gasket when putting up the lower part of the crankcase, the trouble will probably be remedied. However, you do not state that the car referred to is a Chevrolet and if you will advise the make and model of the car, more exact information can be given.

Vacuum Probably Not Good

Editor THE AUTOMOBILE:—My Saxon roadster, model 1915, smokes badly and has used 1 gallon of oil in 100 miles. What is the trouble and how can I remedy it?

Laurelville, O. W. P. DEHAVEN.

—The Saxon motor is oiled by splash and when a splash system smokes, the trouble can generally be put down to either too high a level in the splash trough, too deep dipping of the connecting-rods or bad piston rings. The first two amount to practically the same thing, because if the level of the oil is too high, the connecting-rod is sure to dip too deeply into the oil and hence the effect is to splash too much oil to the cylinders. When the piston rings are faulty, the oil leaks past the rings and after it reaches the combustion space is burned in large quantities, thereby causing the smoking and sooting. The proper course for you to pursue is first to determine the proper level in the crankcase which is exactly up to the bottom of the pipe plug P shown in Fig. 6.

The trouble with your oiling system might be in the leakage of air in the vacuum tank which controls the supply to the crankcase. If air leaks into the cap at the top the oil will flow out of the tank into the crankcase and the result will be such as you mention. Therefore, see that the filler cap on top of the reservoir is absolutely air tight. If you will do this and also see that the oil level is not above the plug in the bottom, your system will work all right. In the instruction books for the Saxon car attention is called to the danger of having air in the oil tank. They state in this that whenever the filler plug is taken off the tank or even loosened for any purpose whatever, enough oil must be put in the tank to bring it to the point of overflowing so that there will be no air space inclosed in the tank when the plug is put on. If this is not done no vacuum can form in the top and all the oil will run quickly into the motor and out of the exhaust pipe. If you have been in the habit of disregarding this warning the cause of your trouble is self-evident.

Valve Timing of Knight Motor

Editor THE AUTOMOBILE:—Will you please give me the valve timing of a typical Knight motor, such as the Stearns or Moline?

Princeton, N. J. A. K. CHAPMAN.

—The timing of the Stearns-Knight is as follows: inlet opens 4 degrees past top center; inlet closes 40 degrees past bottom center; exhaust opens 60 degrees before bottom center and closes at top center. The timing of the Moline is as follows: Inlet opens at 20 degrees past top center and closes 50 degrees past bottom center. Exhaust opens at 50 degrees before bottom center and closes at 5 degrees after the top center.

Wants Eight-Cylinder Motor for a White

Editor THE AUTOMOBILE:—What do you think as to the practicability of installing an eight-cylinder motor in a White 30 chassis? I have no doubt but that the factor of safety in the chassis is sufficient for the installation of such a motor. I would also like you to tell me just how much trouble it would entail to carry out my idea, also as to the clutch mounting, etc.

Atlanta, Ga. G. A. SIMPSON.

—While the factor of safety of the chassis is no doubt large enough to take care of the installation of an eight-cylinder motor, it would be impractical to attempt it on account of the difficulties in connecting up the clutch, etc. Considerable machine work would be necessary and the expense would be so great that it would not be justified.

7 Volts Needed for Starting Current

Editor THE AUTOMOBILE:—I have a 1910 Velie, with 4.5-inch bore and 5.25-inch stroke, low tension Splitdorf magneto and six-cell No. 6 dry battery ignition, model L Schebler carbureter. There are two switches so that the magneto and dry battery, Atwater Kent distributer, can be both cut in and worked on the two sets of spark plugs at the same time.

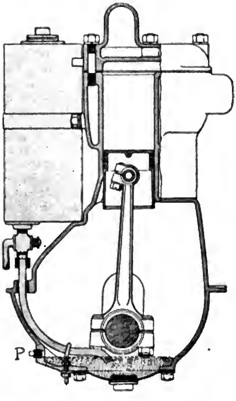
I read in THE AUTOMOBILE that it was a good idea when bringing the car in from a run to put some kerosene in the cylinders to cut the carbon and soften it up and so a couple of weeks ago when putting the car in the garage, I put some kerosene in the cylinders through priming cups and the next day I had trouble in starting the motor. One, two or three cylinders would fire and then I would have to crank again, but after several crankings, the engine started all right. The last time I had the car out, when I put it back in the garage I put some more kerosene in the cylinders, probably about three tablespoonsful in each cylinder, and about two or three nights after that I tried to start the engine but could not do so. The next night I tried again, cranking it for about an hour or so, priming with gasoline several times, but the engine would not start. One, two or three cylinders would fire and then the engine would stop. I took the spark plugs out and found a slight carbon soot on them. I cleaned them off and put them back with no better results. I seemed to get a good spark through the dry battery but did not test the spark from the magneto. Between these two times of putting kerosene in the cylinders I had the car out and it started satisfactorily. It is a hard engine to start, anyway, but I did not see the theory of it starting so hard after dosing with kerosene. Can you enlighten me on this and advise if the use of the kerosene is responsible?

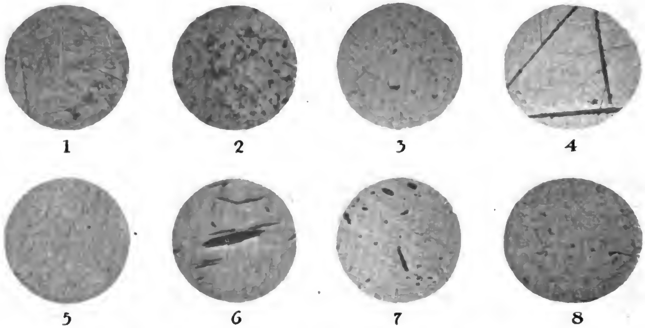
Buffalo, N. Y. LEON SMITH.

—It would be a good idea to put a voltmeter on your dry batteries and see if they are giving you the proper current. You should have about 7 volts to provide good ignition current so that the voltage at the terminal will be at least 6. New dry cells will test approximately 1.5 volts a piece and when in really good condition you can sometimes use as few as four cells with good results. A fifth can then be added when the voltage drops and finally a sixth. With the sixth cell the current supply should last for a long time. If you test the cells with an ammeter, they should register 25 or better, but you must remember that in connecting cells in series the amperage remains practically the same, whereas the voltage of each added cell is added to the total; thus, for six cells having a voltage of 1.5 and amperage of 25 the resulting current will be of 9 volts, with little more than 25 amperes.

It might be possible that the presence of kerosene would have a slight effect on starting the motor, but this would immediately disappear if the motor priming cocks were open before the engine was started and the motor turned over several times to blow any residue out of the cylinders. The motor should then be primed and, with a good spark, will start immediately. Any motor with good compression will start if there is a charge in the cylinders and if the spark is as it should be.

Fig. 6—Vacuum tank in position on the side of the motor of a Saxon roadster. If the cap is not fastened so that it is airtight it will release the vacuum and permit oil to flow into the crankcase. The correct level of the oil is at the bottom of the plug P





Examples of different ball bearing surfaces examined under the microscope and magnified 120 diameters. Number 5 is an example of a Hess-Bright bearing

Ball Bearings in Theory and Practice*

Part II

Co-efficients of Friction and Methods of Lubrication of Extreme Importance in Bearing Practice

By B. D. Gray

Vice-President and Manager of the Hess-Bright Mfg. Co.

ONE of Stribeck's findings that completely reversed previously established theory was the relatively high carrying capacity and low friction of the ball bearing as compared with the roller. Prior to the knowledge gained from these tests, differences in the two were predicated upon the theory of a line and a point contact, assuming that there was a pure rolling action in both cases. But pure rolling is a theoretical possibility merely, requiring for its realization absolutely true shapes initially, and inelastic materials that will not change shape under load. For example, to produce a series of rollers truly cylindrical and alike as to diameter, also a perfectly cylindrical shaft, and a truly cylindrical box, within the requisite small limits of error necessary to produce pure rolling motion with perfect line contact, is difficult and commercially not realizable. The taper roller bearing presents still greater difficulties. Under heavy loads such accuracy as may be obtained is largely defeated by deflections of the machine framing or shafting. This causes the rollers to skew more or less, and it follows that the theoretical long line contact of the roller does not exist in fact, but is limited to a small fraction of the roll length.

One of our customers who has also used taper roller bearings and who has a well-equipped physical laboratory in which he has made numerous careful bearing tests informs us that the co-efficient of friction of our bearings is one-fourth that of taper roller bearings even when the latter are tested under the most favorable conditions—more favorable than are frequently obtained in actual service.

The co-efficient of friction for properly made ball bearings will average about 0.0015, while based upon the above mentioned tests the co-efficient of friction for taper roller bearings would average about 0.006.

A paper on Comparative Tests of Three Types of Line-shaft Bearings, by Carl C. Thomas, E. R. Maurer and L. E. A. Kelso (see A. S. M. E. Journal, Vol. 36, No. 3, March, 1914), gives interesting figures on the co-efficients of friction for Hess-Bright bearings, flexible roller bearings and plain ring-oiling babbitted bearings. I am giving below a tabulation of these based upon curves contained in the paper.

COMPARISON OF CO-EFFICIENTS OF FRICTION

Peripheral Speed of Shaft—150 Ft. per Min. Corres. to 235 R.P.M.

Bearing	Average Load per Bearing—727 lbs.		Average Load per Bearing—1227 lbs.		Average Load per Bearing—1727 lbs.	
	Temp. bearing 77° F. Coeff. Friction	Temp. bearing 100° F. Coeff. Friction	Temp. bearing 77° F. Coeff. Friction	Temp. bearing 100° F. Coeff. Friction	Temp. bearing 77° F. Coeff. Friction	Temp. bearing 100° F. Coeff. Friction
Ball ..	0.0025	0.0019	0.0022	0.0018	0.0020	0.0016
Roller .	0.0069	0.0055	0.0055	0.0047	0.0049	0.0042
Babbitt	0.0112	0.0075	0.0082	0.0058	0.0070	0.0051

It will be noted that the co-efficients of friction for all three types of bearing decrease with increase of bearing temperature and load (for loads and temperatures given).

---

*Note.—From a paper read before the Electric Vehicle Assn. of America, Philadelphia, Pa., April 14, 1915.

This same customer mentioned before as having experimentally determined that the co-efficient of friction of our bearings was one-fourth that of taper roller bearings, also states that a decided difference may be observed in the coasting properties of their automobiles when mounted on roller bearings and on Hess-Bright or other high-grade annular ball bearings. I found a great difference in the coasting of my Cadillac after replacing the taper roller bearings in the hubs with 2ROs. Unfortunately, however, it did not occur to me to measure the draw bar pull before making the change, and through lack of time and facilities this comparison has never been made. A prominent axle manufacturer has, however, made the statement to us that he made tests of this character, and found the difference in draw bar pull to be decidedly in favor of ball bearings.

In any tests of this nature the taper roller bearings are likely to be adjusted to a nicety. In actual service and in the hands of the layman or a careless chauffeur or repairman they may be adjusted so as to cause a tremendous increase in friction. As many of us know from experience, a taper roller bearing makes a fine clutch when set up endwise tightly with a nut.

The much vaunted adjustability of the taper roller bearing to compensate for wear is mythical. It is not susceptible of adjustment in the true sense of the word except when it is new and when all parts have been accurately made. If the cup or the cone has worn out of round, Fig. 13, or if any of the rolls have been unevenly worn, it is an absolute impossibility to adjust the bearing so that the rolls bear evenly all around, and any attempt to adjust it results in misalignment, undue stress and strains and probable early destruction of the bearing or correlated parts. The non-adjustable annular or 2RO bearing mounted in such a way that an inexperienced or careless person in removing it cannot replace it in any but the correct manner has a decided advantage over any bearing which may be adjusted.

Annular or 2RO ball bearings, if properly selected as to size, properly mounted and enclosed, are quite as reliable and durable as any other part of an automobile. Several years ago there arose in this country a feeling that annular ball bearings were not suitable for mountings where they would be subjected to considerable end thrust, and especially end shock, as in front hubs. The reason for this was due more to improper selection and mounting, supplemented by extensive advertising of roller bearings, than to inherent fault in the ball bearings. A number of automobile manufacturers have retained annular bearings in the front hubs of their cars with most satisfactory results. Abroad practically no roller bearings are used in automobiles in any location. The annular bearing is almost universally used throughout the car, and has not been a source of trouble in hubs, as was claimed for it in this country. It is said by some that the excellent roads in Europe do not impose such severe service on wheel bearings as the poor roads in this country. From personal experience in driving 16,000 miles in five countries on the continent, I am convinced that hub bearings on European cars do not have an easier time of it than those in the hubs of cars used in this country. My personal experience also with the Alco and Berliet cars made in this country convinces me that the ball bearing is not only adequate but the best for the purpose if properly selected and mounted.

As I have already pointed out, the theoretical line contact of roller bearings is only rarely obtained, since it depends upon extreme accuracy of manufacture of the cup, cone and rolls, upon perfect alignment and upon keeping the rolls in their proper position. In the ball bearings we have not a point contact, as many suppose, but a substantial area due partly to deformation and partly to the shape of the parts in contact; I refer to the concavity of the ball path or grooves whose radius in one direction very nearly coincides with that of the ball.

This was very clearly brought out in a test which we made a short time ago. One and one-half inch diameter balls in contact with a flat disk, a grooved disk and a cupped disk, as shown in Fig. 14, were subjected to a load of 10,000 pounds in our testing machine. Vitriol was applied around the contact points and allowed to etch the exposed surfaces; that is, those which were not actually in contact. Then the load was relieved and the contact diameter was measured by means of a micrometer microscope. In the cases of the flat and cupped disks the areas of contact were circular, but in the case of the grooved disk the area of contact was elongated, resembling an ellipse. The pressure per unit area was computed and found to be:

Flat surface	581,395 lbs. per sq. in.
Grooved surface	212,766 lbs. per sq. in.
Cupped surface	146,413 lbs. per sq. in.

This test shows clearly the reason for the increased carrying capacity of the curved (grooved) ball track type of bearing as against that type with flat or practically flat tracks. It is self-evident that the more closely the groove envelops the ball the lower will be the pressure per *unit* area and hence the greater will be the ability to carry load.

As an indication of the capacity and durability of ball bearings, I will give you the results of a test recently completed. A No. 6407 bearing was subjected to a radial load of 3,500 pounds and thrust load of 1,750 pounds and run continuously at 1,445 r.p.m. for 531¼ hours before failure occurred.

This bearing has a bore of 35 millimeters (1.3780 inches), outside diameter of 100 millimeters (3.9370 inches) and a width of 25 millimeters (0.9843 inch).

To get an idea of what the above radial and thrust figures would be the equivalent of in automobile front hub service, let us assume a 36-inch wheel running at 1,445 r.p.m. This would mean a speed of 154.6 miles per hour. A run of 531¼ hours would be the equivalent of 154.6 x 531.25 or 82,141 miles.

Also assume that two bearings are used to a hub, one carrying 3,500 pounds radial load and 1,750 pounds thrust, while the other carries 3,500 pounds radial load only. The total radial load per hub would then amount to 7,000 pounds per hub, and with four hubs (assuming the rear hubs carry the same load as the front hubs—in the average car they carry more) the total load would be approximately 28,000 pounds.

Based on the above, conservatively, this would be the equivalent of 82,141 miles in the front hub of a car weighing (with live load) 7,000 pounds and running continuously at 154.6 miles per hour (allowing a factor of 4 for shock).

Of course, in the final analysis, relative capacities of ball and roller bearings can best be determined by test, but we do not fear any comparative test made without prejudice.

The question of lubrication is a matter of such vital importance to the satisfactory operation of ball bearings that a

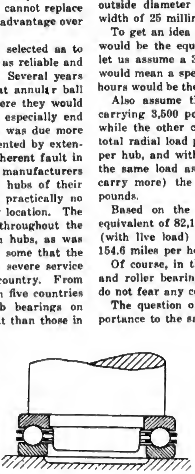


Fig. 11—Thrust bearing of the flat type

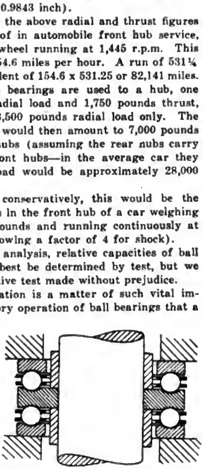


Fig. 12—Two-direction thrust bearing of flat type

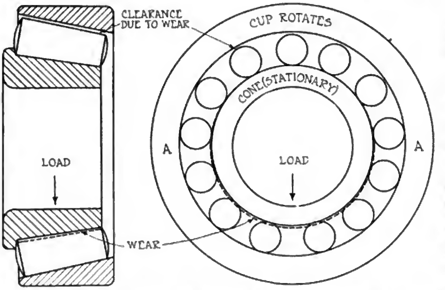


Fig. 13—Showing the functions and clearances of the different members of a taper bearing which has undergone wear. Clearance Due to Wear—Clearance between cup and rolls due to wear of lower surface of cone. Wear—Dotted line indicates original shape of cone before wear has occurred. Any attempt to adjust for wear produces pinching of rolls amounting to a maximum at points A and correspondingly less at other points

paper of this character would hardly be complete without some reference to it. Several years ago one of our representatives, W. L. Batt, covered the subject very fully for the *American Machinist* and I herewith give extracts.

"Oil is essential for the operation of plain bearings, but it is not so well known that ball bearings likewise require a certain amount of lubrication; it is all too frequently assumed that the latter may run entirely dry.

"Contrary to this assumption, lubrication has a very positive action in a ball bearing. This action is many fold, existing both between the ball and the path upon which it rolls and between the ball and the separator. Though the principle of the ball bearing is a rolling one, there is in the most perfectly designed bearing a sliding action which, however slight, must yet be provided for. If balls and raceways were absolutely incompressible there would in practice be solely point contact and therefore, a pure rolling action, but as far as present-day mechanical processes go, even the most perfect of materials are somewhat elastic, and there is an actual area of deformation between the ball and the raceway under load. At the extremities of this area, whose diameter is, of course, very small, sliding must exist, but the presence of a lubricant at this point renders what small amount of friction there is almost negligible. Improbable as it may seem, there is an actual film of lubricant maintained between these surfaces of contact, however minute they are, providing the lubricant be one of sufficient viscosity.

"Aside from its lubricating quality, oil or grease acts as a protecting agent for the ball bearing. The finely polished surfaces of the balls and raceways are subject to attack by rust through atmospheric action and may be damaged by the entrance of foreign matter from the outside, such as grit and dust. Lubricant effectually surrounding the bearing will not be penetrated by this atmospheric moisture, and thus the surfaces of action are preserved in their original finely polished condition.

"In order that the lubricant may in itself be no source of danger, it must respond to certain requirements; incidentally, requirements exacted of the ball bearing lubricant are thoroughly desirable in one to be used in plain bearings as well.

"First and most vital is the requirement that the lubricant of itself shall do no damage to the bearing, neither originally nor through deterioration. The most common fault in oils is the presence of free acid or its development. Free acid is never found in properly refined mineral or hydrocarbon oils, nor will these deteriorate due to the action of the atmosphere, and therefore the only kind of oil satisfactory for ball bearing lubrication is mineral oil. Vegetable oils, such as castor, cotton-seed, rape, linseed and the like, are barred, principally because of their tendency to gum up, become rancid and develop acid. The animal oils are objectionable for the same reason. The so-called petroleum greases, among which are vaseline and cosmoline, have no detrimental action in themselves, since they are derivatives of mineral oil; they have, however, low viscosity and a low melting point; 100 to 125° F.; they pound out thin in action and have little lubricating value. Their use is limited to very slow speeds and their chief advantage is low cost.

"Just as acid is a thing to be guarded against in oils, so is free alkali the most common enemy to ball bearings, among the greases. The familiar yellow cup grease is usually a combination of a mineral oil and some vegetable or mineral oil or fat, which latter is saponified by the addition of a caustic; the result is a lubricant having body and stiffness. The saponifying material should be small in quantity and very carefully compounded, else free alkali, having a detrimental action on the steel may result. The action of an alkali, as of an acid, is to pit or etch the surfaces upon which it is deposited.

"The addition of mica, ground cork, wood and such substances, frequently added to overcome noise in gear cases of automobiles, is a positive menace to the ball bearing, since this foreign matter opposes free ball rotation; if it be present in large enough amount the result may easily be that the balls are wedged between the raceways and actual fracture may result. Certainly the free rolling quality of the ball bearing will be lost.

"The question of the beneficial effect of graphite in ball bearing lubrication is one often asked. The answer is simply that graphite in any shape or form that will settle and pack with time when quiescent cannot be of assistance to the ball bearing itself."

Parenthetically.—Some time ago we made a few tests of graphite oils and greases as ball bearing lubricants. We tested a No. 308 bearing running under 100 per cent. overload and using a graphite oil as the lubricant. The test was normal in every way and nothing unusual was noticed. After a run of 337 hours the bearing was removed and examined, and it was noticed that a considerable amount of wear had occurred—much more than was the case in similar tests where only a pure oil or light grease was used. The only conclusion we can draw from this is that the graphite in the oil, in spite of its being extremely finely divided and practically impalpable, had a slight abrasive action and that it does not improve the running qualities of the bearing. On the contrary, it is slightly injurious and tends to increase the friction slightly over that when oil alone is used.

Another test was conducted with a graphite grease which the manufacturers recommend for the lubrication of ball and roller bearings. It was a heavy grease with finely pulverized graphite. A trial was made of this by putting a quantity into the thrust bearings of one of the heads of our endurance testing machine. After a run of a few days the head became very noisy and finally locked the shaft. Examination of the bearings disclosed very distinct and somewhat irregular markings in the ball tracks—something like long chatter marks—as if the graphite had caused each ball to slide a short distance, thus slightly abrading the surface of the steel, until a little mound of the graphite had packed so hard under the ball that it was forced to roll over, only to repeat the sliding until another mound of graphite had packed under it.

These results show clearly that graphite has no value in so far as reduction of ball bearing friction is concerned, and while it may be of considerable value to the other elements carried upon the ball bearings themselves, such as transmission gears, etc., the possible source of damage to the ball bearings cannot be overlooked.

The effect of speed upon the choice of lubricants should also be considered. As a general statement, greases are suitable for low speeds, while oils are preferable for high speeds. Oil is really the better all around lubricant. It should be of sufficient viscosity to maintain a film between the pressure surfaces, and the quantity used should only be enough to cover the surfaces—at high speed—the less the better. Oil is more difficult to retain in the bearing box than grease. This, however, is merely a detail of design, since it is an easy matter to design a box that will not leak oil, and then it is simply a question of good workmanship to make sure that the joints are tight.

Quoting again from Mr. Batt's paper: "In order that the lubricant may be effectually retained, various arrangements are used, depending upon the conditions surrounding the bearing. In the simplest sort of mounting for a radial bearing the shaft projects through the casing, and the casing itself is provided with two lips, between which is a space for lubricant. If the conditions be such that additional protection is needed, one additional groove is provided and this may be fitted with a cup of some sort from which grease will be steadily fed to the groove to keep that filled. This makes a definite frictionless packing. For still more severe conditions a third groove is added; in this latter groove felt is occasionally placed, whose adherence to the shaft is guaranteed by some sort of spring tension. Unfortunately, this is subject to drying out and thus loses its efficiency; when that occurs it is a positive detriment.

"The single or multiple-groove arrangement, empty or with only grease filling, is the most effective; but it is essential that the bore of the lips be not more than 1-64 inch larger than the shaft in diameter, that the lip edges be sharp instead of rounded over, and that the lips be at least 3-32 inch wide. The grooves may also be cut in the shaft, leaving bands between with sharp edges. The only objection to this is the weakness of the shaft."

In closing, I feel that a few "Don'ts" for ball bearing users would not be out of place, especially since the majority of us are users of ball bearings in one way or another. These don'ts are particularly for the automobile owner, but are also generally applicable to the user of any machinery having ball bearings.

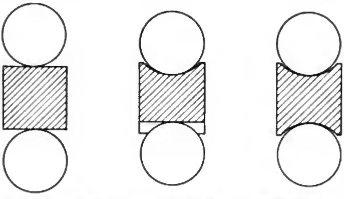


Fig. 14—Three types of race. Left, flat disk; Center, groove disk; Right, cupped disk

Don't let the bearing fill up with grit.

Don't let acid get into the bearing. Always use a neutral lubricant.

Don't let water get into the bearing. In washing an automobile, especially the wheel hubs, be careful not to let the stream of water under city pressure play directly against the inner end of the hub.

Don't let oil leak out of the bearing.

Don't believe the man who says a ball bearing will run without oil.

Don't use grease containing foreign fillers, such as sawdust, ground cork, etc. These may be of value in deadening the sound of gears, but they are injurious to ball bearings.

Don't take a bearing apart—if you want to play with it, get an extra one.

Don't put new balls in—send the bearing to the manufacturer if you think they are needed.

Don't set a thrust bearing up until it resists rotation. Ball bearing friction is so low as to be perceptible to the touch only under excessive loads.

(*Continued on page* 903)

[Note—The illustrations shown below were reversed in the first instalment and are shown herewith with proper captions.—Ed.]

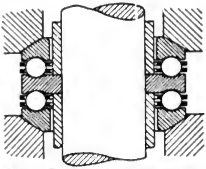


Fig. 9—Two-direction thrust bearing with spherical seats

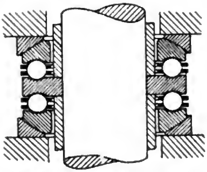


Fig. 10—Two-direction thrust bearing with aligning washer

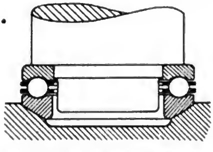


Fig. 6—Thrust bearing with spherical seat

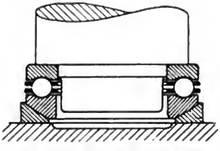


Fig. 7—Thrust bearing with aligning washer

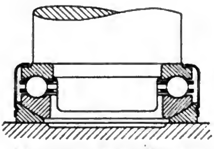
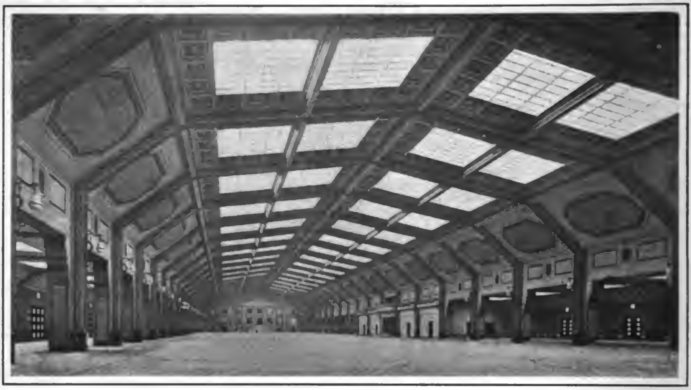


Fig. 8—Thrust bearing with aligning washer and inclosing case



Main exhibition hall and exterior view, from Kaiserdamm, of building erected in Berlin to house international automobile show

Berlin's Motor Show Building

GERMANY'S international automobile show, which was to have been held in September 1914, came to naught on account of the more important business in which the country became engaged in Belgium and elsewhere, but the large building which had been erected to house the exposition, and to remain for similar occasions requiring a vast covered space, was formally opened in January. The main show room is about 730 feet long by 162 feet wide and parallel with it there are two side halls 700 feet long and 39 feet wide. The height of the main hall at the middle is over 60 feet. At the North end there is the inevitable Kaiser entrance, comprising five ornamental portals and a large Kaiser *loge* which can also be used for an orchestra and two large assembly halls. Altogther the area is more than 180,000 square feet. At the South end there is a restaurant which can be reached from the street as well as from the exposition, the street being the new boulevard called the Kaiserdamm. The ground which the building occupies was originally very hilly and a trace of this formation remains in the form of a slight general slope of the floor from East to West. The floor is only hard sand, with a view to laying any special flooring over it when required, it is said. A large steam heating plant in a basement at the Southwest corner supplies the side halls and the assembly rooms through radiators but presses heated air directly into the main hall, the restaurant and the kitchen through slits in the architectural iron work. The latter is very unobtrusively worked into the decorative and color scheme. It is especially noticed that the large trussed arches supporting the roof are kept almost flush with the skylights within the building while clearly showing their substantial dimensions as ribs on the outside of the roof. The main entrance is at the middle of the West side and comprises seven columnar portals flanked with two special entrances in low square towers serving as bases for terraced pedestals topped with massive sculpture representing automobiles with wings—this being the artist's way of indicating that the hall is for aeroplane expositions also. On the East side, opposite the main entrance and fronting Rognitz street, are the offices of the building, parlors and telephone booths. Exhibits are taken into the building through a basement extending under a large portion of this side, the rise of the ground making this basement easily accessible from the street.

Elaborate electric lighting in conjunction with a striking yet not garish coloration of the interior and a studied plainness of the architectonic lines are among the features mentioned with special pride of achievement, as they are believed to produce a pleasing artistic sense of fitness, while being very economical in making it possible to dispense with all other comprehensive decoration for any occasion for which the building may be used. Perhaps it is now used for a hospital for wounded soldiers or for prisoners' barracks.

This large and permanent structure, claimed to be the largest in the world, was erected in seven months. The *Verein Deutscher Motorfahrzeng-Industrieller* (Association of German Motor Vehicle Manufacturers) and the *Kaiserlicher Automobil Club* worked together in planning, financing and pushing the enterprise to completion.

Discussion of "The Improvement of Spring Systems"

Contributed Views on Horizontal Springing, Steering, Skidding and Bouncing

With Comments by M. C. K.

COMMUNICATIONS from members of the industry continue to be received on the subject of the horizontal element in road shocks, its various effects and the means for making it harmless. The two shorter letters bear witness of the interest taken in the matter and of the desire for having the shortcoming which crops out in the standard spring suspension at this point taken care of in practical construction. No comment seems to be necessary.

Testimony from the Road

Editor THE AUTOMOBILE:—I have read, with much interest, the discussion of "The Improvement of Spring Systems" and certainly agree with M. C. K. From my own personal experience I am fully convinced that air tires do not absorb horizontal shocks that are at all severe. These shocks are resisted by the strength of parts other than the springs.

The lack of cushioning means on front axle to take the horizontal shock is responsible in a great many cases for damage done to steering gear and component parts. I have seen one severe accident which was caused by steering arm breaking as the result of driving over rough roads and this car is fitted with large air tires. Most springs now in use can take shock in one direction only, vertically.

Syracuse, N. Y. May 1, 1915. F. Mc. V.

New Way of Appraising Shock Values

Editor THE AUTOMOBILE:—The writer has followed with more than usual interest the articles on "The Improvement of Spring Systems," by M. C. K., in particular those dwelling on the question of horizontal components, and how they should be absorbed. After due consideration of the matter it seems that horizontal components do exist to a considerable and annoying degree, and this is graphically illustrated in the accompanying set of curves.

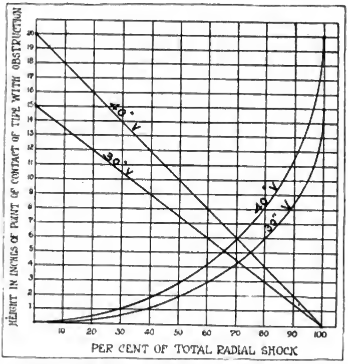
Instead of showing the relation of the horizontal component to the vertical component, these curves show the relation of both components to the total radial shock. The ordinates represent the height in inches of the point of contact of the tire with the obstacle, while the abscissae show the per cent. of the total shock. Curves marked "H" show the horizontal components with the different sized obstacles up to the height of the wheel center for both thirty and forty inch wheels. Curves marked "V" show the corresponding vertical components. It will be seen that with thirty inch wheels an obstacle of an inch and a half gives a horizontal component of very nearly half the size of the vertical component, and an obstacle of two inches gives a horizontal component equal to half of the total shock. An obstacle a little less than four and a half inches high gives a horizontal component almost three quarters as great as the total shock, and equal to the vertical component, and all obstacles above this height of four and a half inches have a greater horizontal than a vertical component.

With larger wheels one would naturally expect less shock, and this is found to be correct. With forty inch wheels it takes a two inch obstacle to give a horizontal component equal to half the vertical components; a two and three-quarter inch obstacle to give a component equal to half the total shock; and a five and three quarter obstacle to give a horizontal component three quarters as great as the total shock, and equal to the vertical component, above which height the horizontal components are greater than the vertical components.

These figures do not take into consideration the fact that the total weight of the car works against the obstacles horizontally as momentum, while only the weight on the axle concerned works vertically. So the relative size of the horizontal components will be much larger than stated above for the conditions given. From all these considerations it would almost seem that there might be conditions where horizontal spring suspension would be even more desirable than vertical spring suspension.

The main consideration, then, is to secure the proper method to successfully absorb this horizontal component as well as we now absorb the vertical component. The former has been taken care of to a lesser degree by tilting the spring at the same angle that the axle is tilted, somewhere in the nighborhood of four degrees. In this manner the springs may absorb a small proportion of the horizontal component of certain shocks, but for the majority of cases, especially with the larger obstacles, it is impossible to absorb them in this way.

Not being provided with a proper method of suspending the horizontal component, the frame is called upon to absorb it with results only too well known to discuss. But in being transferred from the tire to the frame, the horizontal component makes quite a journey, leaving strain and wear all along the line on wheel bearings, steering spindles, steering connections, steering gear, springs, spring clips, spring bolts and frame. Consequently the solution to the absorption of the horizontal component should eliminate or reduce to the



Diagram, showing first step in S. P. H. method for estimating components of road shocks minimum the shock to all these parts, and must be so constructed as to keep the car on the road without difficulty, and at the same time coupled with simplicity so as to make the manufacturing problem as economical as possible.

Detroit, May 3, 1915. S. P. H.

Shocks Need Not Reach Steering

The well known pioneer constructor, Charles E. Duryea, whose extensive experience with light cars ought to be valuable, seizes upon the fact that the horizontal element in a shock reaches the steering gear primarily because the front axle is articulated and that there is a remedy, therefore, which is more radical than cushioning of the offending element in the shock can be. His letter, which also touches upon several other matters of interest, follows.

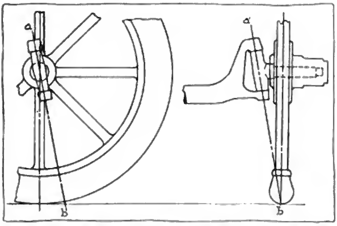
The Views of a Pioneer

Editor THE AUTOMOBILE:—I have read C. A. D.'s statements on the steering matter on page 810 with much interest. What he says is all right but what surprises me is that engineers and the public generally do not know that "the reaction of the front wheels about their steering spindles" can be practically reduced to zero by a construction that costs no more, is just as strong and simple and is better all around. With the example of the bicycle and its perfect steering before us every day surely no one need be in ignorance of what good steering can be. There is no such "reaction" to the front wheel of a cycle. It will go over a brick "hands off."

Auto steerings can have this same perfection; this same freedom from shocks and tendency to turn around their steering pivots. Autos have been built that way in America for at least 23 years.

THE REQUIRED CONSTRUCTION

What is the answer? Simply that the steering pivot line extends into the plane of the wheel slightly ahead of the point of tire contact on the ground. This is done by giving the pivot line a slight inclination. Usually from 6 to 12 degrees is required. See sketch. It is just as easy to forge steering knuckles with the proper angle as with none. The difference in cost of machining is nothing after the jigs are made. The benefits are many. A vehicle fitted with this proper steering will run over a common brick with no shock to the steering whatever. It will take much larger obstructions with safety. Here is an example. At one of the early Chicago Shows when the policemen were more lenient than nowadays, it was my demonstrating stunt to take a lever steering vehicle out onto Michigan avenue and run two wheels diagonally over the corner of the curbing at the cross streets; and this without holding the lever while the wheels struck the curb and went over it. Those curbs are about 5 inches high as many of your readers know, and striking them at an angle of about 45 degrees tended very strongly to deflect the wheels but thanks to the superior qualities of the steering they were not deflected. Further tests were often made. One, for example, was that of taking off the tie bar connecting the two front wheels and leaving one free. By steering the other wheel the vehicle could be taken practically anywhere over ordinary roads. I have driven across car tracks, turned around in a street having double car tracks, driven though sand, climbed small hills and done similar feats with the tie bar not in place.



Forward and outward rake of steering pivot which protects steering gears and drivers against annoying effects from horizontal shock component

When will the public wake up and demand of the makers this superior thing? When will engineers quit talking about "Irreversible steering gears" and the shocks they must withstand? Why build wrong?

FORE-AND-AFT SPRINGING

As to fore and aft springing. There is room to go wrong on this. The old Victor spring-fork bicycle was a case in point. It was perfectly free to yield fore and aft. When the wheel came to an obstacle that the momentum of the wheel was not sufficient to carry it over, the wheel stopped and stood against the obstacle until the rear wheel and frame could compress the spring fork enough to force the front wheel over. This stopping and having to be started again took power and the bicycle was heavy to propel although beautifully springy. The best action obtains when the wheel may yield backward slightly as it rises over the obstacle, to the end that part of the propulsion energy may be diverted to lifting the wheel instead of requiring wholly extra energy for the lifting purpose.

WHAT PREVENTS SKIDDING?

Concerning O. W. H.'s remarks and skidding my experience may be of interest. After building pneumatic tired motor vehicles for a dozen years I built a number using solid rubber tires and continued this for about 5 years. I found less tendency to skid but more tendency to bounce. This is easily understood. Just as a skate or a sled runner skids sidewise less easily than a toboggan, so a solid rubber tire grips the surface better than a pneumatic. Recognizing the advantage of edges and narrower surfaces most tires now are provided with rough threads, usually by ridges or knobs raised above the surface but often by grooves in the tread. Having built vehicles for years that were practically free from skidding I consider it more a matter of proper weight disposition than of tire size or surface. On ice or greasy asphalt the edges of the tires get very little chance to grip. Much weight on the rear wheels is the best preventive of skidding.

WHY SOLID TIRES BOUNCE

Bouncing is another matter. Solid tires are not so deep as pneumatic. They would be very expensive if made so deep and large. While solid rubber is not so resilient as is the air tire, its action is quicker because of its lesser depth. In other words a much smaller movement of the wheel compresses it to its limit and starts the wheel up away from the ground. As a result of this action the solid tire vehicle bounces off the road at speeds far below those at which the air tire will be holding smoothly. My experience was that a well sprung motor buggy riding as easy as if air-tired at speeds below 18 miles per hour on ordinary macadam roads would bounce badly at speeds of 20 to 25 or 30.

RESILIENCY IN TIRES

Just what the effect of a slow tire would be, as proposed by O. W. H., I am not prepared to say, but who would want such a tire? Certain tires on the market now will give 10 per cent. to 25 per cent. more mileage per gallon of fuel than others because they are more resilient, and their use is certain to extend. In the cycle days when human muscle was our motor we woke up on this subject early and built resiliometers to actually measure the difference in different tire constructions. All tires that compress in action absorb power as they compress and unless perfectly resilient they do not give all this power back as they resume their shape behind the point of contact. This difference is very noticeable in certain tires. In the last five mile race at the R. I. State Fair in 1896 our vehicle was fitted with single tube pneumatics. Being a gasoline car it could not start from the tape as fast as could the electrics. It was therefore fully eight rods behind at the quarter, at which time all the cars seemed to have found their gait. It gained steadily on the others after this, clearly showing greater speed, and had almost caught the leader when on the back stretch where it could be plainly seen, it slowed perceptibly. Inquiry showed that at this point a valve tube had been cut off and let the air out. The stiff single tube tire required much power to compress it but gave out practically none as it resumed its shape. We lost the race. Users who wish economy must use not only light vehicles but light tires and must not hope to have them puncture proof but must get safety by quick repairs or replacements.

Philadelphia, May 10, 1915. CHAS. E. DURYEA.

Mr. Duryea's views on skidding and bouncing, in so far as here expressed with reference to the difference between air tires and solids, are so clearly and tersely worded that nothing more need be said, apparently. But at other points a few somewhat dissenting comments may contribute to a sharper focusing of the essentials. In comparing bicycles with automobiles, the peculiarities of bicycles are not negligible. They list readily to either side, which eases shocks, and the road is picked for them. Large obstacles, which are the only ones producing marked horizontal effects, are not struck, as a rule. The steering post has a decided rake. The load is light and the inflation of tires low. The axle is not articulated. With such important differences in construction and conditions a parallel is not convincing.

Duryea's Point Widely Recognized

Better than the analogy with bicycles, therefore, the mechanical fact that a pivot with the outward and forward rake directs shocks to the end of the fixed axle instead of to that short pivoted portion upon which the steering acts, sustains Mr. D.'s argument. It is not uncommon, however, to aim the pivot to the middle of the tire tread, and this is the feature which saves the steering gear. Many wheel spindles are inclined for this purpose. To aim the pivot forward gives the self-steering properties in higher degree, when not exaggerated, but this feature, too, is found recognized here and there. While these arrangements reduce the turning moment against the steering gear connections to nil or to a minimum (since in heavy cars it is necessary to disk the wheel, too, to accomplish the purpose completely) they do not ease the force of shocks or of the horizontal component of a shock against the pivots and the vehicle as a whole. In the case of heavy vehicles it may be questionable if it is more advisable to throw the whole brunt of the shock upon the end-bearings of the pivot, as Mr. D. prefers, or to take up a part of it in the coil springs of the steering connections and even in the steering gear or the arms of the driver.

Walking Speeds Unimportant

In the matter of the Victor bicycle, the supposition of not having enough momentum to carry the vehicle over the obstacle is scarcely of interest, as shocks of such mildness endanger nothing in the case of automobiles. Also, it is not contemplated to make automobile axles "perfectly free to yield fore and aft." On the contrary, if a slight rake of the spring action is provided to take care of the small horizontal shocks, which affect comfort, any springing to permit the axle an additional horizontal movement, can be exceedingly stiff, being used almost exclusively for safety in emergencies. The composite wheel previously described may eventually, however, be found to afford a better method in the case of heavy vehicles, though at present it may appear as a too radical departure from customary expedients.

The action described as the best by Mr. D. is no doubt desirable, though many designers seem much in favor of a purely vertical axle movement, but it is less efficient the higher the speed and the harder the tires; that is, it affords less yielding the more yielding is needed.

Resiliency Only Incidental

"Certain tires," D. says, "will give 25 per cent. more mileage per gallon of fuel than others BECAUSE they are more resilient ......" The BECAUSE seems arbitrary, even if the tires referred to are in fact more resilient. The reason for saving power by using them might be that their resistance to flexion is smaller, and not that they extend with nearly the same force that is spent in flexing them. It is possible to imagine a tire flexing with small resistance yet resuming its shape slowly.

Mr. D. seems to believe that the power absorbed in flexion is returned by a resilient tire in form of help for the propulsion, but the saving effected is really due to the smaller acceleration of masses which the tire flexing with small resistance makes possible; the vehicle body, for example, is moved less and less rapidly. But the extension of the tire to its normal shape returns no power in a useful manner. This objection also covers Mr. D.'s rapid conclusion from his racing experience in 1896. The flat tire had to be flexed all the way round, yet saved no load lift or acceleration.

Ball Bearings in Theory and Practice

Part II

(Continued from page 899)

Don't hammer the races of a ball bearing with a hard hammer. They are hardened and toughened steel, and treatment of this character can very readily result in a cracked or dented race or very often it will result in flattened balls.

Don't tamper with the locks provided by the car builder—they are provided for the express purpose of keeping you from making adjustments.

When in doubt, communicate with the bearing manufacturer or his qualified representative.

In view of the fact that you are all primarily interested in electric vehicles, it has occurred to me that it might be well to specify where ball bearings are used on "electrics." Doubtless many of you already possess this information, but for those who do not, it will prove interesting.

On all types of electric vehicles, whether chain, bevel shaft or worm shaft drive, ball bearings are used in the wheel hubs, on the armature shaft of the motor and on the differential.

On the chain drive they are used on the jackshaft alongside of or directly under the driving sprockets.

On the bevel shaft drive cars, ball bearings are used back of the bevel pinion and on each side of the bevel gear on the differential.

On the worm shaft drive cars, ball bearings are used on the worm shaft and on each side of the worm wheel on the differential.

It is hardly necessary for me to point out how important ball bearings are in the operation of an electric vehicle They reduce the friction at all bearing points to a minimum and allow maximum mileage to be secured from the battery capacity available.

Willard's New Office Building

CLEVELAND, O., May 15—The new office building of the Willard Storage Battery Co., this city, is an example of what can be done to increase the efficiency of employees by careful attention to their comfort and the development of interdepartment relations. Formerly the offices were a mile from the factories.

Among the features of the building are a large dining room where employees are served at noon, experimental laboratory and a photograph gallery.

This brick and stone building is 150 by 30 feet and has been occupied 6 weeks. It is one of ten structures with 6 acres of floorspace which the company is erecting.

ACCESSORIES

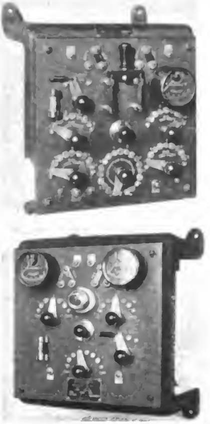
Small Westinghouse Rectifier

TO eliminate the waste of energy in resistances for cutting down the voltage in large motor generator sets or direct current supply circuits for battery charging, the Westinghouse company has brought out a small mercury rectifier charging outfit called modified type E, illustrated herewith, specially designed for public garages which have a number of lighting and starting batteries to charge every night. Similar outfits for the car owner who desires to charge one or two batteries are also available.

The device consists of a cast iron wall bracket carrying a small slate panel for the switches and connections, the mercury bulb being mounted behind the panel for protection. A knob on the front tilts the bulb for starting. Back of the bulb and mounted on the bracket are the transformer and reactance coil. The outfit charges one three-cell battery at a time or a number of them in series. Provision is also made for charging one or two single cells, which is very advantageous if one or more low ones are to be charged. Adjustments to suit the number of cells to be charged are made by changing the transformer connections and no energy is wasted in series resistance. It is easy to adjust for a tapering charge such as is suited to lead cells or for the more constant current which is best for charging the Edison type. In both cases the outfit need not be touched after the charge has been started. When the series system is used each battery is disconnected as it becomes fully charged and the charge continued on the rest with a lower dial setting because of the smaller number. Provision is made for mounting a D. C. ammeter on the panel when desired.

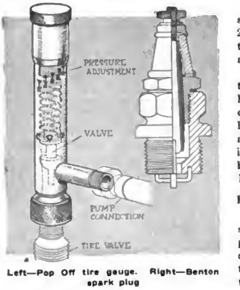
Both 5 and 10-ampere outfits are designed for operation on either 110 or 220-volt, 60-cycle circuits. Link connections adjust the outfit to suit either voltage.

At a 5 cents per kilowatt-hour rate, the 10-ampere outfit costs .012 cent per hour for current to charge six cells, .025 cent for eighteen cells and .048 cent per hour for thirty-six cells. Using the 5-ampere outfit the hourly cost for current is correspondingly reduced.—Westinghouse Elect. & Mfg. Co., East Pittsburgh, Pa.



Upper—Westinghouse large capacity type E 5 and 10-ampere mercury vapor rectifier

Lower—Type E 10-ampere rectifier outfit



Left—Pop Off tire gauge. Right—Benton spark plug

Pop Off Tire Gauge

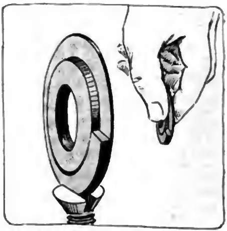
The gauge illustrated herewith is designed to automatically insure the correct pressure in a tire and to prevent accidents due to inflating casings beyond their strength. The indicator is set for the desired number of pounds pressure and when this has been reached the valve in the gauge automatically closes and no more air can be forced into the tire, while the operator is warned by the air escaping through the holes in the gauge. In applying the gauge it is screwed to the nipple just as the pump is ordinarily attached and the pump is screwed to the L-pipe on the gauge, this having the standard nipple thread. The gauge may be left attached to the pump, if desired, rendering it necessary to make only one attachment. The device is said to not only prevent over-inflation or under-inflation, but also to result in a considerable saving of time in that no testing and adjustment of gauge and air pressure are necessary. With the Pop Off gauge any pressure from 50 to 110 pounds may be secured. Price, $1.00.—American Sanitary Lock Co., Indianapolis, Ind.

Benton Spark Plug

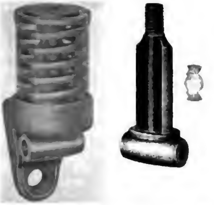
The plug shown in the illustration is claimed to minimize common defects in spark plug construction, to resist fouling and to permit easy cleaning. The insulator is thin sheet mica spirally wound upon the central electrode and forced to a permanent gas and oil tight joint within a steel bushing. The mica above the bushing is inclosed in a porcelain spacer which could be cracked or entirely removed without short-circuiting the plug.

The insulator is easily removed for cleaning by unscrewing a single joint, when the insulator surface may be washed with gasoline or scraped with a knife. This also facilitates adjustment of the spark gap. Frequent cleaning has no detrimental effect on the fit of the joint. Battering of thread surfaces, etc., is prevented by case-hardening.

Te prevent overheating of the insulation the center electrode has greater cross-section than the mica insulation itself and offers a large body of metal to rapidly conduct the heat through the plug to the air. The wire used in the electrode terminals is a special composition which is said to neither fuse nor cor-



Ingenious pocket screw driver made by Hess & Son



Adco shock absorber, showing peculiar shape of central member

rode, the outer wire forming the spark gap being bent in a semi-circle around the central electrode to give the spark a wide selection of points.

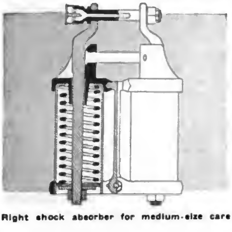
The internal passages of the plug are designed so that exploding gas blows away from the insulator much of the carbon that would otherwise be deposited on it. The plugs sell for $1 each, a special set of four for Ford cars being furnished at $3.—L. F. Benton Co., Vergennes, Vt.

Pocket Screwdriver

One would not recognize the article shown in the accompanying illustration as being a screwdriver, yet it acts as such with great facility. Though only an inch in diameter, the power is quite surprising and it is possible to move quite a large screw. Owing to the edge being of varying thickness, one can choose the point on the circumference that best fits the slot in the screw head which prevents slipping and helps the action. Even without putting anything through the hole to act as a lever the power is enough for lots of the small screws on an automobile, and with a 3-inch nail used as a tommy bar one can move screws in wood up to 2 inches long. The price is 10 cents.—Hess & Son, Philadelphia, Pa.

Rigid Ford Shock Absorber

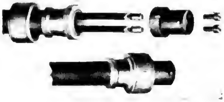
The Adco is a simple coil spring shock reducer which has as its special feature great area of all moving parts, and exceptional durability is therefore claimed for it. The sketch shows the substantial flat section coil spring and the peculiar shape of the central member. It is pointed out that this section gives a very large wearing surface and that it also provides great lateral rigidity. Because of this it is asserted that the addition of a set of Adcos to a Ford car in no way reduces the lateral rigidity of the suspension; rather to the contrary in fact. There is a manganese bronze bushing in the swivel pin end of the center piece. Two can be obtained for $8 to fit either front or rear springs and the full set of four costs $15.—Auto Device Mfg. Co., Milwaukee, Wis.



Right shock absorber for medium-size cars

Shock Absorber for Medium Heavy Cars

The "Right" shock absorber of supplementary spring type is designed with a travel of 2 inches, which is sufficient to enable it to deal with quite violent bumps. The construction is very simple and the parts strong, the piston being vulcanized fiber. This material has the advantage that it cannot rust or corrode and needs no lubrication. Practically the only part liable to wear is the steel bushing at the top of the cylinder and this is arranged so that it can be renewed easily and at very small cost. The outfit is proportioned to suit cars of medium size, and sells for $15 the set.—Right Motor Specialties Co., Chicago, Ill.



National terminals for Ediswan type lamp fittings

Utility Tire Grips

The Utility Auto Shoe is a spring steel strap with waterproof webbing strap attachment that can be secured to a tire either to give a driving grip in heavy mud, to act as a strengthener of a weak spot in the shoe, or to hold a blowout patch. Eight are supplied in a set, and the steel portions are 1-16-inch thick by 1 3-4 inches wide. The illustration explains the device completely. Obvious good points are the small space taken in the kit and the ease of application. The cost of a set is from $4.50 for 3-inch tires to $6 for 5-inch tires.—Franklin Auto Shoe Co., Pendleton, Ind.

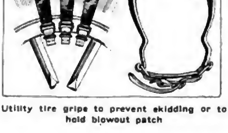
Light-Weight Woodworth Tread

The light-weight Woodworth tread has been placed on the market with many advantages claimed for it over previous types of tire protectors, one of which is lower price. The tread is of special process leather said to give nearly double the durability of the best chrome-tanned hides under abrasive wear. It is of one-ply of leather, and has three to six rows of steel studs according to the size. Coil springs 3 inches long placed about a foot apart and connected by elastic fabric strips hold the protector tightly on the tire, as illustrated, preventing chafing and over-heating. The leather is waterproof and flexible and is said to have no noticeable effect on the power or riding qualities of the car. The light-weight treads list at $6.90 each for 30 by 3 1-2-inch tires, $9.70 each for the 34 by 4 size, other prices being in proportion.—Leather Tire Goods Co., Niagara Falls, N. Y.

The new light-weight Woodworth tread mounted on wheel

National Electric Fittings

The use of flexible tubing together with junction and switch boxes has shown a marked increase since the development of electrical systems for automobiles. The terminals for Ediswan type lamp fittings, illustrated herewith, are easily wired and strong. These terminals are made in all sizes in single and double contact types and are designed to be used in connection with the various types of flexible metal and insulating tubing produced by the National company under the names of Autoflex, Tube, Special Flextube, Auto Steelflex and Auto Brassflex. The terminals sell for 65 cents each. The company also manufactures a complete line of junction boxes and other materials for automobile wiring.—National Metal Molding Co., Pittsburgh, Pa.



Utility tire grips to prevent skidding or to hold blowout patch

Harding Connecting-Rod Under Tension

Two-Cycle English Design Has Double Truncated Pistons —Uses No Crankcase Compression

A TWO-CYCLE engine which has several features of originality has been described in English papers of recent date. This is the Harding two-stroke motor of truncated piston design, having no crankcase compression and depending on the direct suction produced above the piston for bringing the charge into the cylinders and also producing a pure air current for scavenging purposes. Probably the most remarkable feature about the entire engine is that the connecting-rod is under tension instead of compression on the power stroke.

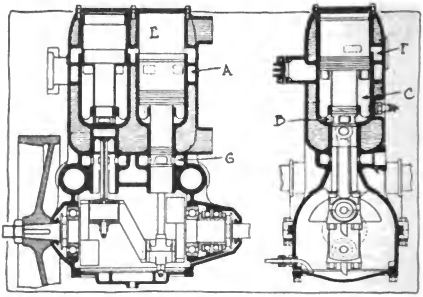


Fig. 2—Longitudinal and transverse sections through Harding two-cycle motor, showing double pistons and ample water jackets carried well down on the cylinders, as the explosion takes place beneath the pistons

Referring to the drawings, the motor is shown in different parts of the cycle in Fig. 1. As will be noted, the pistons are double, making an aperture or volume between the piston and the wall of the cylinder. It is in this space that compression and explosion take place, the piston being forced upward by the pressure against the annular surface of the upper part of the piston.

Assuming the gas to be under compression as at the left of Fig. 1, and the motor at the last of the exhaust stroke, the exhaust gases are being forced out the passage A while the intake gases are entering the annular space from the interior of the piston through B. As the piston descends the ports A are closed by the upper wall and the gas is being compressed in the space C. When firing occurs, the gas is fully compressed as at B and at the same time a vacuum exists above the piston at E allowing gases to enter from the carbureter through the port F. At the same time pure air is drawn in through G at the bottom extremity of the piston and on exhaust this air materially helps in scavenging.

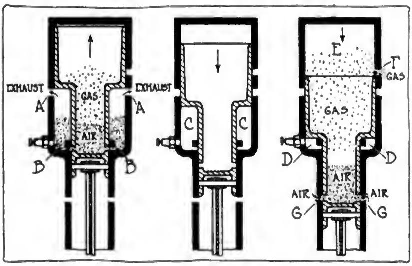


Fig. 1—Illustrating the two-stroke cycle of the Harding motor, showing use of air for scavenging

It is aimed by this system to overcome the two great difficulties in two-stroke design, the proper scavenging and the proper intake of the next charge. The scavenging is taken care of by the introduction of the fresh air and the proper introduction of the succeeding charge is taken care of by eliminating crankcase compression and having the flow of gas directly from the carbureter. In working out this result several unusual features are found. The first is that the explosion takes place below the piston, thus forcing it upwards, and at all times in the cycle there is more pressure below the piston than above it. The result of this is that the connecting-rod is always in tension and never under compression.

No Baffle Plate Required

It is usual in standard two-cycle practice to find a baffle plate used to properly distribute the charge but with this motor none is necessary. In arranging the scavenging amount of pure air can be controlled and the air and the gas sweep through the entire length of the combustion chamber. A great exhaust area can be procured by making the ports at the top of the stroke as large as desired and since the diameter of the cylinder is greatest at this point it is stated three times the usual exhaust area can be obtained. This allows the timing to be such as to utilize fully the expansion.

Pistons Easily Removable

The pistons can be removed directly through the top of the engine by simply removing the top plate and drawing them out. The objections offered to the motor are its increase in the weight of the reciprocating parts and the pumping loss in the upper cylinders. Those who have seen the engine, however, state that these are compensated for by the advantages in scavenging and introducing the charge and also under test a speed of 200 r.p.m. with steady running was reached without the semblance of a miss.

The Automobile

PUBLISHED WEEKLY

Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, May 20, 1915 No. 20

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Avenue, Phone Harrison 7707
Detroit—95 Fort St., West, Phone Main 1351
Boston—1035 Old South Bldg., Phone Fort Hill 3292
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - - - - - - - - - - - One Year, $3.00
Canada - One Year, 5.00
Foreign Countries - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

A Foretaste of Speed

WITH the stage not even set for the speed classic of 1915 at Indianapolis and with some of the entrants to the race still far from the scene of the event, indications are already being made by the contestants upon the ground that the highest hopes for the high-speed, low-displacement power plants are coming into their own.

Speeds greatly in excess of the records of 1914 are being unofficially announced from day to day as the drivers in their early morning trials force their mounts around the 2.5-mile circuit and new cars which have heretofore never put a tire upon the surface of a racing track are outshining the best efforts of previous designs with motors 50 per cent. larger in piston displacement.

The lesson to be drawn from this is not yet complete and will not be until the test of the long 500-mile grind has shown the world whether or not the hopes of the small displacement motor have been realized. With higher rotative speeds it naturally follows that the greatest possible strength must be supplied by the bearings, the reciprocating parts and especially parts subject to the great strains of alternate stresses. What is done in one lap may not be done in 200 laps and yet, looking backward over the progress of events during the past 4 years and tracing the curves of development during this period of time, the machines we have today stand as the logical continuation of these curves over the course which seems most reasonable if their plotting were to be continued.

Yet, every curve has its peak, and if this year shows another point in the onward course of this curve without the slightest sign of a falling off in efficiency of speed, power or endurance we will go a step beyond until finally the peak or maximum point is reached. The varied nature of our entries this year is calculated to furnish us with this information better than ever before.

The Michigan Law

NEXT January, Michigan will have a new automobile tax law which provides a horsepower tax plus a fee for each 100 pounds of weight of car. Detroit fought it, and naturally many manufacturers of cars fought it. But it went through, and it means a material increase over the $3 now charged for registration.

As Michigan is one of the states with a large automobile registration, it is looked upon as representative so far as automobile laws are concerned. Undoubtedly if the new law works out satisfactorily, other states will copy it. In the long run, though the new tax seems large, it will prove less than the automobilist now pays, for by its provisions, he is exempted from any other city, county or state tax on the vehicle. Now a personal property tax is levied in addition to the $3 registration fee. The money will be used for road development.

Engineers believe that should the law be widely adopted, it would have a great influence in the promotion of lighter cars, and smaller-bore motors.

The solons at Lansing did not know what they were doing for the automobile industry when they made the law, and though it may seem oppressive just now, it will undoubtedly prove a far reaching influence in time, if it is adhered to without amendment. It will give the state better roads, promote lighter motor and chassis design, and boost the small high-speed engine.

Automobiles Solve the Problem

LAST week Detroit was treated to a street car strike which lasted for about 48 hours. The solution of the transportation problem was the automobile and the strike was treated more as a new experience by the city than as a real calamity. Everybody who owned a car pitched in to help out, and before the tie-up was many hours old an army of cars was transporting humanity to and fro about the city, so that business was not held up.

Doubtless the street car men and the traction company officials saw the writing on the wall, for they made haste to call it all off. It would not have required many days for Detroiters to have become thoroughly accustomed to the army of jitney buses that came into being with marvelous rapidity, when the full importance of the tie-up became apparent.

Detroit has undoubtedly proven that street car strikes are a thing of the past.

Dunn Is Overland Vice-President

President of Fisk Rubber Co. Acquires Interest in Toledo Firm—Is Director

TOLEDO, O., May 18—*Special Telegram*—Harry T. Dunn, president of the Fisk Rubber Co., Chicopee Falls, Mass., since its inception, has become vice-president and a director of the Willys-Overland Co., this city, in which he has acquired an interest, and in the future will devote the major portion of his time to that organization.

It was under Mr. Dunn's leadership that the Fisk Rubber Co. attained its present prominence and prestige in the tire industry. His connection with the Willys-Overland Co. accentuates his long friendship with John N. Willys, the rapid growth of the company and the plans which Mr. Willys has formulated for its development being responsible for the present arrangement.

Personnel Unchanged

The present personnel of the Fisk Rubber Co. and of the Willys-Overland Co. will remain unchanged.

1916 Oaklands Lower in Appearance and Price

PONTIAC, MICH., May 20—This week the Oakland Motor Car Co., this city, makes public the details of its four-cylinder model for 1916, which is the successor of model 37. It is designated as model 38, and is to sell at $1,050 in either roadster, touring car or speedster type. This price is $150 lower than the previous model's touring car, and $100 less than that of the model 37 roadster.

The general design of chassis and bodies is the same as formerly. By redesigning the clutch, the power plant has been shortened 2 inches, making a more compact unit.

Outwardly, the radiator, hood and cowl have been raised 1 inch, which adds to the lines of the car. In the driving compartment, more room has been secured by deepening it is so as to give 2 inches more leg space. It also has been widened 2 inches. Due to these changes, the car has a larger front appearance.

Other body details that have come in for revision are the replacing of the former metal running boards with the linoleum-covered variety, while a neat combination of the metal instrument board with the body—also of metal—lends to the appearance in this particular.

The Oakland motor is of Northway make, and is a 3 1-2 by 5 detachable head, block type, with clutch and gearset in unit. The Stewart vacuum feed is retained, as also the Marvel carbureter and Delco combination ignition, starting and lighting system. The attractive V-shaped radiator is also used, and the unique oilless rocker bearings on the brake operating system and the gear-shifting lever are still continued.

The drive is of the Hotchkiss type with tubular propeller shaft. The frame is tapered to follow the lines of the body. Three-quarter elliptic rear springs are underslung from the axle, allowing the car to be low hung—one of its distinguishing features. The wheelbase is 112 inches, and the wheels are shod with 33 by 4 tires all around, non-skids being fitted in the rear.

Bollstrom To Market Four-Wheel-Drive Chassis

DETROIT, MICH., May 17—Word comes from Battle Creek, Mich., that the Bollstrom Products Sales Co. of that city is to start delivery in November of a four-wheel-drive motor vehicle which is the design of Maurice Bollstrom, pioneer in the four-wheel drive type of vehicle. He has designed a chassis of 1-2-ton capacity, which will be used as the basis of either roadster, touring car or delivery car.

The Bollstrom concern is not to make the vehicles itself, but states that it has closed a contract with another firm to do the actual manufacturing for it. It also is asserted that agencies are now being closed for the future product, having already made selling connections in some of the larger cities.

Big Race at Sheepshead October 2

NEW YORK CITY, May 15—Although nothing definite has been announced it is generally understood that the Sheepshead Bay motor speedway will be opened on October 2 by a big race, the details of which have not as yet been announced. Work is progressing rapidly on this speedway at the present time. Seven hundred men are at work and three-quarters of the grading has already been completed and 1-4 of a mile of concrete sleepers which will support the track on the straightaways are in place. The steel work which will carry the wood track on the bankings is coming through on schedule and it is expected that the entire supporting frame work to carry the track will be ready so that the laying of the wood surface can begin June 15.

Three new names in the motor industry have been added to the list of stockholders, these being Windsor T. White and Walter White of the White Co., Cleveland, and R. D. Chapin, president of the Hudson Motor Car Co., Detroit.

Wilson Re-Elected A. A. A. Head

Delegates from 20 States Vote for Uniform Tax, Federal Aid and Tour Bureau

BOSTON, May 18—The annual meeting of the American Automobile Association was held here yesterday and today, and it was attended by delegates representing twenty States. President John A. Wilson called the meeting to order yesterday morning and the forenoon session was given over to reading reports of committees on what had been accomplished during the year. This was followed by the election of officers and there was no opposition to the names brought in by the nominating committee. President Wilson was re-elected amid a tumult of applause. The other officers chosen were: H. M. Rowe, Maryland, first vice-president; Ralph W. Smith, Colorado, second vice-president; P. J. Walker, California, third vice-president; H. J. Clark, Minnesota, fourth vice-president; Preston Belvin, Virginia, fifth vice-president; John A. Brooks, Connecticut, secretary; H. A. Bonnell, New Jersey, treasurer; A. G. Batchelder, New York, chairman executive committee.

At the afternoon session the main discussion centered about a resolution presented by Charles Thaddeus Terry, of New York, on double taxation, reading as follows:

"Whereas, The motor-driven vehicle has become the common means of transportation, commercially and socially, that it enters into every progressive phase of human existence, and should no longer be considered as a special means of travel; therefore be it

"Resolved, That the American Automobile Association through its National Legislative board contends, in the several States and in the Congress and courts of the United States, for a uniform method of taxation, which shall recognize the fact that an automobile should now be included in a general property classification and taxed only as personal property, that no other tax whatever shall be imposed either in connection with the vehicle or its operation, expect a nominal registration fee covering only the clerical cost of the issuing of an identification number for the vehicle and its operator in order that the police powers of the State or municipalities may not be impaired."

Ex-President Lewis R. Speare, representing Massachusetts, opposed the resolution and said that Massachusetts was satisfied with its law even though it were costing Bay State motorists more than $1,000,000 a year. Some of the other speakers did not seem to get the drift of the resolution, but H. M. Rowe, of Maryland, made the most convincing speech in favor of it, after which it was easily passed by a voice vote. Three other resolutions were offered and passed, one pledging the confidence of the association in President Woodrow Wilson in the present international crisis; another on federal aid for highways, and the third for a bureau of tours under national government supervision. All were passed unanimously.

There were rumors of a fight to have the New York headquarters moved to Chicago, and also to have the Washington headquarters closed, but there was perfect harmony when the matter came up and no changes made. Dallas and Cleveland wanted the next meeting, but the executive officers had picked out Washington and that settled it, so it was voted to go to the national capital. It was also voted to change the fiscal year to a later period. The annual report showed a good balance in the treasury. A number of new clubs were voted in and there are now 139 such organizations on the rolls.

N. Y. 50,000 Cars Ahead of 1914

NEW YORK CITY, May 17—New York State automobile registrations have gained 50,000 over 1914, that is, in the period included between February 1 to May 8. The actual number of registrations is 168,428 from February, 1914, to the same month in 1915, and 169,598 in the period included between February, 1915, to May 8, 1915.

Registration Feb. 1-May 8.

	Owners	Chauffeurs	Fees
New York office	73,193	42,699	$678,644.50
1914	57,269	37,557	593,864.25
Gain	15,924	5,142	$84,780.25
Buffalo office	54,168	8,574	414,426.50
1914	34,393	6,233	289,546.00
Gain	19,775	2,341	$124,880.50
Albany office	42,237	8,157	322,387.00
1914	27,311	6,202	234,313.00
Gain	14,926	1,955	$88,074.00
Total	169,598	59,430	1,415,458.00
1914	118,978	49,992	1,117,723.25
Gain	50,620	9,438	$297,734.75
Total, 1914. Feb.-Feb., 1915	168,428	67,170	1,533,367.86
Feb.-May 8, 1915	169,598	59,430	1,415,458.00
	Gain	Loss	Loss
	1,170	8,740	*$118,909.86

*Loss of $71,315 due to half rate provision, recently abolished.

May Build Eight in Reading

READING, PA., May 18—Eight-cylinder cars may be manufactured in this city in the near future. A company here, which is not yet incorporated, has been negotiating with parts makers for the parts and equipment for a medium-priced eight-cylinder car. It expects to manufacture 500 the first year.

Considerable headway has been made with its plans and test cars will be on the road in a month.

90 M.P.H. in Speedway Practice

Cooper's Stutz Covers 40 Miles in 26:28—Schebler Adds $2,000 to Cash Prizes

INDIANAPOLIS, IND., May 16—Earl Cooper, the Californian who captured the American road racing championship in 1913, has hung up the best practice record to date, but before the sun sets to-morrow his feat may be eclipsed as there are several cars now being worked out on the track that already are in the pink of condition and showing a world of speed in two and three circuits of the oval.

Cooper established his practice record this afternoon. At the wheel of one of the new Stutz entries, he covered 40 miles in 26 minutes 28 seconds, a speed of 90 1-2 miles an hour. His fastest lap was 1 minute 37 seconds and his slowest 1 minute 42 1-2 seconds.

Although the Stutz is a native product and very popular with local fans, the foreign cars are not without their favorites and will be heavily backed. Resta's Peugeot looks especially dangerous, and the winner of the 1915 Vanderbilt cup and grand prize is driving the track as if he knew every brick of the 3,500,000 with which it is paved.

John de Palma, Ralph's brother, who will make his début as a big league driver at Indianapolis May 29, has overhauled the Delage that carried Thomas to victory last year, and the motor of the French car has a most menacing roar.

The two Sunbeams, entered by the English maker, had not shown much until today. The drivers, Porporato and Graham, have been working on them all week, and in practice this afternoon were circling the track at a 90-mile-an-hour clip.

De Palma arrived from Detroit yesterday morning. He unloaded his Mercedes, drove it to the speedway under its own power and without lifting the hood, covered a lap at a speed of 90 miles an hour on his first trial. He spent today experimenting with tires of different sizes. He already has decided on his gear ratio, and to obtain sufficient engine revolutions to insure maximum power must use 33 by 4 1-2 casings. Changing the tire sizes is an alternative to changing the rear axle gears.

Three of the three-car teams, Duesenberg, Bergdoll and F.R.P., have not arrived as yet, but they are expected the first of the week in order to prepare their machines for the elimination trials that are scheduled for Thursday, Friday and Saturday. The following cars already are quartered at the speedway:

Cars at the Track

The three Maxwells, Ralph de Palma's Mercedes, Graham's Sunbeam, Porporato's Sunbeam, Cornelian, John de Palma's Delage, the three Stutzes, the three Peugeots, Oldfield's Bugatti, Sebring, Grant's Sunbeam, Limberg's Sunbeam, the three Mercers, the Burman Special, the Harroun Special, Klein's Kleinart and the Mais Special.

The three Mercers, counted on to regain the championship lost to France in 1913 and 1914, have not been seen in action as yet. The cars did not arrive

List of Entries for Indianapolis 500-Mile Race

Car	Driver	Entrants
Maxwell	Carlson	Maxwell Motor Sales Corp.
Maxwell	Rickenbacher	Maxwell Motor Sales Corp.
Maxwell	—	Maxwell Motor Sales Corp.
Mercedes	De Palma	E. C. Patterson
Sunbeam	Porporato	Louis Coatalen
Sunbeam	Graham	Louis Coatalen
Du Chesneau	Brown	C. A. Du Chesneau
Duesenberg	Alley	F. S. Duesenberg
Duesenberg	O'Donnell	F. S. Duesenberg
Cornelian	Chevrolet	Blood Bros. Machine Co.
Delage	J. De Palma	J. E. Wilson
Stutz	Anderson	Stutz Motor Car Co.
Stutz	Cooper	Stutz Motor Car Co.
Stutz	Wilcox	Stutz Motor Car Co.
Peugeot	Resta	Peugeot Auto Import Co.
Peugeot	Bragg	Peugeot Auto Import Co.
Peugeot	Babcock	Peugeot Auto Import Co.
Bergdoll	E. Bergdoll	G. C. Bergdoll
Bergdoll	J. Bergdoll	G. C. Bergdoll
Mercer	Pullen	Mercer Automobile Co.
Mercer	Ruckstell	Mercer Automobile Co.
Mercer	Nikrent	Mercer Automobile Co.
Bugatti	Oldfield	C. W. Fuller
Bergdoll	Haupt	G. C. Bergdoll
Emden	Donaldson	R. E. Donaldson
Porter-Knight	Hughes	F. R. Porter
Porter-Knight	Keene	F. R. Porter
Porter-Knight	Whalen	F. R. Porter
Sebring	Cooper	E. E. Miles and J. W. Gwin
Sunbeam	Grant	Fortuna Racing Team, Inc.
Sunbeam	Limberg	Fortuna Racing Team, Inc.
Cino-Purcell	Cox	W. R. Purcell
Burman	Burman	Bob Burman
Harroun	Orr	Ray Harroun
Mulford	Mulford	Luther Brown
Cino	McNay	E. D. McNay
Kleinart	Klein	E. E. Klein
Mais	Mais	J. A. Mais
Duesenberg	—	F. S. Duesenberg
Shambaugh Spec.	Shambaugh	Charles Shambaugh
Bals Special	Hall	N. B. Bals

from Trenton, N. J., until late this afternoon and were not unloaded in time to participate in the Sunday practice.

The Maxwells made their first appearance this afternoon. Barney Oldfield warmed up one of Ray Harroun's latest speed creations, but could not get much speed out of it because it was new and consequently stiff. There is a remote possibility that Barney may drive a Maxwell. Two of the cylinders on his Bugatti are cracked and unless he can have new ones made here and get the German car in shape for the gruelling grind, may switch. After testing the Maxwell this afternoon, Oldfield suggested several changes that he wanted made in the car, and after this work has been done, will take it out again.

Two cars as yet are without drivers, the third Duesenberg entry and the third Maxwell. The Peugeot team has been completed by the signing of Caleb Bragg last week to take the car in which Galvin overturned in practice, injuring its driver and mechanic so badly that they will not be in shape to participate in the chase for the $50,000 in prize money. Percy Graham, who was sent from England to be Porporato's team-mate in the second Sunbeam, is an English sportsman who has participated only in amateur events on the Brooklands track. He was substituted for Jean Chassagne, who could not make the trip because of a rush of work on war material at the Sunbeam factory. Joe Cooper, an unknown, will be at the wheel of the Sebring.

Wheeler & Schebler Offer $2,000

Wheeler & Schebler, this city, are offering $2,000 in cash prizes for the 500-mile race to be divided as follows: $1,000 to the winner; $500 to second; $300 to third, and $200 to fourth. These prizes are to be awarded on condition that the Schebler carbureter is used. This brings the total cash prize offers up to $54,300, divided up into $50,000 from the Indianapolis Motor Speedway; $1,300 from the Bosch Magneto Co.; $1,000 from the Emil Grossman Mfg. Co., and $2,000 from Wheeler & Schebler.

Officials Named

The officials for the race have been announced as follows: David Beecroft and F. A. Croselmire, New York, A. A. A. representatives; A. R. Pardington, Detroit, referee; F. L. Edwards, director of contests of the Chicago motor speedway, chairman technical committee, and Tom Hay, Chicago, starter.

The order of the time trials will be in the inverse order of entry, the last car starting first, and the first starting last. This is to give the early entrants a chance to figure on the other fellow's performance, so that he may judge his own accordingly. Three trials will be allowed each man, the best of the three to count.

Governor Night at N. Y. S. A. E.

Two Papers and Committee Report on Governing Motor and Vehicle Speed

NEW YORK CITY, May 20—The meeting of the Metropolitan Section of the Society of Automobile Engineers, held tonight at the Automobile Club of America, was devoted to governors. The program called for papers to be delivered on this topic by Theodore Douglas, of the Duplex Engine Governor Co., Frank H. Trego of the Knox Motor Co., and a report of the Research Committee on Governors by Chairman McCoomb, of the General Vehicle Co. Mr. Trego's paper, entitled The Use of Governors for the Control of Motor Speed in Commercial Vehicles, follows, in part:

The object of a governor for the restriction of motor speed in commercial vehicles is either for the purpose of protecting the chassis or the motor from damage resulting from speed beyond which the governor will not allow the motor to operate.

Governors have so far been produced in such a manner that they will close the carbureter throttle when the motor reaches a given speed, generally ranging from 1,000 to 1,200 r.p.m. It is apparent that the motor, to be all that is desired, must have full power up to the speed beyond which it is not expected to run. Therefore, any governor which gradually closes the throttle as the speed increased would not be successful. A governor is, therefore, required which will snap the throttle closed when the given speed is reached, and they seem to have been built largely along this line, with, however, the objectionable feature of surging as the motor rises above and falls below the point at which the throttle will suddenly close.

Road and Load Conditions

Another stumbling block in the way of successfully governing the motor lies in the fact that road and load conditions will govern the position of the throttle necessary to bring the motor to the speed limit for which the governor is set, and it is safe to assume that without load a slightly open throttle will cause the motor to revolve at 1,000 r.p.m. or more, whereas, pulling a full load it would require a wide-open throttle to obtain the same speed.

In handling freight by motor vehicle it is highly important that the returning empty should be accomplished at a greater speed than the outgoing haul fully loaded. The vehicle should be able to stand a higher rate of speed when empty than when loaded, and, as time enters largely into the cost of transportation, every advantage should be taken of this fact. This, however, is impossible with a governor controlling the motor speed, as the governor will hold the vehicle down when empty as well as loaded.

It has been demonstrated time and again that it is impossible to get a vehicle out of trouble in certain road conditions, as for example, a mud-hole, without the full power of the motor with the assistance of the prompt engagement of the clutch. The action of the governor under this condition is to immediately close the throttle when the set speed of the motor is reached by the driver opening the throttle with a disengaged clutch. Therefore, when the clutch is engaged the load is applied when the throttle is closed and the throttle is not opened until the speed of the motor is dragged down by the load, thus losing greatly its power, due to a decrease in revolutions per minute. This makes it impossible to speed up the motor, engage the clutch, and lift the vehicle forward by a sudden application of power to the rear wheels, and has been the cause of so many drivers removing or disconnecting the governor and some manufacturers of motor vehicles abandoning it entirely. No governor will prevent a driver from driving down hill at a reckless pace, and therefore will not hold down the speed under all conditions.

Restrict Power of Motor

A better scheme than the use of governors is the restriction of the power of the motor beyond speeds which equal the miles per hour it is desired that the full loaded vehicle shall run. In doing this the designer is obliged to allow the vehicle to run faster than this speed when empty or lightly loaded, for the full power of the motor will not under those circumstances be required. On the other hand, why should the vehicle not run faster? Generally, a vehicle designed to carry 10 tons, for example, at 10 miles per hour, ought to be able to run 13 to 14 miles per hour when empty, and I have found by careful designing and experimenting that it is possible to so restrict the power of the motor that a speed of say 15 miles per hour empty cannot be exceeded on a level road and have the peak of the power curve of the motor range between 9 and 10 miles per hour of the vehicle.

It is seen that this vehicle is restricted to the desired speed on the out-going trip fully loaded, but may return for another load at a higher rate of speed. Instant application of full power may also be made when the vehicle is stuck in bad going, a procedure impossible when equipped with a governor.

They have been designing governors operating from the transmission to the throttle of the motor, but there is nothing herein to prevent an ignorant driver from racing the motor at high speed when the transmission is in low gear or neutral, a very dangerous liberty to give the ordinary driver of a truck.

The successful completion of a motor whose power will be restricted after a given speed will require, of course, considerable experimenting. The following points will control the situation:

Controlling Factors

Location of the firing point; valve timing; weight of reciprocating parts; size of intake manifold; size of carbureter; and size of lift of valve.

No hard and fast rule can be laid down which will apply to motors of various sizes and design; therefore, each individual motor will present a problem by itself, but this, however, can be worked out with the aid of a dynamometer.

Advances Made in S. A. Exports

Stable Financial Conditions Due to Large Crops and Firm Market Quotations

New York City, May 17—Conditions throughout commercial South America show a generally strong situation financially, according to the reports of representatives of the National City Bank of New York in that part of the world. From Argentina comes the word that the quantity of corn available for exportation in the current year will be about 5,000,000 tons as compared with but 3,542,000 tons for last year. A vessel which left New York for the Eastern Coast of South America a few days ago carried for Brazil $25,000 worth of printed and advertising matter, $3,000 worth of agricultural instruments, $10,000 worth of miscellaneous machinery. For Buenos Aires this vessel carried $20,000 worth of automobiles.

Business conditions in Argentina in the first quarter of the present year are described by the manager of the Buenos Aires Branch of the National City Bank as showing a substantial improvement and one likely to be of a permanent character. The crops are abundant, the price is high and the supply and price of meat normal. The foreign exports will probably exceed those of any previous year and there is a waiting market for every pound of beef and wool that the country can supply.

Exports from New York to South America in the first week of April was the largest of any week of the war period. They totaled $3,500,000 against a weekly average of about $1,500,000 during the war period. Large quantities of petroleum and petroleum products are being shipped to various parts of the Continent.

Chicago S. A. E. Section?

Chicago, Ill., May 17—When W. H. VanDervoort, president of the Moline Automobile Co., was elected president of the Society of Automobile Engineers last week it was expected that one of the events of his year of office would be starting a section of the S. A. E. in Chicago. For over a year the thought of establishing a section in the windy city has been under consideration. There are not so many engineers in Chicago itself, but the surrounding territory, including such outlying cities as Kenosha, Racine, Milwaukee, Moline, Rockford, etc., brings up the number considerably, so that it is considered there is actually plenty of material for a Chicago section. There are 175 members of the S. A. E. in Iowa, Illinois, Wisconsin and northwestern Indiana.

At the present moment President VanDervoort is canvassing the field with the object of seeing if a Chicago section cannot be made during the present season.

While it might be difficult to have monthly meetings for a Chicago section, there is no reason why meetings every 2 months might not be sufficient at certain seasons in the year. As Chicago is one of the great distributing points for cars it is suggested that during the winter season meetings of an educational nature might be conducted which would be of great benefit to the merchandising department of the motor industry.

Kelly-Springfield Truck Elects Directors and New Officers

Springfield, O., May 14—At a meeting of the stockholders of the Kelly-Springfield Motor Truck Co. a dividend of 4 per cent. on preferred stock was declared.

The stockholders elected these directors: Capt. Marion McMillin, A. P. Lathrop, C. W. Young, E. S. Kelly, J. B. Cartmell, H. E. Freeman, C. L. Bauer, J. L. Geddes, and C. N. Jellisse.

The board organized by electing J. L. Geddes as president; Captain McMillin, vice-president; J. M. McCarthy, second vice-president; G. W. Barden, secretary and treasurer; C. W. Young, assistant secretary, and C. N. Jellisse, assistant treasurer.

Monarch Reorganized—Plan to Build 3,000 Eights

Detroit, Mich., May 17—The Monarch Motor Car Co., which started in business about 2 years ago with a capital stock of $30,000 has been reorganized and its capital stock increased to $400,000. Eastern capitalists are backing the company, with incorporation under Delaware law.

R. C. Hupp, who has been president since the concern was started, remains as such. A. F. Spaulding, of Spaulding, McClellan & Co., is vice-president; George B. Turner, formerly of the Bankers Trust Co., New York, is secretary-treasurer. H. D. W. MacKaye has been appointed director of sales; A. A. Lehr, director of engineering and purchases; Walter R. Bamford, production manager; G. J. Conyne, assistant production manager; J. L. Bell, service manager and M. L. Shanks, office manager.

The company is planning to enlarge the plant and to make from 3,000 to 5,000 eight-cylinder cars for the 1916 season. This car with either a seven-passenger touring or a roadster body will be listed at $1,500.

New Transcontinental Record

Stutz Bearcat Covers 3,728.4 Miles in 11 Days 7 Hours, and 15 Minutes

New York City, May 18—At 10.15 this morning a Stutz Bearcat roadster completed the transcontinental trip from San Diego, Cal., to this city in 11 days, 7 hours, and 15 minutes, Erwin G. Baker driving the car the entire distance, and thus establishing a transcontinental record for a single driver as well as greatly reducing the time for a trip between the Pacific Coast and the Atlantic Ocean. The distance covered was 3,728.4 miles. The trip started from San Diego at midnight on the morning of May 7, the route being by way of Phoenix, Ariz., El Paso, Texas, Roswell, New Mexico, Plainview, Plains and Emporia, Kan., Lexington, Mo., Greenville, Ill., Dayton, O., Greenberg, Pa., Philadelphia and New York.

The 2 first days of the trip were the greatest in mileage, the first day to Phoenix being 409.1 miles, and the second day from Phoenix to El Paso, 592 miles. On the third day 6 hours were lost in miring in quicksand in crossing two streams, and only 244 miles were covered.

Mr. Baker, although new in transcontinental motoring, has had considerable experience in transcontinental traveling with a motorcycle, having covered the Coast to Coast trip in 11 days, 12 hours, and 10 minutes by motorcycle. On the present trip he was accompanied by W. F. Sturm, of Indianapolis, as official observer who had the car officially checked out at San Diego, by A. A. A. officials, checked at the night stops with official signatures and seals, and checked at the finish by an A. A. A. representative.

Single Set of Tires Used

The car went through the run with a single set of tires, the same air being in the fronts at the finish. The car is now being given an official examination by the Automobile Club of America. Its equipment included Houk wire wheels, Stromberg carbureter, Bosch magneto, Hartford shock absorbers, A. C. spark plugs, Stewart horn, Prest-O-Lite tank, etc.

Throughout the trip driver Baker and his companion averaged 4 or 5 hours sleep each night, generally driving until 9.30 or 10 and getting away at 4 o'clock the following morning.

The Stutz Bearcat was a standard model, with four-cylinder motor, 4 3-4 by 5 1-2 inches bore and stroke. It was stripped of fenders and carried a wire radiator screen, with the springs taped.

Paige to Double Production

Additions Will Make Output 150 Cars a Day—Methods Improved

DETROIT, MICH., May 17—For the purpose of doubling its production the Paige-Detroit Motor Car Co. will begin the erection of an addition to its plant, to consist of a three-story building 60 feet wide and 500 feet long. This will make it possible to build 150 cars a day or seventy more than the present daily output. The company intends to make 15,000 cars next season.

Considerable new machinery will be installed and the total expense will be $275,000 or more.

Production methods will be improved and one of the features when the new addition is completed will be the installation of a mechanical conveyor.

By this system the integral parts of the car are placed on a moving platform of the endless chain type and part by part is added as the embryo car moves along from one group of workers to another. Thus the rear axle, which was the beginning of the car, will have become a complete car by the time it has reached the end of the conveyor.

The Paige-Detroit company started in business in 1909. Last year it moved into its new plant, the main building being 792 feet long and 60 feet wide. When completed the concern will have one of the largest automobile plants in the country. The first year the total floorspace was 2,400 square feet. At the present time it is 390,000 square feet. When the addition is completed the total will be over 600,000 square feet.

Higher-Speed Motor in 1916 Lewis VI—New Body

NEW YORK CITY, May 19—A smaller higher-speed motor, detail mechanical changes and body refinements mark the 1916 Lewis VI, whose price remains at $1,600. As heretofore, a single chassis is produced. The motor has been reduced in bore from 3 1-2 to 3 1-4 and the stroke remains at 6 inches. At the same time the gear ratio has been increased to 4 to 1, it being 3 3-4 this year. A new oiling system with leads to the main bearings and silent chain drive has been adopted. The electrical system is a Remy and the timer-distributer is now driven from the pump shaft through a worm gear. It is vertically mounted. The Stewart single-cylinder motor-driven tire pump has been added. It is mounted at the right side of the gearcase and the hose is carried in a compartment in the floorboard.

Flush-sided body with double cowl is a new feature. The instrument board, windshield base and front cowl is a single aluminum casting. The height of the radiator cap has been reduced and the lines of the hood have been rounded considerably.

A six-passenger touring body and two-passenger runabout are mounted on the one chassis. The latter has a collapsible steering gear and a disappearing top. Tires are carried in a compartment at the rear.

The Cutler-Hammer magnetic gearshift is optional at $150 additional cost.

Studebakers Enter Export Assn.

NEW YORK CITY, May 14—Clement Studebaker, Jr., G. M. Studebaker and C. A. Carlisle, of the Studebaker Corp., South Bend, Ind., have joined the International Traders, Ltd. G. B. Hanford, general manager of the association, stated that the organization is in a general import and export business and that the recent addition of the Studebaker members did not presage any connection with Studebaker automobile business.

The International Traders was formed last fall, and has gone after business in Europe and South America on a large scale. Although much of the export business has been in war orders, officials of the company maintain they are working more along lines that will develop a permanent movement.

The company has an authorized capital stock of $1,000,000. The directors, besides those named, include G. B. Hanford, J. L. Moon, who is president of the organization; F. O. Seaver, vice-president; E. M. Lowell, treasurer, and E. E. Dawson.

Used Car Report for Salesmen

CHICAGO, ILL., May 17—A Salesman's edition of the Central Used Car Market Report is to be issued by the Chicago Automobile Trade Assn. It will be of vest-pocket size, 5 by 2 1-2 inches, and will cost $5 a year, appearing in revised and up-to-date form with the regular report every 3 months. Also, a Credit Bureau is planned for Chicago.

The regular report is too large to be carried by a salesman, and the Salesman's Edition is designed to fill this need.

The book will be issued only to subscribers to the larger report, according to present plans.

Co-operation in the used car report service is now being furnished by twenty-seven associations and it is planned to rebate to each $2.50 out of every $5.00 received, this money to be used for the routine work of contributing associations. Revenue from this plan is to be used to establish a credit bureau for furnishing information, court service, etc., to members.

Tax H.P. and Weight in Michigan

New Law Goes Into Effect Jan. 1, 1916—25 Cents Per H. P. and 25 Per 100 Lbs.

DETROIT, Mich, May 15—The new Michigan motor vehicle law will go into effect January 1, 1916. It is a radical departure from the previous law principally because all cars will be taxed according to horsepower and weight.

Briefly stated the principal provisions are:

Gasoline and steam cars will be taxed 25 cents per horsepower and 25 cents per 100 pounds of weight. The horsepower will be computed by the standard S.A.E. formula.

The weight of a motor vehicle will be that of the car fully equipped at which the manufacturer represents it or the weight given in the shipping bill. If not given or known then the weight will be determined on a standard scale.

Electric vehicles will be taxed $1 for each horsepower and 25 cents per 100 pounds.

Motor trucks will be considered those having more than two wheels and only one seat with no provision for other seats and which have been built and are operated for the purpose of transporting articles other than persons.

Gasoline and steam trucks will be taxed 15 cents per horsepower and 15 cents per 100 pounds.

The tax for electric trucks will be 50 cents per horsepower and 25 cents per 100 pounds.

Motorcycles are subject to a tax of 25 cents per horsepower and 25 cents per 100 pounds.

Automobile manufacturers and dealers will pay a tax of $50 for five cars and $10 for every car in excess of five.

All motor vehicles registered after the first day of September in any calendar year will be subjected to only one-half the regular tax rates.

Automobile manufacturers or dealers will not be exempt from paying taxes as personal property on cars in stock or bond except on the specified number that have been registered by them to operate on the public highways.

Any person desiring to operate a car as a chauffeur must register and pay a fee of $2. Chauffeurs registering after August first pay only one-half of the regular fee.

Farmack Car Enters Field

CHICAGO, ILL., May 18—This city is again breaking into the passenger car field with the announcement of the Farmack car, made by the Farmack

Motor Car Corp., 332 South Michigan avenue. While actual production has not yet begun, it is proposed to build three models using the same chassis. The price of the touring car will be about $750 including an electric starting and lighting system. A cabriolet, and three passenger roadster models also will be marketed. The car as outlined will have a 106-inch wheelbase, four-cylinder, 3 1-2 by 5 valve-in-the-head motor, cone clutch, three-speed gearset, floating axle and 32 by 3 1-2 tires. It will be assembled. The concern states that between August 1, 1915, and August 1, 1916, 5,000 cars will be shipped. This newly formed corporation has as its head A. J. Farmer, who was last connected with the Farmer Mfg. Co., Detroit; vice-president, George H. McKenney, a Chicago physician; secretary-treasurer, M. M. McIntyre. The officers make it plain that no deposits will be accepted until production is under way. The old Staver plant is to be used as a temporary factory.

Dyneto System for Fords

SYRACUSE, N. Y., May 18—The Dyneto Electric Co., this city, which has been producing single unit starting and lighting systems for Franklin, Regal and other cars, has put out a special outfit for Fords. The motor generator is practically the same as that furnished for larger cars and all the important features which enter into the construction of the larger types have been retained. Current regulation is accomplished by the inherent quality of a compound winding.

The installation is made by means of a bracket which holds the apparatus firmly. It is stated that the entire outfit can be installed in approximately 3 hours by anyone who is only slightly familiar with the use of tools. No drilling or machine work is required. The outfit is sold complete including a Willard battery, battery-box, wiring, switches, etc., with a complete marking system by means of which it is readily possible for anyone to make the installation.

Moorehouse Is Chief Engineer for Mutual Motors

JACKSON, MICH., May 15—A. Moorehouse has been appointed chief engineer of the Mutual Motors Co., of this city. For 4 or 5 years Mr. Moorehouse has been in the engineering department of the Hudson Co., prior to which time he was connected with the Cadillac.

N. A. C. C. Annual Meeting June 3

NEW YORK CITY, May 19—The annual meeting of the National Automobile Chamber of Commerce, Inc., will be held June 3, the monthly meeting of the directors being scheduled for June 2.

40 Cents Per H.P. in California

S. A. E. Rating Used as Basis —All Vehicles Must Carry Lights at Night

SACRAMENTO, CAL., May 12—A fixed registration fee of 40 cents per horsepower, S. A. E. rating, has been adopted by the State legislature during the present session. This new amendment to the motor vehicle act accomplishes an annual saving of about $50,000 by allowing owners to keep their same number plates and re-register them each year. One section of the amendment requires all horse-drawn vehicles as well as automobiles to carry lights at night. The former law taxed automobiles under a blanket rating covering of from 10 to 20, 20 to 30, etc., horsepower.

Pa. License Raise Defeated

HARRISBURG, PA., May 11—The bill to increase the automobile license fees in order to raise money for highway improvement was defeated in the house last night. This bill, introduced by Rep. Lipschutz, called for an average increase of 25 per cent. on all automobile and commercial vehicle license rates.

York Men Organize To Build $700 Bell Car

YORK, PA., May 15—The Bell Motor Car Co. is the latest addition to the automobile industry in this city. The new concern will engage in the manufacture of a low-priced car, selling between $700 and $800, and will be incorporated at $50,000. Operations will be started July 1 in the large three-story factory building along the Columbia & Frederick branch of the Pennsylvania railroad and the intersection of Center street, now occupied by the Bailey Mfg. Co., manufacturer of commercial car bodies. It is the aim of the new company to build 1,500 cars the first year.

The Bell car will be manufactured in two models, a roadster and a five-passenger touring car. The cars will be fully equipped. Ernest T. Gililard, former chief engineer and designer for the Sphinx Motor Car Co., this city, will fill this capacity for the new company. The body design for the new car is now being worked out and the 1916 model will contain a number of distinctive features.

Application will be made to Governor Brumbaugh, Tuesday, June 8, for a charter for the intended corporation. The incorporators are Henry M. Stauffer, Lancaster; Dr. Harry W. Posey, Woodbine, York county; Dr. B. Frank Posey and Ernest T. Gilliard, York. The proposed new industry is to be a close corporation and the entire issue of stock is to be held by the four incorporators. At a recent meeting the following officers were elected: President, Henry M. Stauffer; vice-president, Dr. Harry W. Posey; secretary and treasurer, Dr. B. Frank Posey.

Changes in Hupp Ranks

DETROIT, MICH., May 17—J. E. Fields, formerly connected with the advertising department of the Chalmers Co. has been appointed director of service for the Hupp Motor Car Co. Other Hupmobile appointments include Frederick Dickinson, assistant advertising manager; and O. C. Hutchinson, district manager, in charge of factory distribution warehouses in Boston and New York.

McIntyre Files Petition

AUBURN, IND., May 15—W. H. McIntyre, this city, automobile manufacturer has filed a voluntary petition in bankruptcy before United States Commissioner Thomas J. Logan in Federal court. He schedules his liabilities at $183,440.49 and his assets at $5,015, $600 of which he claims exempt under the bankruptcy laws of the United States. In his petition he says that he is a manufacturer's manager by occupation, although the business with which he is identified is not mentioned. The indebtedness is mostly in notes, held by different banks. The Hamilton National, of Fort Wayne, holds notes of from $500 to $10,000 and the First National bank, of Fort Wayne, holds his notes from $478 to $10,000. Other notes are held by the City National bank, of Auburn; the Savings Loan & Trust Co., Auburn, and the Northern National bank, Toledo, O. In the lists of assets is mentioned real estate valued at $5,000 although there is a mortgage on his property amounting to $1,500, held by the Commercial bank at Ashley, Ind. The petition states that the notes are secured by mortgages on the McIntyre automobile plant.

Asks Receiver for Motsinger

LA FAYETTE, IND., May 13—Thomas Sharp Wilson, who recently was removed as treasurer and director of the Motsinger Device Mfg. Co., yesterday filed a petition in the circuit court asking for a receiver for the company. The latter was incorporated several years ago to manufacture the Motsinger carbureter. Wilson's petition alleges that he has $10,000 worth of stock in the company, that the liabilities will amount to $30,000, and the building and equipment will not bring $40,000. The petition alleges that Motsinger is advertising the sale of $15,000 of new stock, in addition to the original $150,000 capital.

War Trucks Feature of Exports

United Kingdom Still Largest Buyer of American Vehicles —Passenger Cars Fall Off

WASHINGTON, D. C., May 14—Gross statistics of the exports of motor cars, in March, already published in THE AUTOMOBILE are supplemented this week by the bureau of foreign and domestic commerce by detailed figures. The interesting feature of the figures is the tremendous increase in the number of commercial cars shipped abroad in March last, as compared with the exports for the same month of last year. The figures show that during March last 1,339 motor trucks, valued at $4,725,563 were shipped abroad, and it is understood they went to the warring countries in Europe. In March a year ago the number shipped abroad was fifty and the value $63,932. During the 9 months ended March the exports of trucks increased from 543, valued at $861,654, in 1914, to 6,313, valued at $18,737,487, in 1915.

Passenger Cars Drop 1109

On the other hand the exports of passenger cars dropped from 3,538, valued at $2,984,915, in March, 1914, to 2,429, valued at $1,958,302, in March last, and from 19,928, valued at $17,904,002, during the 9 months of 1914 to 11,563, valued at $9,551,731, during the same period of 1915.

As has been the case for a number of years, the United Kingdom was the largest buyer of American cars during the periods under consideration. The exports of cars, both commercial and passenger, increased from 819, valued at $637,884, in March, 1914, to 1,566, valued at $2,468,014, in March last, while during the 9 months' period the number increased from 5,732, valued at $4,542,123, in 1914 to 6,197, valued at $8,915,029, in 1915.

While France imported only 164 cars, valued at $98,427, in March, 1914, the number in March, 1915 increased to 460, and the value to $1,918,053, while during the 9 months' period the number increased from 700, valued at $509,241, in 1914, to 2,896, valued at $8,325,140, in 1915.

The blockade on Germany is shown by the fact that in March, 1914, 361 cars, valued at $264,203, were shipped to that country, while in March last the number had decreased to four and the value to $2,800. During the 9 months' period the exports to Germany dropped from 951, valued at $677,347, in 1914, to 20, valued at $20,164 in 1915.

Italy's imports of American cars amounted to 23, valued at $13,664, in March, 1914, and during March last the number exported also was twenty-three, but the value had dropped to $13,273. During the 9 months' period the shipments to that country declined from 234, valued at $163,808, in 1914, to sixty-five, valued at $48,385, in 1915.

Under the head of "other Europe" the exports show a decline in number but an increase in value. In March, 1914, the shipments amounted to 590, valued at $498,142, while in March last shipments were 431 and the value $1,293,577. During the 9 months' period the number exported was 1,741, valued at $1,404,969, while during the 9 months of 1915 it was 1,263, and the value $3,594,223.

Effect of the War on Canada

The effect of the war is shown in the exports to Canada, the returns showing that during March, 1914, the number of cars shipped to that country was 500, valued at $531,029, while in March last the number had increased to 345 and the value to $317,516. During the 9 months' period the number decreased from 2,555, valued at $3,471,086, in 1914, to 2,072, valued at $2,553,942, in 1915.

Automobile Exports and Imports for March and Preceding 9 Months

EXPORTS

	March				9 Months Ending March			
	1914		1915		1914		1915	
	Number	Value	Number	Value	Number	Value	Number	Value
Automobiles								
Commercial	50	$63,932	1,339	$4,725,563	543	$861,654	6,313	$18,737,487
Passenger	3,538	2,984,915	2,429	1,958,302	19,928	17,904,002	11,563	9,551,731
Total	3,588	$3,048,847	3,768	$6,683,865	20,471	$18,765,656	17,876	$28,289,218
Parts								
Parts	....	701,038	....	762,386	.....	4,923,339	.....	4,116,608
Total	...	$3,749,885	....	$7,446,251	.....	$23,688,995	.....	$32,405,826
BY COUNTRIES								
Automobiles								
France	164	$98,427	460	$1,918,053	700	$509,241	2,896	$8,325,140
Germany	361	264,203	4	2,800	951	677,347	20	20,164
Italy	23	13,664	23	13,273	234	163,808	65	48,385
United Kingdom	819	637,884	1,566	2,468,014	5,732	4,542,123	6,197	8,915,029
Other Europe	596	498,142	431	1,293,577	1,741	1,404,969	1,263	3,594,223
Canada	500	531,029	345	317,516	2,555	3,471,086	2,072	2,553,942
Mexico	21	24,139	9	4,861	154	241,667	58	59,635
West Indies and Bermuda	36	34,652	223	136,675	408	383,281	874	576,317
South America	129	114,276	205	96,599	1,592	1,614,860	808	434,051
British Oceana	561	491,850	284	252,212	3,077	2,658,621	2,164	1,788,803
Asia and other Oceana	196	186,647	132	115,366	1,664	1,617,970	946	1,559,043
Other countries	188	154,904	86	64,919	1,663	1,480,683	513	414,486
Total	3,588	$3,048,847	3,768	$6,683,865	20,471	$18,765,656	17,876	$28,289,218
Tires								
Belgium	....	....	....	....	.....	$15,429	.....	....
France	....	....	....	....	.....	....	.....	$6,090
Germany	....	$18,396	....	....	.....	88,930	.....	....
England	....	171 127	....	$449,560	.....	1,031,117	.....	1,530,701
Canada	...	74,927	....	50,000	.....	583,412	.....	464,392
Mexico	...	6,296	....	8,332	.....	100,249	.....	73,349
Philippine Islands	....	10,283	....	3,384	.....	110,803	.....	160,631
Other countries	....	46,075	....	116,229	.....	449,019	.....	652,445
Total	....	$327,104	....	$627,505	.....	$2,378,959	.....	$2,887,608
IMPORTS								
Automobiles ....dut.	15	$15,867	17	$28,105	245	$545,226	244	$405,021
Parts of (except tires)...dut.	....	90,928	....	73,302	.....	458,730	.....	640,215
Total automobiles and parts of	....	$106,795	...	$101,407	.....	$1,033,956	.....	$1,045,236
BY COUNTRIES								
Automobiles								
France	7	$7,008	2	$9,360	110	$264,600	40	$100,371
Germany	....	....	....	....	15	37,307	6	13,606
Italy	5	5,679	1	2,000	44	64,345	91	96,920
United Kingdom	1	1,500	3	5,676	37	111,722	60	143,032
Other countries	2	1,680	11	11,069	39	67,252	47	51,092
Total	15	$15,867	17	$28,105	245	$545,226	244	$405,021

Other countries show losses all along the line. Mexico's imports of American cars fell from 21, valued at $24,139, in March, 1914, to 9, valued at $4,861, in March last, while during the 9 months' period the number fell from 154, valued at $241,667, in 1914, to 58, valued at $59,635.

British Oceana imported 561 American cars, valued at $491,850, in March, 1914, while in March last the number decreased to 284 and the value to $252,212. During the 9 months' period the number decreased from 3,077, valued at $2,658,621, in 1914, to 2,164, valued at $1,788,803, in 1914.

In March, 1914, Asia and other Oceana 196 cars, valued at $185,647, were imported from this country, while in March last the number fell to 132 and the value to $115,366. During the 9 months' period the number decreased from 1,664, valued at $1,617,970, in 1914, to 946, valued at $1,559,043, in 1915.

One hundred and twenty-nine cars, valued at $114,276, were exported from this country to South America in March, 1914, while during March last the number increased to 205 and the value decreased to $96,599. The 9 months' period shows a loss from 1,592 cars, valued at $1,614,860, in 1914, to 808 cars, valued at $434,051, in 1915.

The full statistics are given in the accompanying table.

Continental Motor Adds 90,000 Square Feet

DETROIT, MICH., May 17—Additions to the plant of the Continental Motor Mfg. Co., in Muskegon, Mich., have been started and when completed will provide 90,000 square feet of additional floorspace. This will make the total of the Muskegon plant 350,000 or equal to the space of the Detroit plant.

It means that the Continental company will have a total of 700,000 square feet of floorspace.

The additions will consist of a three-story building 60 by 200 feet, to be used for the screw products; a three-story shipping building; the erection of a new testing department or building and a new heating plant. The buildings alone will probably cost about $50,000, being made of reinforced concrete and steel, while the new machinery to be installed will be worth $150,000 to $200,000.

The company hopes to build 10,000 more four-cylinder motors when the increased production facilities are completed.

At the Detroit plant the additions which were started last year are now all finished.

It is estimated by the Continental company that by July first 50,000 motors for 1915 will have been delivered.

Concerning the 1916 output nothing definite is available but it is thought quite possible that under normal conditions the output will not be far from 65,000 motors.

There are now 3,800 men employed in the two plants. When the Muskegon plant is completed the total working force will be increased to about 4,900 men.

$19,000 for Breach of Contract

CHICAGO, ILL., May 19—*Special Telegram*—Cecil E. Gibson and B. F. Meixell have been awarded $19,000 damages from the American Motor Car Sales Co. by the jury in the superior court of Marion county.

Suit was brought by the plaintiffs for $150,000 damages for alleged breach of contract. Gibson and Meixell claimed they were Marion agents in 1909 and 1910 in Indianapolis and that the agency was taken away from them without due cause, the loss in profits amounting to the sum asked for.

According to John N. Willys, then head of the Marion concern, there always was a dispute as to whether or not there was a contract. It was claimed by defendant that if there was a contract the plaintiffs would have been unable to sell any considerable number of cars and the defendant would have settled for a reasonable amount, possibly $25,000. The verdict of the jury is in keeping with defendant's contention as to the amount of damages.

Now the Gemco Mfg. Co.

MILWAUKEE, WIS., May 17—The Garage Equipment Mfg. Co., of Milwaukee, Wis., originally incorporated as the Garage Equipment Co., has made a second change in its style and will henceforth be known as the Gemco Mfg. Co. The change is made to conform with the now well established trademark "Gemco."

Colby Motor Co. Assets To Be Sold May 26

MASON CITY, IA., May 14—The receiver's sale of the Colby Motor Co., of this city will be held here Wednesday, May 26. Samuel A. Schneider, receiver, has issued a small booklet showing the various parts to be disposed of. The sale will include five buildings comprising office and factory and much personal property intended for cars, such as 100 radiators, 100 frames and other items including steering gears, electric wiring, windshields, bolts and nuts, springs, body, etc. The buildings, including approximately 7 acres of land, will be sold first. The personal property will then be sold in smaller blocks, the sale continuing until all the property is sold.

Auction Lozier's Plattsburg Plant

Sale Begins May 26—15 Brick Buildings, Machinery, Tools, Raw Stock, Etc.

PLATTSBURG, N. Y., May 14—The Lozier Motor Co. plant at Plattsburg, valued at $1,000,000, will be sold at public auction beginning May 25 by Charles Shongood, auctioneer, New York City.

The sale will include about $100,000 worth of tools and bids will be received for about 100,000 feet of single and double-ply belting in all sizes. The raw stock offered includes about 500 tons of new iron and steel, rods, tubing and sheets of soft and high-speed tool steel.

The Lozier marine department, consisting of the service, good will and everything pertaining to it, will be sold in one lot as a going business.

The real estate which will be sold comprises fifteen modern brick buildings, equipped with traveling cranes, electric motors, air compressor system and all equipment of an up-to-date plant. The property covers 145,000 feet of floor space and is situated on a 327-acre plot, having canal as well as railroad connections. The plant will be sold in parcels to suit buyers.

Columbus Buggy Assets Sold—To Supply Parts

COLUMBUS, O., May 14—The auction sale at the plant of the New Columbus Buggy Co., held May 12 and 13, was a success in every particular. A large number of buyers were present not only from Ohio but also from adjoining states.

The first day was devoted to the sale of sixty-five automobiles, which were disposed of at good auction prices within 2 hours.

There were thirty-five new electrics, twelve new gasoline cars and the remainder were used cars. All of the materials on hand and equipment, with the exception of the patterns for the making of parts, were disposed of also. The company retained the patterns and will continue to furnish parts. This business will be under the management of L. M. Browne. The buggy business was sold to A. Webber, of Louisville, Ky., who will move it to that city.

Gordon Rubber May Increase Capital

CANTON, O., May 15—The Gordon Rubber Co., Canton, O., through its directors, will meet June 10, to consider the increase of the capital stock from $300,000 to $600,000 to care for the erection of a shop and other extensions which will double the capacity of the plant.

10,000-Miles Solid Tire Warranty

British Manufacturers Adopt Standard Guarantee for 1 Year of Service

LONDON, ENG., May 3—British tire manufacturers have agreed upon a standard solid tire guarantee of 10,000 miles within a period of 1 year, as a result of investigations by the Solid Tire Committee. This guarantee has been adopted by over twenty firms, representing most of the important makers of tires in England. The guarantee is as follows:

"Solid rubber tires supplied for use in the United Kingdom are guaranteed for 10,000 miles' service. We undertake that on a claim being admitted by us, the tire will be repaired free, or replaced at a charge proportionate to the failed mileage or unexpired time at our option, and in cases where tires are so replaced, the failed tires become our property. This guarantee is given subject to the following conditions:

"1—Claims under the guarantee must be made within 12 months from the date of the sale of the tire by us.

"2—The vehicle to which the tire is fitted shall be maintained in good running order, shall not be run at excessive speed, the brakes shall not be applied so as to cause the tires to skid, and no error in wheel alignment shall be permitted.

"3—The total load shall not at any time exceed that set out in the schedule below for the respective sections of tires:

SCHEDULE OF LOADS

Section of Tire, mm.	Approximate Inch-Size	Maximum Load per Tire in Pounds
75	3	1,120
85	3½	1,496
90	3½	1,680
100	4	2,128
110	4½	2,576
120	4¾	3,024
130	5	3,476
140	5½	3,696

"4—No liability will be accepted by us for accidents to vehicles, property, or individuals arising in respect of vehicles fitted with tires, the subject of this guarantee, and this guarantee is given instead of and expressly excluding any kind of implied condition or warranty, and the damages for which we make ourselves responsible hereunder are limited to the replacement of failed tires as above mentioned.

"5—And such other conditions as may be set out in our terms of sale.

"Note: The guarantee in the above terms may be extended, at the option of the tire maker, to cover tires applied to countries outside the United Kingdom, provided that the mileage guaranteed shall not exceed 10,000 miles, and for a period of no more than 12 months."

Mileage Test for Victor Tires

SPRINGFIELD, O., May 17—The Victor Tire & Rubber Co. has begun a mileage capacity test of its new pneumatic tires by fitting a set of Victor tires to a Cole eight and running the car a total of 300 miles daily for as many days as the tires hold out. The car is run 150 miles each day and 150 miles each night.

Market Prices Steady

NEW YORK CITY, May 18—Market prices this week were steadier with few changes. Most of the changes were small. Most of the metals were strong. Aluminum went up 1-4 cent, being firm and in good demand. Lead, though unchanged, was stronger. Trade, however, in copper and tin has been kept within very narrow limits. Domestic consumers in copper display small interest and there is very little export demand temporarily. At the same time there is no pressure to sell, and prices for electrolytic continue nominal at 18 3-4 cents. Lake copper continued irregular, dropping to 18 1-2 cents on Friday. Tin went down $1.00 per 100 pounds. The restrictions against sales of tin in the local market are keeping trade down and forcing consumers to pay a premium of nearly 2 cents per pound over the importation cost.

Fine Up-river Para rubber went up 1 cent with offerings light. Manufacturers did not evince much interest and the transactions reported were restricted to comparatively small quantities. A light shipment of rubber was received last week from London and Liverpool.

Cyanide potash rose 1 cent last week, this being the only change that occurred in the oils, lubricants and chemical markets. Petroleum prices were generally steady. Linseed oil was in moderate demand and steady while rapeseed oil was quiet with prices unchanged.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum	.19½	.19½	.19½	.19½	.19½	.19¾	+.00¼
Antimony	.34	.34	.34	.34	.34	.34	......
Beams & Channels, 100 lbs.	1.31	1.31	1.31	1.31	1.31	1.31	......
Bessemer Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Copper, Elec., lb.	.18⅝	.18⅝	.18⅝	.18⅝	.18¾	.18¾	+.00⅛
Copper, Lake, lb.	.19	.19	.19	.18½	.18½	.18½	—.00½
Cottonseed Oil, bbl	6.39	6.30	6.30	6.24	6.25	6.29	—.10
Cyanide Potash, lb.	.23	.23	.23	.24	.24	.24	+.01
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	4.20	4.20	4.20	4.20	4.20	4.20	......
Linseed Oil	.67	.67	.67	.67	.67	.67	......
Open-Hearth Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, refined	.82	.82	.82	.82	.82	.82	......
Rubber, Fine Up River, Para	.60	.61	.61	.61	.61	.61	+.01
Silk, raw, Ital.	..	..	3.90	..	..	3.90	......
Silk, raw, Japan	..	..	3.55	..	..	3.52½	—.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	40.00	39.50	39.50	39.25	39.00	39.00	—1.00
Tire Scrap	.05	.05	.05	.05	.05	.05	......

Fisk Adds Three Buildings—More in Prospect

CHICOPEE, MASS., May 15—The Fisk Rubber Co. has started construction on additional buildings for its factory. Plans have been drawn by G. B. Allen, of Hartford, for three structures on the property acquired by the company on Oak and Grove streets. The additions will give the company a two-story branch store and service station, a six-story reinforced concrete storehouse 110 by 310 feet, and a six-story office building 60 by 100 feet. At the present time there is under construction a seven-story addition to the Nos. 7 and 8 mills of the company. When the new buildings being contemplated are finished it will give the factory a floorspace of 22 acres instead of the 14 it has at present. The company does not propose to stop even when these new buildings are done if the conditions warrant it, for the plans allow for an increase to 60 acres of floorspace. Railroad spur tracks with a capacity of forty cars have been planned. There are now 3,000 men employed at the factory.

Stevens-Duryea Plants Purchased by Westinghouse

SPRINGFIELD, MASS., May 13—Negotiations have been definitely completed for the purchase of the plant and business of the J. Stevens Arms & Tool Co., Chicopee Falls, and the plants of the Stevens-Duryea Co., in the same city and East Springfield.

The corporate and commercial identity of the J. Stevens Arms & Tool Co. will be retained, and its usual line of rifles will be manufactured. When the war order rush is over, the usual line of Westinghouse products will be manufactured at the plants. It is expected that employment will be furnished for 8,000 men by the new business.

Five-Story Addition for New Process Gear Co. Plant

SYRACUSE, N. Y., May 15—The New Process Gear Co. is rushing plans of new five-story factory building to be 240 feet long by 75 feet wide giving 90,000 additional square feet of floorspace. This is expected to be completed October 1. This is in addition to the new four-story building at present under construction.

For the first 4 months of 1915 the company's business has increased 50 per cent., and there is on order machinery totaling in value $150,000 for installation in the new buildings.

Ford to Double Kansas City Plant

KANSAS CITY, MO., May 19—The Ford Motor Co. will double its assembling plant here. To the present three-story 77 by 420-foot plant there will be added a three-story building 400 by 120. The cost is estimated at $250,000.

Ford Plant for Winnipeg

WINNIPEG, MAN., May 14—Work will be commenced immediately on the erection of an assembly plant here for the Ford Motor Co. The new factory will cost upward of $250,000, and the site is admirably situated, having track facility for shipping purposes, which will allow of the rapid movement of raw material and finished cars. The new plant will be four stories in height.

Fickling Buys Dunlap Wheel Plant

LONG ISLAND CITY, May 14—The Fickling Enameling Corp., this city, has purchased the enameling plant of the Dunlap Wire Wheel Co., located in Long Island City. This plant is one of the best and most up-to-date plants for enameling wire wheels in the country. The corporation is prepared to continue the service supplied by the Dunlap company.

Further Declines in Securities

Wild Rumors and President's Message to Germany Affect Market—Few Gains

NEW YORK CITY, May 15—Wild rumors again had their deadly effect on security prices this week. A violent collapse occurred when word was passed around that President Wilson had been assassinated. During the decline certain interests responsible for the rumor took advantage and cleaned up a tidy sum of money. The stock exchange authorities have ordered an investigation, having thus far traced the report to Pittsburgh.

After the facts of this rumor were known the market picked up, prices seeming to gather strength as time went on until finally the entire market developed a substantial rally, until Friday morning, when President Wilson's note to Germany was made public. The market seemed to interpret it most seriously and prices immediately began to melt away and steadily dropped to the lowest recent figures.

The predictions that Germany would return a favorable reply influenced extensive short covering, which appeared to be the chief source of the buying on Saturday.

A few tire and motor issues closed with gains. Firestone common rose 5 points while that of Kelly-Springfield rose 15 points, the largest gain for the week. International Motor common rose 2 1-2 points and its preferred rose 6 points. Packard preferred rose 4 1-2 points. Chalmers preferred rose 1 point. The drops ranged from 1 to 19 points.

Detroit securities were a little stronger last week, the gains ranging from 1 to 5 1-4 points. Packard common rose 5 1-4 points and its preferred rose 1 point; Continental common rose 5 points while the preferred rose 1 1-2; Chalmers preferred rose 2 points.

Disposes of Lyons-Atlas Interests

INDIANAPOLIS, IND., May 15—J. W. Lyons, who was succeeded by E. H. Pampell in the presidency of the Lyons-Atlas Co., has disposed of his interest in that concern. Mr. Pampell is a Rock Island man.

Pope Co. Not Insolvent

HARTFORD, CONN., May 15—Creditors of the Pope Mfg. Co. can take a grain of hope from the statements of Arthur L. Shipman, associate counsel for Receiver George Pope, made in superior court Friday. To a direct question asked by Judge Burpee, Mr. Shipman said that the concern is not insolvent. Up to the present time the receiver has paid 45 per cent. on claims to creditors.

Charles A. Persons, one of the receivers of the company in Massachusetts, said: "The company's business and condition in this state is, we think, in a very healthy state.

"February shipments were $72,272; March, $135,024; and April, $148,464. As receivers we started with no cash, and now have $177,000 on hand. On April 30 our bills payable amounted to $31,512, while our receivables, after reserve and suspense, were $384,740."

Automobile Securities Quotations on New York and Detroit Exchanges

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co., com	215	..	300	..	..
Ajax Rubber Co., pfd	99	..	101	..	..
Aluminum Castings pfd	98	100	98	101	..
J. I Case, pfd	81	83	80	88	—1
Chalmers Motor Company, com	92	95	91	94	—2
Chalmers Motor Company, pfd	90½	92½	95	98	+1
Electric Storage Battery Co.	..	..	49½	51	—1½
Firestone Tire & Rubber Co., com	287	292	490	..	+5
Firestone Tire & Rubber Co. pfd	106	109	110	112½	..
General Motors Company, com	83½	84½	128	129	—10
General Motors Company, pfd	92	93½	97	98	..
B. F. Goodrich Company, com	26¼	27	40	42	—3
B. F. Goodrich Company, pfd	89¾	90	101	102	— ½
Goodyear Tire & Rubber Co., com	172	176	244	248	—1
Goodyear Tire & Rubber Co., pfd	98	100	105	106½	..
Gray & Davis, Inc., pfd	95	102½	..	..	..
International Motor Co., com	..	5	12½	13½	+2½
International Motor Co., pfd	3	10	31	32	+6
Kelly-Springfield Tire Co., com	..	..	131	134	+15
Kelly-Springfield Tire Co., 1st pfd.	..	..	83	86	..
Kelly-Springfield Tire Co., 2nd pfd.	..	..	130	140	..
Maxwell Motor Company, com	..	..	36	38	—10½
Maxwell Motor Company, 1st pfd	..	..	78½	80	—2½
Maxwell Motor Company, 2nd pfd	..	..	30	32	—8
Miller Rubber Company, com	..	..	180	188	..
Miller Rubber Company, pfd	..	..	104	105	..
New Departure Mfg. Co., com	123	125	106	..	..
New Departure Mfg. Co., pfd	105½	..	136	141	..
Packard Motor Car Co., com	103	..	103	..	—2
Packard Motor Car Co., pfd	94	98	98½	..	+4½
Peerless Motor Car Co., com	18	25	20	21	..
Peerless Motor Car Co., pfd	..	70	..	55	..
Portage Rubber Co., com	..	30	35	38	..
Portage Rubber Co., pfd	..	85	85	88	..
*Reo Motor Truck Company	8¾	9½	14½	15½	..
*Reo Motor Car Company	28	30	31	33	..
Splitdorf Electric Co., pfd	40	50	..	..	..
Stewart-Warner Speed. Corp., com	48	50	60	63	—8
Stewart-Warner Speed. Corp., pfd	99	100	102	104	—1

	1914		1915		Net
	Bid	Asked	Bid	Asked	Ch'ges
Studebaker Corporation, com	34	35	61	63	—3
Studebaker Corporation, pfd	90½	91½	97	99	—4
Swinehart Tire & Rubber Co	60	65	80	90	..
Texas Company	140	141	121	123	—8
U. S. Rubber Co., com	58¾	59	60	61	..
U. S. Rubber Co., pfd	102⅝	102⅞	104	106	—2
Vacuum Oil Company	115	119	194	197	—19
White Company, pfd	107	110	103	108	..
Willys-Overland Co., com	48	52	109	111	—8
Willys-Overland Co., pfd	88	92	98	100	—2

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS					
Chalmers Motor Co., com	92	..	..	92	—3
Chalmers Motor Co., pfd	90½	93	95	98	+2
Continental Motor Co., com	150	180	175	185	+5
Continental Motor Co., pfd	..	80	83½	85½	+1½
General Motors Co., com	83½	84½	128	130	—11
General Motors Co., pfd	92	93½	98	100	..
Maxwell Motor Co., com	10½	11½	35	39	—10
Maxwell Motor Co., 1st pfd	42½	43½	76½	78	—4
Maxwell Motor Co., 2nd pfd	17	18	31	32½	— ¼
Packard Motor Car Co., com	103	..	103	105	+5¼
Packard Motor Car Co., pfd	97½	..	98	100½	+1
*Reo Motor Car Co	..	28¾	32¼	33¾	+1¾
*Reo Motor Truck Co	9¾	10½	14¾	15½	— ¼
Studebaker Corp., com	..	..	61½	63½	—5½
Studebaker Corp., pfd	..	..	..	100	—2
INACTIVE STOCKS					
*Atlas Drop Forge Co	..	21	..	26	..
Ford Motor Co. of Canada	..	555	700	..	..
Kelsey Wheel Co.	..	193	195	..	..
*W. K. Prudden Co.	..	21	19½	21	..
Regal Motor Car Co., pfd	..	35	..	25	..
BONDS					
General Motors, notes 6's, 1915	101	102	..	..	..
Packard Motor Co. 5's, 1916	95	98½	98¼	..	..

---

*Par value $10, all others $100 par value.

Maxwell Wins at Columbus

Endicott Covers 100 Miles in 1:38:28 2-5—Rickenbacher Stars First Day

COLUMBUS, O., May 17.—One of the most successful race meetings ever held in Columbus took place at the Columbus Driving Park May 15 and 16. The weather was favorable, and the crowd on Sunday was the largest that ever attended an automobile race in the Buckeye capital. It is announced that about 18,000 attended.

The feature of the meeting was the 100-mile race, in which eleven cars started. This race was won by Endicott in a Maxwell in 1 hour 38 minutes and 28 2-5 seconds. He finished only 10 seconds ahead of Hearne in a Case, who had closely pursued him from the eightieth mile. Endicott did not stop at all during the race, and negotiated the last 25 miles with a bad front outside tire and the last 15 miles with two tires about ready to collapse. For the last 15 miles it was a question if the tires would hold out, as those on the Case driven by Hearne were good. Hearne stopped only once, in the seventy-seventh lap to adjust his clutch, and in so doing lost the lead which he had maintained from the seventeenth lap.

Two accidents occurred during the race, but luckily none were serious. Rickenbacher, driving a Maxwell, took the lead from the start and was almost a lap ahead on the seventeenth mile when his right front tire blew out and he went through the fence. He, as well as his mechanician, escaped injury.

Gotof, driving a National, went through the fence about the same place on the twenty-ninth lap and also escaped injury. Disbrow, driving a Case, went out on the forty-fourth lap because of a broken valve. Milton, driving a Mercer, had considerable trouble with his transmission, and Tidmarsh, with the Great Western, also had trouble. At the finish eight cars were still in the running, though all but five were really out of the race.

Louis Disbrow, while driving his Simplex Zip in an exhibition mile, went through the fence after breaking his right front axle, but like the other two escaped injury. He was driving alone.

Rickenbacher Wins 25-Mile

During the first day's racing the feature was the 25-mile minor sweepstakes and consolation race. There were eight starters in this event, which was won by Rickenbacher in a Maxwell in 23 minutes and 18 3-5 seconds. Hearne, in a Case, was second, and Raimey, in a Case, was third.

Some interest was stirred up in the match race between Disbrow in his "Jay Eye See" and Rickenbacher in his "Blitzen Benz." This was scheduled for the first day, but Rickenbacher entered under protest because of a broken magneto. He tried to have the magneto repaired and started the second day, but was beated by Disbrow in 1:04 2-5. Rickenbacher's car did not run well.

In the 5-mile free-for-all final heat Raimey, in a Case, won, with Hearne, in a Case, second and Disbrow, in a Simplex Zip, third. The time was 4:58 3-5.

In the Australian pursuit race Endicott won on the seventh lap by passing Brown in a Chalmers, Jennings in a Keeton and Tidmarsh's Great Western.

In the exhibition performances Disbrow in his "Jay Eye See" covered a mile in 52 4-5, while Rickenbacher went the distance in the "Blitzen Benz" in 51 3-5.

In the team match race between the Maxwell and the Case teams, Hearne in a Case covered the 5 miles in 4:55 2-5, with Raimey in a Case second in 4:55 4-5 and Endicott in a Maxwell third in 4:56.

There were six starters in the 5-mile consolation race, which was won by Tidmarsh in the Great Western in 5:11 3-5. Clarke in a Tornado was second and Gotof's National third.

Table of Results in Columbus 100-Mile Race

Car.	Driver.	10	20	30	40	50	60	70	80	90	100	Time
Maxwell	Endicott	4	3	3	3	3	2	2	1	1	1	—1:38:28 2/5
Case	Hearne	2	1	1	1	1	1	1	2	2	2	—1:38:38 2/5
Edwards Special	Kennedy	7	7	6	6	6	5	3	3	3	3	
Tornado	Clarke	5	4	4	4	4	4	4	4	4	4	
Case	Raimey	6	6	5	5	5	5	5	5	5	5	
Chalmers	Brown	9	9	8	8	8	6	6	6	6	6	
Great Western	Tidmarsh	8	8	7	7	7	7	7	7	7	7	
Case	Disbrow	3	2	2	2	2	out, broken valve.					
Mercer	Milton	11	10	out, dropped driveshaft.								
National	Gotof	10	5	out, went through fence.								
Maxwell	Rickenbacher	1	out, went through fence.									

Chicago Automobile Club To Handle Speedway Race

CHICAGO, ILL., May 14.—By a contract signed today by President J. T. Brown of the Chicago Automobile Club and David F. Reid, president of the Speedway Park Assn., the C. A. C. is given complete control of the first 500-mile race to be held on Chicago's new speedway June 19. The contract provides that the club shall have "absolute and exclusive control of the track, pits, judges' stand and appurtenances thereto and all parties working thereon or therein on the 19th day of June and in the preliminary practice for the race." The local club is to receive for this service $1,000.

Guarantee of the purse of $54,000, the largest ever offered for a motoring event, is provided by the stipulation that it be placed in the hands of the referee 4 days prior to the race. The contract also calls for the completion of the track by June 5. According to the contractor, the surface will be ready for practice by June 1.

Arrangements with the speedway are similar to those under which the C. A. C. conducts the annual Elgin road races. The club is to provide all officials.

Work Starts on Twin City Speedway—Race in October

MINNEAPOLIS, MINN., May 15—Work was begun on the Speedway of the Twin City Motor Speedway Co., Fort Snelling. The first sod was turned by Mayor Winn Powers, of St. Paul. Representatives were present from the Minneapolis Civic & Commerce Assn. and the St. Paul Association of Commerce. The contractors will move 200,000 cubic yards of dirt at a cost of about $30,000. Two million feet of dimension timber has been ordered and 50,000 barrels of concrete. The track is to be completed by August 15. The first race is planned for the first Saturday in October. A Twin-City 500-mile classic will be run annually, and another race for July 4, 1916, and thereafter each year.

$12,000 for Hamline Races

MINNEAPOLIS, MINN., May 15—For the 2-day automobile races at the State Fair grounds at Hamline between Minneapolis and St. Paul next fall, a purse of $12,000 has been voted by the directors. The races will be September 8 and 11. Supervisor Charles Patterson and Superintendent J. R. Hickey will attend the Indianapolis race to interest drivers. The program will be made for a 150 or 200-mile race. The track is a 1-mile dirt oval. It has been rented to J. A. Sloan and E. A. Moross for a race June 26. The race is to be under auspices of the International Contest Assn.

Rules for Yellowstone Tours?

WASHINGTON, D. C., May 18—The possibility of horses taking fright at the sight of automobiles in Yellowstone Park when it is opened to motor traffic on August 1, has brought out a plan, worked out by Colonel Brett, U. S. A., the superintendent of the park, which will give entrance to the park during certain hours to automobiles alone, and during certain hours to horse-drawn vehicles alone. All traffic must be in one direction—opposite to the hands of the clock.

New Jitney Assn. Is International

Headquarters at Kansas City—Insurance Plan Approved—Officers Elected

KANSAS CITY, Mo., May 14—Fixing permanent headquarters at this city and electing as its officers men who live in this vicinity, the first International Jitney Assn. convention was brought to a close by a resolution thanking the American Federation of Labor for indispensable assistance. The place of the next annual convention is to be submitted to a majority referendum on February 1.

The convention recognized three breakers ahead—legislation and danger of the disintegration of the association and the operating costs of jitney buses which is a very indeterminate factor.

A temporary committee on legislation reported that it was opposed to any drastic regulation at this time and proposed a wait until regulation could be intelligent. This was approved.

There was enthusiasm and comradeship among the members, several of whom represented several associations. The backing of trade unionism has given the association most of its confidence and the closing resolution required that all purchases by the association should bear the union label, wherever possible. It was voted to make the organization international in order to admit Canadian operators.

To Study Operating Costs

Operating costs are to be studied by the committee on equipment and good roads and bulletins sent to the members. The convention hopes to get rates on supplies by giving its endorsement to certain commodities. Applications for associate memberships have been made by the Highland Body Co., Cincinnati, O.; Gramm Motor Truck Co., Lima, O., and the Pennsylvania Rubber Co., Jeannette, Pa.

W. H. Miller, chairman of a temporary committee on insurance, reported that several different plans of insurance had been studied, and recommended, without prejudice to the others, the National Indemnity Exchange which will ask the state of Missouri for a charter when the new insurance laws go into effect on June 18.

The indemnity exchange has a mutual or lodge plan and will issue separate policies for fire and theft, public and passenger liability, property damage and collision insurance. It is said that the cost, which will be figured on a horsepower rate, will be from 50 to 75 per cent. less than that charged by old line companies.

A National Organizer

Local jitney associations are to be admitted to membership on payment of $10 fee and 25 cents initial membership fee for each car in each local association and 10 cents per month per car. Single memberships are $2 down and $1 per year.

As soon as money comes into the treasury, a national organizer is to be en-

Entries Vary Greatly in Displacement

(*Continued from page 887*)

there are two individual systems used, one with a plunger pump and the other with a rotary gear pump. There are also two independent ignition systems with two separate Bosch magnetos and two sets of sparkplugs. All the bearings except the connecting-rods and wristpins are ball design. The carbureter is a Zenith, and the tires 32 by 4 front and 33 by 4.5 rear of Nassau make on Rudge-Whitworth wire wheels. The gear ratio is 2.25 to 1 and the car weight is stated to be 1,750 pounds.

First Non-Stock Stutz Cars

Most of the details of the Stutz cars will be kept a secret until after the race. The cars are, however, different from any Stutzes as yet made and are interesting because they are the first pure racing machines as yet made by the Stutz company. All three will be alike. They have four-cylinder block motors 3 13-16 by 6.5 inches, giving just a little over 296 inches piston displacement. The wheelbases are 103 inches and they will be equipped with Silvertown cord tires on Houk wheels.

The motors have sixteen valves, four to a cylinder. The camshaft is overhead and the valves are set at an angle in the cylinder. The crankshaft is carried on three ball bearings and the motor is oiled by a combination force feed system which delivers oil independently to the ball bearings of the crankshaft and through the hollow shaft itself to the lower connecting rod bearings. The pistons are a special alloy and are very light, giving a motor designed for high speeds. The best efficiency is somewhere in the neighborhood of 2,800 r.p.m.

The gearset provides three speeds and the car weight is 2,150 pounds with oil in the motor but the tanks not full. The rear system is a duplicate of that employed on the regular stock Stutz model. It is stated that this new Stutz has already made faster time than the fastest time made by a Stutz car in the race of last year.

Cornelian Smallest Entry

The smallest entry in the race is the Cornelian. This car has a piston displacement of only 117 cubic inches, a little over 1-3 of the limit. The motor is a four-cylinder Sterling, valve-in-head design, 2.875 by 4 inches with 1.25-inch valve. The pistons are of aluminum alloy and the motor is said to be capable of a speed of 3,500 r.p.m. A flexible rear axle with four universals is one feature, two transverse half elliptic springs for the front suspension is another, and a third is the use of a single steel shell to form the body and frame. The car will be piloted by Louis Chevrolet.

Mercedes Overhauled

Ralph De Palma's Mercedes has been overhauled completely and fitted with a new body at the Packard factory. It also has a Packard carbureter. No change in the engine was necessary to bring it to the 300 cubic inch limit, as it always has had a displacement of 274 cubic inches, its dimensions being 3 5-8 by 6 inches. The horsepower is about 100, and the car weighs 2,300 pounds fitted with its new body and ready for the race. The body is streamline in type, and the wheelbase is 110 inches.

John De Palma's Delage is the machine which Rene Thomas drove at Indianapolis last year—the winner. Only, in order to bring it within the 300-inch limit, the National company is overhauling it and putting in smaller cylinders. In other respects it is without change.

The Emden is one of the dark horses as regards performance, although the specifications covering the main points have been announced. The car is entered by its builders, the Donaldson Bros., and is to be driven by Harry Grant Donaldson, with one of his brothers as mechanician. It is a four-cylinder design with 4.25 by 5.25 cylinders, having a piston displacement of 298 inches. 34 by 4 1-2 Silvertown cord tires are used on Rudge-Whitworth wire wheels. Ignition is by a Bosch double-distributor magneto and the carbureter is a Rayfield. It is geared 2 13-20 to 1.

Many of the entrants are keeping their specifications profoundly secret. The Sebring car to be driven by Joe Cooper is another of the cars of which little or nothing is generally known and the Bergdolls are likewise enveloped in secrecy.

gaged by the directors and sent on a tour. Where his time is engaged by an embryo local association, it is to reimburse the national body.

Several interesting statements were made in addresses to the convention. W. H. Miller, president of the Kansas City Transportation Co., said:

"It would take 4,800 Fords or 1,200 large buses to care for the overflow from our jitneys in this city alone today." He went on:

"I would insist that all operators be required to take a physical and mental examination in order that we have only fit drivers."

Harry G. Kyle, ex-police judge and attorney for the Kansas City Automobile Dealers' Assn. said: "For the permanency of your service I would recommend that you drive all the time, day and night, rain and shine. I notice that it is hard to get a jitney when the weather is bad. This will not maintain your popularity.

Factories to Meet Demand

"In my discussions with automobile dealers I find that many factories are planning extensively on a big jitney development.

"It is my honest opinion, after a study of the jitney situation, that there will not be a steel rail in any of our large cities in 10 years and that all local transportation will be by motor."

Officers of the Association

Officers of the International association are: Perry T. Allen, Springfield, Mo., attorney for the Teamsters and Chauffeurs' Union, president; E. F. Maxwell, manager of the Topeka Jitney Co., Topeka, Kansas, vice-president; E. K. Carnes, traffic manager of the Kansas City Jitney Assn., secretary-treasurer; Ross B. Gilully, Kansas City, Mo., general counsel; Dr. Gordon A. Beedle, Kansas City, Mo., national medical adviser.

The board of directors is to consist of president and vice-president and the chairman of three standing committees, as follows:

Ways and Means, William Haensler, secretary of the Auto Service Assn., San Antonio, Tex.; Insurance, Rex Means, St. Joseph, Mo.; Equipment and Good Roads, C. F. Morphu, manager of the Kansas City Transportation Co., Kansas City, Mo.

Atlanta to New York City by Jitney

ATLANTA, GA., May 13—Atlanta to New York City by jitney is a new project about to be started by local promoters. This line will reach New York City by way of Washington. The name jitney will be used, although the fares charged will be the same as those now in vogue by the steam or trolley lines running parallel to the jitney route.

The promoters intend to make Atlanta the hub of a number of overland jitney lines, extending northwest to link up with the metropolis of the Southeast, such cities as Richmond, Washington, Baltimore, Philadelphia and New York.

The first lines will be from Atlanta to Aiken, S. C., on the northeast, Montgomery, on the southwest, and Chattanooga on the northwest, these to be initial links in the jitney lines to New York and New Orleans. The plan is to form an association, each member operating his cars over a specified number of miles, constituting one link in the route. Each scheduled car's run will be about 25 miles.

Jitneys To Be Regulated in Texas

AUSTIN, TEX, May 14—Jitneys received a severe blow on May 5 when the constitutionality of the city ordinance of Fort Worth which sought to regulate the operation of jitneys, was upheld by the court of criminal appeals. This opinion affects the operators of jitneys all over the state.

The court today, in an opinion by presiding Judge Prendergast, held cities have a perfect right to regulate the operation of jitneys and motor buses. The contention of the applicant, I. W. Sullivan, who was convicted in the corporation court of the violation of the city ordinance of Fort Worth regulating jitneys, was that the $10 fee charged jitneys under the ordinance was occupation tax and therefore unconstitutional. The court held it was a license fee. The court also held that a city has the right to prescribe and designate the routes over which jitneys shall be operated as provided in the Fort Worth ordinance.

Jitneys Boom in Kansas City

KANSAS CITY, MO., May 17—Jitney bus service in Kansas City is expanding as rapidly as did the touring car service at the beginning of the jitney era. The Kansas City Jitney Transportation Co. is adding to its number of cars on its routes, and increasing the schedules. The Kansas City Motor Bus Transportation Co. has been organized by ten individual owners of buses, and has installed a service to be 4-minute at rush hours, 6 minutes at other times, between the downtown district and a terminus near Electric Park, the amusement park of the city. The travel will be almost entirely over boulevards.

A regular motor bus service is in operation between Kansas City and Belton, Mo., 29 miles. A bus line operates, three round trips daily, between Parkville, 11 miles, and Kansas City. Another bus has just been put on a rural route; it operates between Independence, Mo., and Wellington, Mo., 35 miles, and is especially useful for produce delivery as well as passenger traffic.

Rural motor bus service from the city received a demonstration May 15, when several thousand visitors to Longview, the show farm of R. A. Long, millionaire lumberman, used that means of transportation in preference to the railroad.

Jitneys Face Arrest

SEATTLE, WASH., May 10—Five hundred and fifty operators of taxicabs and jitney buses in Seattle are in danger of arrest for running automobiles for hire without complying with the new state law requiring such vehicles to be covered with bonds in the sum of $2,500 as protection for passengers in the event of injury. Prosecutions of jitney bus operators is to be begun at once by Prosecuting Attorney Alfred H. Lundin, following the conviction of the Seattle Taxicab Co. in the Superior Court of King County for having carried passengers without first having obtained a bond, as prescribed in the newly enacted statute.

May Require Franchise

SAN DIEGO, CAL., May 11—Assemblyman Conrad of this city engineered a bill through the Senate at Sacramento without opposition, permitting cities by ordinance to require franchises for operation of jitney buses, sight-seeing motor trucks and taxicabs.

Akron Trolley Revenues Affected

AKRON, O., May 14—Jitney competition will probably force the Northern Ohio Traction & Light Co., in Akron, to curtail its service. While the company had expected a good gain in street railway earnings owing to the increased industrial activity in Akron, the receipts of the street railway lines in that city for April, were $7,000 below those for April, 1914, and substantially all of this decrease was caused by the competition of the jitneys.

$5 to $10,000 Bonds in Savannah

SAVANNAH, GA., May 14—With one important change the ordinance regulating jitney buses has been passed by City Council. Instead of graduating the bond according to a machine's carrying capacity, the ordinance was amended so as to require a $5,000 bond for one car and $10,000 bond for more than one car operated by a person or concern. The ordinance, as originally drawn, provided a bond for $1,000 for each passenger capacity of a car, with a maximum bond of $10,000.

Jitney Package Delivery

ST. LOUIS, MO., May 3—Five-cent package delivery has been inaugurated here by some of the jitney bus people. Packages are delivered within restricted zones for 5 cents. Packages are naturally restricted as to size and weight, extra charge being made for excess.

Factory Miscellany

Troy Body's 3-Story Addition—The Troy Manufacturing Co., Troy, O., manufacturer of automobile bodies, is erecting a three-story addition to its plant.

Franklin's 3-Story Addition—The H. H. Franklin Mfg. Co., Syracuse, N. Y., is about to take bids on a three-story, 56 by 80-foot addition to its automobile factory.

Plughoff Visits Overland Plant—A. D. Plughoff, vice-president of the J. W. Leavitt Co., San Francisco, Cal., and directing Willys-Overland sales on the Pacific Coast, spent several days last week at the Toledo factory.

Rubber Plant Goes to Barberton—The Chamber of Commerce of Barberton, O., has completed negotiations for the removal of the plant of the People's Rubber Co. from Akron to Barberton. The old plant of the Summit Rubber Co. will be occupied and about 100 men will be employed.

J-M Subsidiary's Plant Burned—Several units in the Lockport, N. Y., plant of the Fibre Corporation Co. were burned on May 13 with a loss of $300,000. The fire started when lightning struck one of the buildings during a thunderstorm. The company is a subsidiary of the H. W. Johns-Manville Co.

Truck Part Order to Be Repeated—The Gramm-Bernstein Co., Lima, O., has received orders to duplicate at once a large order for truck parts which was being shipped to England on the Lusitania. The parts were to complete equipment of trucks which had been shipped previously. The plant started on the order at once.

Republic Rubber to Double Shift—The Republic Rubber Co., Youngstown, O., states that May will be one of the biggest months in the plant's history. Some departments are on double shift. The truck tire department is working overtime on a big foreign order. The automobile tire department will turn out 50 per cent. more tires this month than in May, 1914.

Victor Rubber to Add—The Victor Rubber Co., Springfield, O., will erect another building, to be two stories, 30 by 108 feet. It will be erected on the ground between the two wings of the main factory building. The addition will be much like the one which was completed a few weeks ago. Work is to be started at once.

Alco Plant Used to Mfr. Shrapnel—The big plant in Providence, R. I., where Alco cars and trucks were built and which has been idle since the American Locomotive Co. discontinued its motor construction, is to be reopened for the making of brass fuse heads for shrapnel for the Allies. Installation of new machinery has begun and it will give employment to about 1,000 men.

Tire Plant Moved to Mt. Vernon—The plant of the Motor Tire Re-Construction Co. has been moved from the outskirts of Long Island City to Mt. Vernon, N. Y., where the company will use two buildings, one being 100 by 60 feet, two stories high, and the other 130 by 70, four stories high. The New York City offices of the company have been moved to 52 Vanderbilt avenue, in the Vanderbilt Concourse Bldg.

To Rebuild Detroit Auto Dash Plant—Within about 48 hours the people of Milford, Mich., subscribed $1,476.50 towards a cash fund of $1,500, which is part of the conditions under which the plant of the Detroit Auto Dash Co. will be rebuilt. Experts stated that to replace the bare factory building it would require $4,564. It was decided that during 5 years the village taxes would be omitted. The new plant is to be ready within 4 or 5 weeks.

Canadian Ford Breaks Record—Two days after it announced to its men that a minimum wage of $4 a day was in effect, the Ford Motor Co. of Canada, Ltd., Ford, Ont., turned out a record production of cars. One hundred and seventy-one Ford cars were built and shipped on April 23. The best previous record was made on April 13, when 166 cars were shipped by the Ford company. The 1,700 employees of the company were working a 9-hour day up till April 21, when the wage increase was announced and when the hours of labor were shortened to an 8-hour day.

The Automobile Calendar

May 25-26	New York City, National Assn. of Manufacturers' Convention; Waldorf Astoria.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind., H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
May 29	Philadelphia, Pa., Stone Harbor Memorial Day Run from Philadelphia.
May 29-30	Seattle, Wash., Track Races; Northwest Automobile Assn.
May 31	Newark, N. J., Track Race, Olympic Park, Malty Matthews Auto, Racing Assn.
May 31	York, Pa., Track Race, York Fair Grounds, York Motor Club.
June 3	New York City, 11th Annual Automobile Outing for Orphans; Orphans' Auto. Day Assn. of N. Y.
June 7-11	San Francisco, Cal., National Electric Light Assn.
June 9	Galesburg, Ill., 100-Mile Race, Galesburg District Fair Assn.
June 11-12	Effingham, Ill., Hillclimb and Fuel Economy Test, Salt Creek Hill, Effingham Automobile Club.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
July 5	Visalia, Cal., Road Race, Tulare Co. Auto. Assn.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Races.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 8-11	Hamline, Minn., 2-Day Meet at State Fair Grounds between Minneapolis and St. Paul, State Fair.
Sept. 13	Oakland, Cal., Pan American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct.	St. Louis, Mo., Show, Forest Park Highlands, St. Louis Automobile Manufacturers and Dealers' Assn.
Oct. 1-2	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 2	New York City, Sheepshead Bay Motor Speedway Track Meet.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show; Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.

The Week in the Industry

Gockenbach Columbus Fisk Mgr.—The Fisk Rubber Co. has opened a branch in Columbus, O., located at 206 East Gay street in charge of H. S. Gockenbach as manager.

Sommerville Rolls Royce Rep. at Exposition—A. G. Sommerville has been named special representative at the Panama Pacific International Exposition for the Rolls Royce, Ltd., of London.

Kidder Toledo Goodrich Mgr.—H. W. L. Kidder has been appointed manager of the B. F. Goodrich Co. branch in Toledo, O., succeeding C. W. Wacker, who has been promoted to the Cleveland territory.

Hipple N. Y. Mitchell Sales Mgr.—George Hipple, sales manager of the A. Elliott Ranney Co., New York City, former distributor for the Hudson car, has resigned to go with the Carl H. Page Motors Co., the new Mitchell agency, in the capacity of general sales manager.

Garage

North Platte Garage Destroyed—The Hinman garage at North Platte, Neb., was destroyed by fire recently, twenty automobiles in it also being burned; loss, $20,000 to $30,000.

St. Louis Fisk in New Home—The Fisk Rubber Co. has become installed in its new home in St. Louis, Mo., with an entirely new equipment of tire and vulcanizing machinery.

New California Firestone Branch—The Christensen Auto Supply Co., Long Beach, Cal., is the name of a new firm which is handling the Firestone products. P. C. Christensen heads the firm.

Noncarbine Opens In Boston—L. W. Abbott, New England representative of Noncarbine, has just opened salesrooms in Boston, Mass., at 157 Massachusetts avenue, leasing a section of the quarters occupied by the Auburn agency.

Woman Garage Proprietor—The Wollaston Garage at Quincy, Mass., is now being conducted by a woman, Miss McCabe, and she has worked out a novel way to advertise it by having flowers of all kinds tastefully planted about the place, making it unusual and attractive.

Large Garage for Baltimore—Plans are under way for one of the largest automobile garages south of New York. It will be built for William J. Tickner & Sons, Baltimore, Md. It will be 380 by 240 feet, thoroughly equipped and large enough to care for at least 150 machines. Day and night service will be arranged.

Motor Men in New Roles

Watt Heads N. Y. Swinehart Branch—F. D. Watt, formerly manager of the Philadelphia, Pa., branch of the Swinehart Tire and Rubber Co., is now manager of the company's New York City branch.

Stoddard Transferred—Harry Stoddard, who represented the Simms Magneto Co. in Detroit has been transferred to the home office at East Orange, N. J., where he is in charge of the sales department.

Shaw Heads Boston Scripps-Booth—The Scripps-Booth Co. has opened salesrooms in Boston, Mass., at 618 Commonwealth avenue, with A. V. Shaw, formerly with the Franklin agency, in charge of it.

Parker Is District Manager—F. G. Parker, who has been in the automobile field in Maine several years, but left some time ago has gone back to Portland where he is now in charge of the Maxwell Motor Co.

Haney Heads U. S. Tire Branch—The United States Tire Co. has opened a branch at Manchester, N. H., at 1128-38 Elm street, and J. P. Haney, who has been at the Boston branch has been placed in charge.

Mead Heads Stewart-Warner in Portland—A speedometer service station, representing the Stewart-Warner Speedometer Corp. for the Northwest, has been opened in Portland, Ore., at 333 Mead street, with C. H. Mead as manager.

Riley Resigns from Studebaker—N. J. Riley, assistant treasurer of the Studebaker Corp., South Bend, Ind., has resigned, so as to retire from active business permanently. Riley has been an officer of the company for more than 20 years.

Skeetop Returns to Boston—S. A. Skeetop, who had been identified with the Lexington line in Boston, Mass., and later in Providence, R. I., has returned to Boston to become manager of the H. S. Waite Co., agent for the Grant car in the Bay State.

Holly Mgr. Boston Garford—A. S. Holly, until recently manager of the J. C. Tucker Co.'s Boston branch, handling the Chase trucks, has been made manager of the R. E. Taylor Corp., that handles the Garford line in New England, with headquarters in Boston, Mass.

Soule Buys Out Branch—Arthur Soule, formerly of Windham, Me., who has been located at the Chicago agency of the Studebaker for the past 5 years, has returned to Portland, Me., where he has bought out the Studebaker branch located at the Central Garage on Oak street.

Wooler Chandler Designing Engineer—Ernest Wooler, who came over to the United States in 1913 as a member of the Institution of Automobile Engineers, to take up a position as designing engineer with the Continental Motor Mfg. Co., Detroit, has resigned to take a similar position with the Chandler Motor Car Co., Cleveland, O.

Fenstermacher Overland Distributor—S. E. Fenstermacher, of Berwin, Pa., has been appointed distributor for Willys-Overland cars for the northeastern district of Pennsylvania. His organization will be known as the Overland-Berwick Co., of Berwick, Pa. Mr. Fenstermacher has been an Overland dealer since the initial year of the Willys-Overland car.

Dealer

Portland Locomobile Moves—The home of the Locomobile in Portland, Ore., has been removed to 490 Burnside street.

New Mohawk Tire Agents—The Southern Motors Co., Louisville, Ky.; the Scanlon Auto Tire & Supply Co., Rochester, N. Y.; The Erie Supply Co., Toledo, O.; W. J. Holliday Co., Indianapolis, Ind., and the Utica Cycle Co., Utica, N. Y., have recently taken on the distributor's proposition for Mohawk tires.

Packard's New Chicago Addition—A five-story fireproof reinforced concrete service station building is to be erected at 2336-40 Indiana avenue for the occupancy of the Packard Motor Car Co., Chicago, Ill. The building will occupy 70 by 150 feet, and will cost in the neighborhood of $125,000, and will be completed by October 1.

New Ford Service Station in Hartford—The Elmer Automobile Co. has purchased the Palace automobile station at 348 Trumbull street, Hartford, Conn. This property is occupied by the Palace Auto Service Co., Mitchell and Oldsmobile representatives. Mr. Elmer plans to convert the big garage, one of the very first in this city, into a Ford service station. The Palace company will continue to occupy the front of the building. The Elmer company does the largest business of any of the local concerns, having the Ford in five counties of the state.

ZENITH
R.F.H.
SIMPLICITY
SUPERORITY
PRECISION
PERMANENCE
CARBURETOR
·MADE IN DETROIT·

Overland

TRADE MARK REG.

SIX

$1475

F.O.B. TOLEDO

To Buyers of Sixes

We urge you to examine *all* the Sixes.
This is the easiest way to sell you an Overland.
Price considered, the Overland Six is superior at every point. It has
—better looks—more graceful lines
—the longest wheel base
—the most up-to-date 45 horsepower en bloc motor
—it gives the most flexible performance
—it rides the smoothest
—it more comfortably seats seven adults
—it has high tension magneto ignition
—it has the finest bright French finish, long grained hand-buffed leather upholstery.

For these practical advantages *alone* you should get an Overland Six in preference to any other.

Order yours now.

Catalogue on request. Please address Dept. 329.

"Made in U. S. A."

The Willys-Overland Company, Toledo, Ohio

Other models $795 to $1600. All prices f. o. b. Toledo

by Google

[Automotive Industries 32

GLENVILLE BRANCH
5-28-16
amH

MAGAZINE LOAN COLLECTION

THE AUTOMOBILE

Vol. XXXII
No. 21

NEW YORK, MAY 27, 1915

Ten cents a copy
Three dollars a year

GI
S

I

BIDS fair to l ;s as the
FORD amo ;tributors
writes: "Am eq RDS sold
by me." Excell fficiency
are reasons for th S system
for FORD cars.

Price $75 f.o.b. Boston

GRAY & DAVIS, Inc., BOSTON, MASS.

Cleveland Public Library

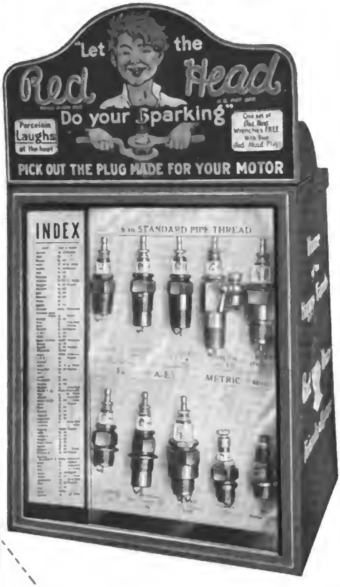
MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

MAGAZINE LOAN COLLECTION

Invest $19.90 In Red Head Plugs and Make Big, Profitable Sales


"Let the Red Head Do your Sparking"
Porcelain Laughs at the heat
One set of Red Head Wrenches FREE with Box Red Head Plugs
PICK OUT THE PLUG MADE FOR YOUR MOTOR
INDEX
STANDARD PIPE THREAD
A.E.
METRIC

through this Cabinet leased free to Garages, Repair Shops and Supply Dealers

It covers the spark plug field like a blanket—it gives you the whole spark plug business in a nutshell.

It contains an assortment of 50 RED HEADS — Standard plugs for all leading cars — Ford, Overland, Reo, Maxwell, Studebaker, Buick, Chalmers, Hudson, etc., also Big Boy plugs for high powered cars and tractors.

As soon as you put in a Display Cabinet you will feel the power of RED HEAD advertising—it connects you with the RED HEAD publicity campaign running in the Saturday Evening Post, farm papers, and medical and motoring magazines.

The display sells for you—the alphabetical car and engine index thinks for you—tells you the size and type of plug required—and the right plug is in the cabinet. No time lost—no sales lost.

With the Cabinet you will receive a full assortment of advertising matter, attractive window display material, street signs, indoor signs, etc.—in fact the Cabinet will put you on the RED HEAD map.

Buy the Cabinet that fits your business: No. 50 contains 50 plugs—your cost $19.90; No. 100 contains 100 plugs, including higher priced types—your cost $44.48.

Place your order at once through your jobber or direct. Use this coupon.

To...

Ship one No. 50 (or) 100 RED HEAD Display Cabinet and Spark Plugs as advertised in Automobile.

Name...

Address...

EMIL GROSSMAN
M'F'G CO., INC.

Bush Terminal
Model Factory No. 20

BROOKLYN
NEW YORK CITY
U. S. A.

Red Head Big Boy

The plug that—

Puts the "Punch" into the Motor
Takes the "Kick" out of the Motorist.

The Plug that the Willys-Overland Co. has adopted as exclusive equipment for Willys-Knight cars.

Over 100,000 sold in the first three months without a line of advertising.

It's a big plug—big porcelain, big steel bushing, big shell—three firing points—and guaranteed forever. $1.00 for all sizes.

Vol. XXXII New York—Thursday, May 27, 1915—Chicago No. 21

The Automobile

Twenty-two Cars Qualify for 500-Mile Race

Wilcox in New Stutz Qualifies at 98.9 M.P.H.—Mercers and Porter-Knights Withdrawn—Cornelian, Smallest Car in Race, Qualifies First Day—Many New Drivers

By David Beecroft

INDIANAPOLIS, IND., Motor Speedway Official Stand—May 24—*Special Telegram*—Speed qualifying trials for the fifth annual 500-mile Speedway race were completed today at 5:30 and the twenty-two cars to start in Saturday's race were definitely known. The trials to select which of the forty cars entered would qualify were scheduled for Thursday, Friday and Saturday of last week, but owing to inclement weather and lack of preparedness on the part of several entrants, the qualifying time was extended for 2 days.

Instead of thirty starters, as a year ago, probably only twenty-two will start, many of the forty entered being eliminated by mechanical troubles and others failing to make the required speed of 80 miles per hour for one lap of the 2 1-2 mile Speedway.

During today many eliminations took place. The team of three new Mercer racers withdrew as two of them broke connecting-rods and tore holes in the cylinder castings and crankcases. The cars were new, some of them having done scarcely 100 miles before reaching the Speedway. The company was not able to get the desired steel for the rods.

Cars Which Qualified

Car	Driver	Time	M.P.H.
Stutz	Wilcox	1:31.0	98.9
Mercedes	R. De Palma	1:31.3	98.6
Peugeot	Resta	1:31.4	98.5
Stutz	Cooper	1:33.0	96.75
Stutz	Anderson	1:33.4	96.4
Sunbeam	Porporato	1:34.0	95.1
Sunbeam	Oldfield	1:36.0	93.75
Peugeot	Burman	1:37.4	92.4
Kleinart	Klein	1:39.8	90.2
Peugeot	Lecain	1:40.6	89.5
Duesenberg	Alley	1:40.0	90.
Sunbeam	Grant	1:40.8	89.25
Duesenberg	O'Donnell	1:41.2	89.0
Peugeot	Babcock	1:41.4	88.9
Sebring	Cooper	1:45.4	85.5
Maxwell	Carlson	1:47.0	84.1
Maxwell	Orr	1:47.8	83.5
Duesenberg	Mulford	1:48.8	82.7
Maxwell	Rickenbacher	1:49.8	82.0
Mais	Mais	1:49.8	82.0
Cino-Purcell	Cox	1:50.4	81.5
Cornelian	Boyer	1:51.0	81.1

There was also keen disappointment when none of the team of three Porter-Knight sleeve-valve cars qualified, due to piston rings breaking. The cars were late in reaching the Speedway and did not have time to work the new motors in. New piston rings were made, but failed to reach here in time.

This year's field of starters gives promise of cutting last year's record of 82.47 miles per hour. While Boillot's Peugeot's qualifying record of a lap at 99.85 miles per hour was not bettered or even equalled, there is this year a group of five or six cars faster than the same number of leaders a year ago. First honors go to Howard Wilcox in one of the new sixteen-valve Stutz cars who made the lap in 1.31, a speed of

98.9 miles per hour, the second fastest circuit ever made on the Speedway. This mark, made Sunday afternoon before an attendance of 7,500, was the most popular event of the 5 days given over to qualifying work.

Mercedes Second

Close behind the Stutz came Ralph De Palma in the Grand Prize Mercedes that won in France a year ago and captured the two Elgin road races last fall. De Palma's time was 1:31.3, only 3-10 of a second slower than Wilcox, and at a speed of 98.6 miles per hour. De Palma made his lap on Saturday. He did not make an additional trial at the Stutz record. Each car in qualifying had three trials if needed. De Palma took two, in 1:31.7 and 1:31.3.

De Palma had but a narrow margin on second place as Resta sent his Peugeot around in 1:31.4, just 1-10 of a second slower than De Palma. Resta drove the track well, but shut off on all four turns, whereas De Palma did not shut off on any of them. Resta's car was designed to carry two extra tires on the rear for road racing and on the Speedway without these the rear is a little light and skids on the turns.

Fourth and fifth places were taken by the other two Stutz cars driven by Earl Cooper and Gil Anderson. Cooper made his best lap in 1:33, a speed of 96.75 miles per hour, and Anderson's time of 1:33.4 was at a pace of 96.4 miles per hour. The work of these Stutz cars qualifying in the first five cars, is one of the best qualifying performances, and stands as a record. The Stutz company set out in a businesslike way to build new designs to meet the 300 cubic inch requirements and have made good. The cars were completed early and have been well worn in.

Sunbeam Sixth

Porporato, a new foreign driver, put his Sunbeam into sixth place in 1:34.6, a pace of 95.1 miles per hour. Burman landed his Peugeot in seventh in 1:37.4 or 92.4 miles per hour. Eighth place was taken by Klein in Kleinart at 1:39.8 or 90.2 miles per hour. Ninth place was taken by Tom Alley in a Duesenberg in 1.40 flat, a pace of 90 miles per hour. The Duesenberg team was late in reaching the track, but was whipped into shape in remarkably quick time. These were the only cars to qualify at a speed of 90 miles per hour or higher. Last year eight cars qualified at 90 or better as compared with nine this year. Last year the motors were 450 cubic inches or under and this year they are 300 inches or under. The small motors have shown up better than was expected.

Oldfield qualified the Bugatti in 1:50.4, a speed of 81.5 miles per hour, but later when warming up for a record trial, burned out a connecting-rod which destroyed the side of the crankcase and the car was withdrawn.

First Ten Cars in 1914

Car	Driver	M.P.H.
Delage	Thomas	82.47
Peugeot	Duray	80.99
Delage	Guyot	80.20
Peugeot	Goux	79.49
Stutz	Oldfield	78.14
Excelsior	Christiaens	77.44
Sunbeam	Grant	75.68
Beaver Bullet	Keene	74.82
Maxwell	Carlson	70.97
Duesenberg	Rickenbacher	70.83

First Ten Cars in 1913

Car	Driver	M.P.H.
Peugeot	Goux	75.94
Mercer	Wishart	73.49
Stutz	Merz	73.39
Sunbeam	Guyot	70.92
Mercedes	Pilette	68.14
Grey Fox	Wilcox	67.65
Mercedes	Mulford	66.95
Case	Disbrow	66.79
Mason	Haupt	63.47
Tulsa	Clark	62.99

First Ten Cars in 1912

Car	Driver	M.P.H.
National	Dawson	78.7
Fiat	Tetzlaff	76.6
Mercer	Hughes	76.3
Stutz	Merz	76.0
Schacht	Endicott	73.3
Stutz	Zengel	73.0
White	Jenkins	72.7
Lozier	Hearne	71.4
National	Wilcox	69.6
Knox	Mulford	56.2

First Ten Cars in 1911

Car	Driver	M.P.H.
Marmon	Harroun	74.8
Lozier	Mulford	74.28
Fiat	Brown	72.7
Mercedes	Wishart	72.6
Marmon	Dawson	72.3
Simplex	De Palma	71.0
National	Merz	70.3
Amplex	Turner	68.9
Knox	Belcher	68.3
Jackson	Cobe	67.9

Emden Withdrawn

The Emden entry from Iowa made a lap in 1:42, or 80.3 miles per hour, but the driver, due to lack of racing experience, was not permitted to drive and the entry was withdrawn.

It was hoped that the Delage entry driven by John De Palma, a brother of Ralph, would qualify which it did in 1:43.4 or 87.25 miles per hour on his first trial. When taking his second trial on Sunday afternoon he skidded entering the homestretch and struck the inside wall, breaking the front end of the frame but not seriously injuring the driver or mechanic; the car skidded on the curve and after turning around twice, rolled three times, without damaging the motor, gearset or transmission parts.

The three Mercers did not have much opportunity for practice. Only one of them came out to qualify. It was driven by Ruckstell and made its lap in 1:47.4 or 84.6 miles per hour.

One of the best qualifying performances was that of the Cornelian with its tiny motor of 116 cubic inches and weighing less than 1,000 pounds. Driven by Boyer it made the 2 1-2 mile lap, in 1:51 or 81.1 miles per hour and was the first car to qualify, taking its trial on Thursday May 20, the only car to take the trials on the opening day.

Although three Bergdoll cars were entered only one reached the Speedway. It arrived before noon today and in its trials failed to qualify, making but 75.95 miles per hour. It was driven by Willie Haupt, who has had a long experience in racing but who was unable to get the motor to fire regularly, missing all the way around the circuit.

Four Peugeots were entered, one being named as a Burman special. As it was a Peugeot design, but with cylinder castings made in an American factory, it was ruled to be a Peugeot entry. This meant that three fastest only would be allowed to start. Two of these cars are larger than the other two, Resta and Burman driving them. It was a fight between Babcock and Lecain driving the smaller two, to see which would qualify. Babcock first qualified.

Lecnin in his second trial, made the lap nearly a second better than Babcock and qualified in 1:40.6 or 89.5 miles per hour. This Peugeot is 183 cubic inches as compared with 274 cubic inches in the cars of Resta and Burman. In their second trials began the battle for positions in the front line of starters on race day, it being considered a big advantage to get in the front line.

The battle for positions in the second line of starters was also a spirited one. The Bergdoll's best time was 1:58.5 or considerably above 1:52.25 which is the lap time for an 80 mile average. Devore in one of the Porter-Knights made the lap in 1:53.7, or a little under the 80 mile an hour gait.

Many old faces in 500-mile races will be missing Saturday and not a single winner of any of the four previous races will be driving. Ray Harroun, the first winner, is managing the Maxwell team but is not doing any driving. Joe Dawson, second winner, will witness this year's race from the pits. Goux and Thomas, winners in 1913 and 1914, are in the war at present. There are other old faces missing this year including Caleb Bragg, Tetzlaff, Knipper, Charles Merz and many foreigners who have been such factors for the last 2 years.

There are new drivers on every hand, some from Europe and many from America. Resta, who recently won the Vanderbilt and Grand Prize, is a real contender. Porporato, handling a Sunbeam, has had a long driving experience abroad.

In the American field are Tom Alley and E. O'Donnell both driving Duesenbergs and who rode as mechanics last year. Other new names are Babcock in a Peugeot, Boyer in Cornelian, Cooper in Sebring, Mais in the Mais, and Cox in the Cino-Purcell.

Four countries are represented in this year's race, America, England, France and Germany, as compared with six in last year's race, Italy and Belgium not being represented this year. Germany has one Mercedes, France has three Peugeots and England has three Sunbeams, a total of seven.

America is represented by fifteen starters representing eight makes. Such American names as Marmon, National and Mercer, so long associatel with 500-mile races, are absent Stutz, Maxwell, and Duesenberg are the three teams representing American factories.

Oldfield Drives Sunbeam

After Barney Oldfield's Bugatti was out with a broken crankcase, Barney was heard to say, "Well, I will watch the race from the Grandstand." These plans were later on upset. Today he signed to drive a Sunbeam, the one to be driven by Graham, an English driver. Graham had qualified the car at 1:43 and Barney in his first trial cut this to 1:36, and so greatly bettered his starting position.

Fast Time Promised

Saturday's start gives promise of being one of the fastest ever seen on the Speedway. In the front row will be four of the fastest cars in the land, two Stutz cars, a Mercedes, and a Peugeot, piloted by such experts as Wilcox, Cooper, De Palma, and Resta. Behind these will come a second line of equally stellar racers, Anderson in a Stutz, Porporato in a Sunbeam, Oldfield in a Sunbeam, and Burman in a Peugeot.

Today the American car record for the 500-miles is held by the National, made in 1912, when Dawson averaged 78.7 miles per hour. In 1913 the fastest American was Wishart in a Mercer who averaged 73.49. Last year Barney Oldfield put the American mark at 78.15 with a Stutz. A new American record is looked for this week.

A protest was lodged with the Contest Board this afternoon by the Peugeot Import Co. against a decision made by the referee requiring Burman's entry to start as a Peugeot.

Burman's car was originally a Peugeot, but as several parts have been replaced during the last year, the Peugeot people believe that under the rules it should be entered as a Burman Special rather than a Peugeot. The apparent reason for the appeal from the referee's decision is that by classing Burman's entry as a Peugeot, one of the four Peugeots entered was not allowed to start, the A. A. A. rules only allowing three cars of any one make to start.

Under this same ruling only the three fastest of the four Sunbeams entered will be allowed to start. The same also applies to the Harroun special, in reality a Maxwell, and which was only allowed to start as a Maxwell. This made four Maxwell entries.

The Deusenberg entries which were late to reach the Speedway made good in their early qualification. Alley set the qualifying pace for his team at 90 miles per hour. O'Donnell was next at 89 and Mulford who reached the Speedway this morning, put the third over at a speed of 82.7 miles per hour. Mulford had entered a car of his own make but it was not shipped from Brooklyn as it was not ready for the race.

Specifications of the 22 Cars That Qualified for the 500-Mile International Sweepstakes Race, To Be Run on the Indianapolis Speedway, Decoration Day

Car	Driver	Bore	Stroke	Cast	Piston Displacement	Valve Location and Number	Diam.	Lift	Gear Ratio	Tires and Sizes	Wheelbase	Carbureter	Magneto
Maxwell	Rickenbacher	3.75	6.75	Block	298	Head 4	2¼	5/16	2.6 to 1	........33x5	....	Master	Bosch
Maxwell	Carlson	3.75	6.75	Block	298	Head 2	2¼	5/16	2.6 to 1	........33x5	....	Master	Bosch
Maxwell	Orr	3.75	6.75	Block	298	Head 2	2¼	5/16	2.6 to 1	........33x5	....	Master	Bosch
Mercedes	R. DePalma	3.60	6.3	Singly	270.9	Head 4	1½	5/16	3.1 to 1	........33x5	112	Packard	Bosch
Sunbeam	Porporato	3.60	6.3	Block	270.9	Head 4	2	½	2.85 to 1	Goodrich 33x5	112	......	Bosch
Sunbeam	Oldfield	3.60	6.3	Block	270.9	Head 4	2	½	2.85 to 1	Goodrich 33x5	112	......	Bosch
Sunbeam	Grant	3.13	5.9	Threes	278	Side 2	2	½	2.75 to 1	Silvertown 34x4½	110	Master	Bosch
Stutz	Anderson	3.7	6.5	Block	296	Head 4	....	....	....	Silvertown 33x5	104	Stromberg	Bosch
Stutz	Cooper	3.7	6.5	Block	296	Head 4	....	....	....	Silvertown 33x5	104	Stromberg	Bosch
Stutz	Wilcox	3.7	6.5	Block	296	Head 4	....	....	....	Silvertown 33x5	104	Zenith	....
Peugeot	Resta	3.60	6.3	Block	274	Head 4	....	....	2.6 to 1	Goodrich 34x4½	....	Zenith	Bosch
Peugeot	Burman	3.1	6.2	Block	183	Head 4	2	5/16	2.5 to 1	......34x4½	107	Master	
Peugeot	Lecain	3.1	6.2	Block	183	Head 4	2	5/16	3 to 1	....33x4½	....	Rayfield	Bosch
Duesenberg	Alley	3.98	6	Block	299	Side Head 2	2¼	½	2.6 to 1	Nassau 33x5	106	Master	....
Duesenberg	O'Donnell	3.98	6	Block	299	Side Head 2	2¼	½	2.6 to 1	Nassau 33x5	106	Master	Bosch
Duesenberg	....	3.98	6	Block	299	Side Head 2	2¼	½	2.6 to 1	Nassau 33x5	106	Schebler	Bosch
Sebring	....	3.98	6	Block	299	Side Head 2	2¼	½	2.6 to 1	........33x5	102	Schebler	Bosch
Purcell	Cox	4.37	4.97	Pairs	299	Side 2	2	5/16	2.3 to 1	Silvertown 34x4½	113	......	....
Cornelian	Chevrolet	2.06	4.25	Block	103	Side Head 4	....	....	2.5 to 1	Nassau 34x5	....	Claudel	....
Delage	J. De Palma	3.65	7.1	Block	299	....	....	....	....	....	....	......	....
Kleinart	Klein	3.98	6	Block	299.5	....	....	....	....	....	....	......	....
Mais	Mais	4.3	4.9	Pairs	284.4	Side Head 2	2¼	½	....	....33x4½	108	Rayfield	Bosch

NOTE.—All cars are four-cylinders, except Grant's Sunbeam, which is a six.

Valve-in-Head Motor Supreme

Close Similarity Marks Many Cars Entered for 500-Mile Race—Multiple Valves Are Common—Ball-Bearing Motors on Many Cars—Gear Ratios Lower

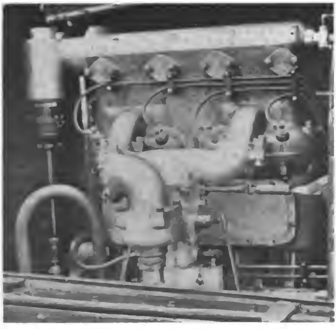
By A. Ludlow Clayden

UNLESS one of the little known cars should show up in a most unexpected and unlikely way it is safe to predict that the first ten cars to finish the Indianapolis Speedway contest will have motors that are very much alike externally. There is not much variation in gear ratio among those which are expected to take a place in the prize list, so there is little to choose in the number of explosions per minute of each motor, which means that high explosion pressure and small windage ought to be the deciding factor.

It is not far from the truth to say that the coming race will be one of acceleration, a test of the power of the cars to get away from 80 miles an hour up to 100, for there will not be many that can do the whole circuit on open throttle. The least sluggishness in getting away as the straightaways are entered is liable to put a car out of the first bunch and this means that weight has a good deal to do with it. Still the main thing is to have as powerful an explosion as possible and it is to this end that we find the predominance of overhead valves, multiple valves and huge intake and exhaust pipes and manifolds.

Motors All One Family

Among the less known cars there are exceptions, but all the names which are household words to the speedway enthusiast denote cars with overhead valve motors and most of these are multiple valve types, too. That is they have three, or usually, four valves per cylinder. The purpose of this is to give the maximum of opening with the minimum lift of valve and weight thereof. For elimination of weight in the valve system and to obtain the greatest possible rapidity of action the majority of the new cars have their camshafts overhead. Some have one and some have two, and there are all sorts of ways of driving the camshaft in use. Some have the valves set at an angle, Peugeot fashion, in a V-shaped combustion chamber; others have them flat, with the stems vertical in an enlarged cylinder head. Some operate the valves almost direct from the cams; others have rockers. But to a man with only a little mechanical knowledge the whole leading bunch are wonderfully similar.


Carbureter side of the Maxwell motor, showing vertical shaft and camshaft drive for overhead valves

Chassis Not Novel

These overhead valve motors are a new feature for racing in America, not because they have not been used before, but because never before has there been so many different cars using the same general scheme in conjunction with all the other kinks of high speed motor work which have been learned from other kinds of racing engines. In the chassis, however we find little that is abnormal and practically nothing that is new.

The Stutz team of three cars is in accordance with up-to-date racing science. There are four valves per cylinder operated by rockers from a single central camshaft which is driven by spur gearing at the front end. Ball bearings are used for the crankshaft, three in number, and the pistons are of a light aluminum alloy. Very considerable secrecy has been observed concerning this new Stutz racing machine, but there is a well accredited rumor to the effect that the motor is made by the Wisconsin company. In appearance the engine bears a strong resemblance to the Mercedes, having the same sort of camshaft case with a good deal of bronze work in it, and the aluminum casing for the train of spur gears at the front end looks very small as compared with Peugeot practice. Doubtless because there is only one camshaft to drive instead of two.

The bodies of these cars are very narrow and the radiators appear to be deeper than usual, so presumably the amount of water carried is greater than that used for most cars on the speedway. Needless to say, the cooling circulation is forced by a large water pump, since thermo-syphon systems are not up to the arduous work of a long race.

The Stutz chassis follows normal lines and is mainly conspicuous for absence of small rods and levers. Although it has no regular streamline tail the radiator, hood and cowl are shaped to offer the minimum of resistance, and a large dual tank for gasoline and oil offers flat sides and a rounded top to carry the draft away over the stern.

Thoroughly American Cars

It is noteworthy that this thoroughly American job is also using an entirely American carbureter in the Stromberg; in fact it is only the Bosch ignition that owes anything to foreign business interests and in this case the foreign nature is overcome by American manufacture. Probably the Stutzes rank high in the estimation of qualified judges of "form" and they are expected to give a very good account of themselves on the great day.

In some of the cars lightness is obtained mainly by the use of small sections of high tensile alloy steels, but in the Maxwells it was preferred to employ larger masses of light alloys. Of course they contain many fine steel portions but their main characteristic is the use of light metals.

Maxwell Has Upright Poppets

The Maxwell motor has overhead valves, of course, but they are not inclined, standing vertical with the stems upward. There are four per cylinder and they are operated by rockers from a single central camshaft, the valves being staggered so as to make room for enough cams.

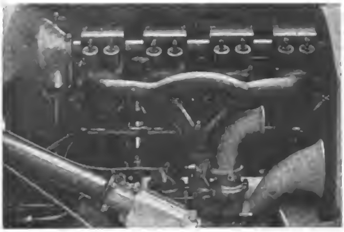
A peculiarity of the motor for these days is that there is no external flywheel unless the clutch be counted as such, since the crankshaft is a counterbalanced structure in which cranks and flywheels are combined. This has been used before for Maxwell motors but hitherto the crankshaft was all one piece, whereas it is now divided in the middle to allow the mounting of a central ball bearing. The rear portion of this compound crankshaft has a splined end which slips into a corresponding female socket inside the center ball bearing. Each flywheel portion has counterweights to balance the crankpins and the rotating parts of the connecting rods.

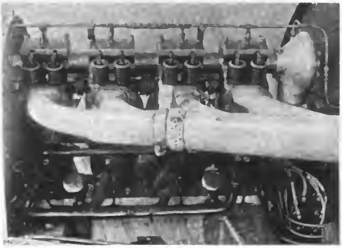
For the pistons an aluminum alloy is employed the weight being thereby cut to 15 ounces as against about 2 pounds for cast iron of similar dimensions; the particular metal used being Magnalium. For other parts such as brake spiders and brackets the choice has been Macadamite, another alloy of great strength and low specific gravity.

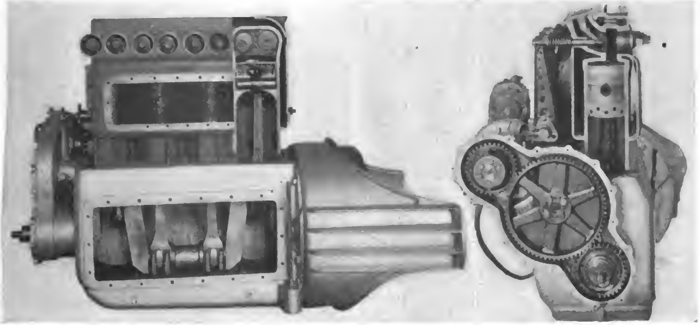
Lubrication is cared for by two independent systems, the simplest being a splash one purely. This is intended only for emergency and is under the control of the mechanic. The main system on which most reliance is placed consists of a low pressure force feed taken to each of the main ball bearings the overflow thence being caught inside sheet metal disks of flat cup form bolted against the balance weight or flywheel masses. Oil is thrown centrifugally to the limits allowed by these inverted saucers and conducted through holes in the crankpins to the connecting-rod bearings.

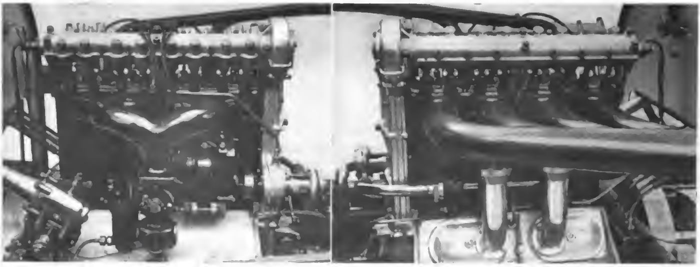
Maxwell is alone in using skew or helical gearing for driving the overhead camshaft instead of a spur gear train or bevel gearing.

A well-known motor appears on almost half the other American entries excepting the small jobs, this being the


De Palma's Mercedes; intake side showing Packard carbureter. It is said that the adoption of this carbureter has clipped several seconds from the time required to make a lap of the 2.5-mile Indianapolis speedway, while there is no trouble in the way of popping and backfiring when shutting the car down on the turns besides increasing the power of the motor for long-distance work


Mercedes exhaust side; note vertical shaft at rear and one of two magnetos driven by a cross shaft


Side and end semi-sectional views of the Duesenberg motors, bringing out peculiarities of construction



Left and right view of Peugeot motors which are expected by many to show up well in this year's race

Duesenberg. This engine is the only example of specialized racing motor manufacture in the world and is fairly well known. The latest models were described in THE AUTOMOBILE dated February 11, page 272, so it is not necessary to do more than outline them here. The overhead valves, two per cylinder, are arranged horizontally and along one side of the cylinder block, while the camshaft is situated in the usual position in the crankcase. Instead of using long push rods and short rockers as has been done in the French Delage motor of similar idea, Duesenberg uses very long rockers with the upper ends bearing against the valves and the lower extremities against the cams. This makes a very neat looking motor and many cars using this engine have shown high speed capabilities.

The lubrication is duplex with a pump forcing in oil in excess of the requirements of the motor and a second pump to remove the surplus and return it to a tank where it can cool. Incidentally this is becoming a regular racing practice since the importance of a steady supply of cool oil was realized.

A particularly interesting small car because it is so small is the Cornelian. This has a Sterling motor of a paltry 116 cubic inch displacement and yet can lap at over 80 miles an hour owing to the negligible weight and windage of the tiny machine.

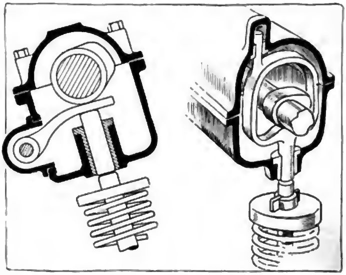
It has no frame at all as the sheet steel body acts as frame as well, and still more extraordinary, it has no axles. This sounds an impossibility, but is explained by the spring system which replaces the axle proper. At the rear there are three springs placed transversely one above and two below and the extremities of these springs are linked to brackets which carry the rear road wheels. The transmission is fixed to the frame-body and drives to the road wheels by two universal shafts after the fashion of the old De Dion cars.

For the front axle a similar construction is used only without the driving shafts, of course, and the car is steered by link rods and chains attached to a small drum which is keyed to the foot of the steering column.

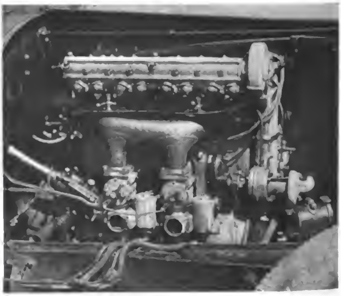
For motor the Sterling of standard type has been bored out a little and the valve gear has been tuned up; also there is a duplex exhaust branch, but the alterations are surprisingly small when the remarkable speed it considered. The total weight is given as 960 pounds only. Of course the car is not expected to come in a winner, but if it completes the course it will be a vindication of many original principles for light car design.

European Cars Important

Two cars stand out foremost among the European entry, Ralph De Palma's Mercedes and Resta's Peugeot. Both



Valve mechanism of Peugeot on the left, and Sunbeam on the right. Both are characteristic racing constructions. The Peugeot type, as may be seen in the illustration, is set at an angle, while the Sunbeam construction is vertically mounted

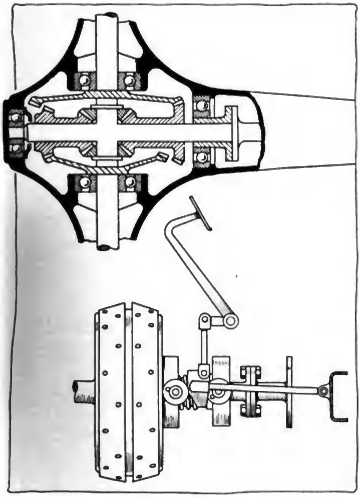


Side view of the Sunbeam motor which involves many unique features of design. Note two carbureters, an unusual construction with a four-cylinder motor represent the best that Germany and France respectively have ever done to date, both are capable of huge speed and both are in the hands of first class men. The rest, the smaller Peugeots and the older cars, have not the mechanical interest of these leading two. We know the cars and look rather to see what the *men* can do with them.

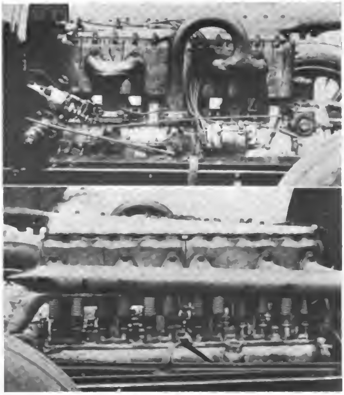
The Mercedes is the one which Wagner drove to second place in the French grand prix last year at Lyons. It has a most original motor in that the separate cylinders are steel forgings with the water jackets of sheet steel welded on. There are four valves overhead, operated by a single centrally located overhead camshaft, rockers being contained in a bronze camshaft casing. The drive for this shaft is by bevel gear and is located at the rear end of the motor, while the bearings are plain and not ball. It contains almost every possible feature of an overhead valve motor, which the Peugeot engineers discarded as not good.

Since this car was dealt with fully in THE AUTOMOBILE just after the French race last July, there is no need to repeat much about it as it has been changed in carbureter only, now having a Packard standard type in place of the original Mercedes. It is understood that this change has cut some two or three seconds off the possible lap time on the Speedway and onlookers can observe that there is no misfiring or popping when the throttle is shut off for the turns as is common with many racing carbureters. Despite the presence of an air valve, which is supposed generally to be bad for high speed work, the Packard carbureter certainly works wonderfully well.

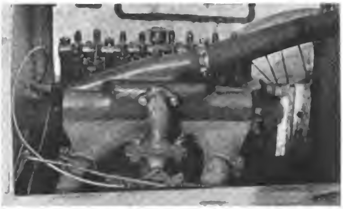
The car now has a new body with a square section tail, this having been built in Detroit to surround the gasoline tank behind the seats. A particularly striking feature is the absolute steadiness of the front wheels when the car is traveling over 100 miles an hour on the straightaways, this being due to a castor wheel system worked out by Mercedes for the French classic.



Mercedes features, above showing the rear axle construction with the duplex bevel gears, and below, the double cone clutch



Sunbeam six motor which will be driven by Grant



Intake side of Sterling motor used in the Cornelian, smallest car in the race

Peugeot List Is Complete

First of all is Resta's car which was the spare car of the Peugeot team at Lyons last year. It is identical with the car that Boillot nearly drove to victory as he was only put out near the finish by a mischance which robbed him of second place. Practically it is as fast as the Mercedes. Cast iron cylinders with four valves per cylinder and two overhead camshafts driven by a train of spur gears at the front end, specify the motor, and the crankshaft bearings are ball. Lubrication is by drip feed through a row of sight feeds which lead to the bearings and sundry other parts, the circulation being maintained by pump and supplementary hand supply.

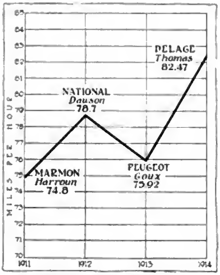
The bodywork has been altered a little; as in the French race a couple of spare wheels were carried standing length-

(*Continued on page* 931)

Speed Records of the 500-Mile Race

Thomas, in the Delage, Covered the Course at 82.47 M.P.H. Last Year—A High Mark for 1915 Winner to Surpass—Speed History

INDIANAPOLIS, IND., May 22—When the thirty-three cars entered in the next Indianapolis 500-mile race start out on their fast journey May 29, they will strive to wrest the laurels away from last year's winner, who negotiated the distance in the record time of 6 hours 3 minutes and 45 seconds, at an average speed of 82.47 miles an hour. René Thomas, in his Delage, indeed did create a record, one which will certainly be worth trying for, when it is considered that this is the second best time made on any track or road in this country for long distance races, the fastest time being made at Corona last Thanksgiving day, when Pullen averaged 87.8 miles per hour in a Mercer for the distance of 301 miles. Previous Indianapolis races, however, have all been fast, each of the winners having made over 74 miles an hour, while nineteen of the prize winners, including the leaders, have succeeded in beating the 70 miles per hour record and twenty-four of them have made the distance under 7 hours. And, to make it more interesting this year, the piston displacement will be smaller than in previous races, the maximum being 300 inches; last year's winning car had 380.2 inches.



Winners' speeds in 500-mile race

Speed Higher Each Year

Going back to 1911 when the first 500-mile race was held, and tracing the time made by the different winners, there was but a slight difference each year; in 1911 Harroun, in a Marmon six, made the distance in 6:42:08, a speed of 74.8 miles an hour; in 1912 Dawson, in a National, bettered the previous record by negotiating the distance in 6:21:06, an average of 78.7; in 1913 there was a perceptible drop in speed, but still better than the 1911 time, Goux's Peugeot making the 500 miles in 6:35:05, an average of 75.94 miles an hour. Last year's time was the best up to that date of any made on either road or track, the previous record having been made at Santa Monica in 1912, by Tetzlaff's Fiat, which averaged 78.71 miles an hour for 300 miles.

A note of interest is brought out by the fact that of the forty prize winners since 1911, there are ten money winners each year, only seven of these were equipped with six-cylinder motors and only one of these sixes succeeded in carrying off first place, and that was in the first race in 1911. The next best showing by the sixes was in 1913 when Guyot's Sunbeam came in fourth, averaging 70.92 miles an hour. Last year Christiaens' Excelsior and Grant's Sunbeam came in sixth and seventh, respectively. This year's list of qualified entries shows only one six, the Sunbeam driven by Harry Grant.

Seating Capacity 75,000

The seating capacity of the track has been increased to 75,000, construction of two new grandstands, seating 15,000 people, having been started last December. Additional improvements

ORDER OF SPEEDWAY TIME RECORDS

Car	Time	M.P.H.	When
Delage	6:03:45	82.47	First in 1914
Peugeot	6:10:24	80.99	Second in 1914
Delage	6:14:01	80.20	Third in 1914
Peugeot	6:17:24	79.49	Fourth in 1914
National	6:21:06	78.7	First in 1912
Stutz	6:23:51	78.14	Fifth in 1914
Excelsior	6:27:24	77.44	Sixth in 1914
Fiat	6:31:29	76.6	Second in 1912
Mercer	6:34:56	76.3	Third in 1912
Peugeot	6:35:05	75.94	First in 1913
Sunbeam	6:36:22	75.68	Seventh in 1914
Stutz	6:36:36	76	Fourth in 1912
Beaver Bullet	6:40:57	74.82	Eighth in 1914
Marmon	6:42:08	74.6	First in 1911
Lozier	6:43:51	74.28	Second in 1911
Schacht	6:46:28	73.3	Fifth in 1912
Mercer	6:48:13.4	73.49	Second in 1913
Stutz	6:48:49.25	73.39	Third in 1913
Stutz	6:50:28	73	Sixth in 1912
Fiat	6:52:29	72.7	Third in 1912
Mercedes	6:52:57	72.6	Fourth in 1911
White	6:52:58	72.5	Seventh in 1912
Marmon	6:54:53	72.3	Fifth in 1911
Lozier	6:59:37	71.4	Eighth in 1912

FIRST TEN CARS IN 1911

Car	Driver	Miles per hour	Time
Marmon	Harroun	74.8	6:42:08
Lozier	Mulford	74.28	6:43:51
Fiat	Bruce-Brown	72.7	6:52:29
Mercedes	Wishart	72.6	6:52:57
Marmon	Dawson	72.3	6:54:34
Simplex	De Palma	71	7:02:02
National	Merz	70.3	7:06:2
Amplex	Turner	68.9	7:15:56
Knox	Belcher	68.3	7:19:09
Jackson	Cobe	67.9	7:21:5

FIRST TEN CARS IN 1912

Car	Driver	Miles per hour	Time
National	Dawson	78.7	6:21:06
Fiat	Tetzlaff	76.6	6:31:29
Mercer	Hughes	76.3	6:33:09
Stutz	Merz	76	6:34:4
Schacht	Endicott	73.3	6:46:28
Stutz	Zengel	73	6:50:28
White	Jenkins	72.7	6:52:38
Lozier	Hearne	71.4	6:59:38
National	Wilcox	69.6	7:11:3
Knox	Mulford	56.2	8:53

FIRST TEN CARS IN 1913

Car	Driver	Miles per hour	Time
Peugeot	Goux	75.94	6:35:05
Mercer	Wishart	73.49	6:48:13
Stutz	Merz	73.39	6:48:49.25
Sunbeam	Guyot	70.92	7:02:58.95
Mercedes	Pilette	68.14	7:20:13
Grey Fox	Wilcox	67.65	7:23:26.55
Mercedes	Mulford	66.95	7:28:05.5
Case	Disbrow	66.79	7:29:09
Mason	Haupt	63.47	7:52:35.1
Tulsa	Clark	62.99	7:56:14.25

FIRST TEN CARS IN 1914

Car	Driver	Miles per hour	Time
Delage	Thomas	82.47	6:03:45
Peugeot	Duray	80.99	6:10:24
Delage	Guyot	80.20	6:14:01
Peugeot	Goux	79.49	6:17:24
Stutz	Oldfield	78.14	6:23:51
Excelsior	Christiaens	77.44	6:27:24
Sunbeam	Grant	75.68	6:36:22
Beaver Bullet	Keene	74.82	6:40:57
Maxwell	Carlson	70.97	7:02:42
Duesenberg	Rickenbacher	70.83	7:03:34

List of Prizes and Cash Offers for the 1915 Indianapolis 500-Mile Race

CASH PRIZES FOR POSITION AT FINISH OF RACE

Donor	1	2	3	4	5	6	7	8	9	10
Indianapolis Speedway....	$20,000	$10,000	$5,000	$3.500	$3,000	$2,200	$1,800	$1,600	$1,500	$1,400
†Wheeler & Schebler......	1,000	500	300	200	—	—	—	—	—	—
*Bosch Magneto Co.......	500	300	200	—	—	—	—	—	—	—
**Bosch Magneto Co......	100	100	100	—	—	—	—	—	—	—
Emil Grossman Mfg. Co...	1,000	—	—	—	—	—	—	—	—	—
Total..................	$22,600	$10,900	$5,600	$3,700	$3,000	$2,200	$1,800	$1,600	$1,500	$1,400

†For Cars Using Schebler Carbureters. *For Cars Using Bosch Magnetos. **For Cars Using Bosch Plugs and Magnetos

TROPHIES

G. & J. Shield for best time 100 miles.
Remy Electric Co., Anderson, Ind. Grand Brassard and Trophy for best time 200 miles.
Prest-O-Lite Co., Boston, Mass. Silver Brick for best time 300 miles.
Wheeler & Schebler, Indianapolis, Ind. Cup for best time 400 miles.

are the erection of a communal garage, accommodating forty cars, in back of the judges' stand, the old garages having been torn down, and their site turned into parking space; the widening of the track on the inside by 15 feet, and the erection of a concrete safety wall all around.

Gate admission is $2. Seat prices in addition to the gate admission, range from 50 cents up to $7, according to position; entire boxes are $60 and single box seats are $7 and $10 according to position. Parking space is free, except for those who want reserved space along the first turn and the main stretch. Space along the main stretch is $10 per car for the front row and $5 per car for the back row; space back of the pits is $25 per car and on the first curve $15 per car for the front row and $10 per car for the back row.

Valve-in-Head Motor Supreme at Indianapolis

(Continued from page 929)

wise of the car and upright inside the tail, which had a humped camel back to accommodate them. This hump has been cut off, as there is no need to carry wheels on the track so the tail is now smooth and ordinary.

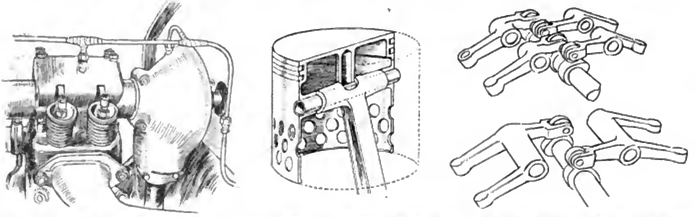
Next in the Peugeot list comes Bob Burman's special car which is a Peugeot with new cylinders, new pistons and new connecting rods. The valve gear is the same as that on Resta's car and the general system is similar, but Burman has cut off 44 ounces of weight from the pistons and a good deal more from the connecting rods. The new pistons are Aloynum and have but a single ring apiece this being very wide, with a deep half round groove cut in the face. This groove catches oil and cares for cylinder lubrication which Burman says was inefficient when first he had the car. The pistons have small holes drilled in them leading to the wristpin which bears in the casting direct, and there is a new oil lead which takes lubricant to the cylinder walls. This lead has two branches and each branch terminates in a double head between a pair of cylinders so that two are fed from each pipe, while there are separate leads to care for the ends of the motor block. Oil is fed under a pressure of 8 pounds per square inch.

The connecting-rod is a hollow form made from a hand forging, very light, very strong, and, it may be added, very expensive, but it is a really beautiful piece of workmanship.

The remaining Peugeots are far below the capacity limit and are not expected to show any very wonderful speeds for, though a three liter Peugeot has once been the surprise of a 500 mile contest, it had not so powerful a field out against it. In general design they are much the same as the larger cars, in fact the latter were developed after the success of the three-liter Peugeots in Continental racing had satisfied the Peugeot engineers that the design was right.

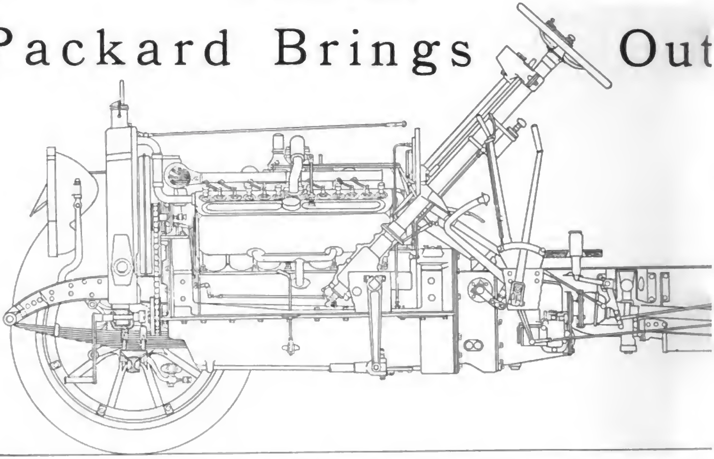
It was an open secret last year that the grand prix Sunbeams were close copies of the 1913 Peugeots, and though there are small detail differences in the motor and many changes in the chassis the statement is true in a broad sense. The motors are almost exactly alike to look at and there is simply a small alteration in the valve operating system. There are two camshafts like the Peugeot, driven in the same way, but instead of using short straight push rods which approximate to a direct action on the valve, the Sunbeams have short rockers. These rockers are not used to bridge a gap between cam and valve, but are simply hinged levers or "fingers." The cam is directly in line with the valve stem head and the finger is there for the cam to wipe against.

Ball bearings are used and oil is fed by sight feeds and pump in the Peugeot way. The pistons are steel with a "leg" which is welded to the center of the head and has its lower extremity resting upon the center of the wristpin so as to give support and help carry away heat from the head. These are the new cars driven by Porporato and Graham.



Left—Mercedes bevel drive for overhead valves. Center—Stutz and Sunbeam type of piston. Upper right—Mercedes uses four rocker arms in valve linkage. Lower right—Stutz with two-rocker arms and two cams for four valves

Packard Brings Out

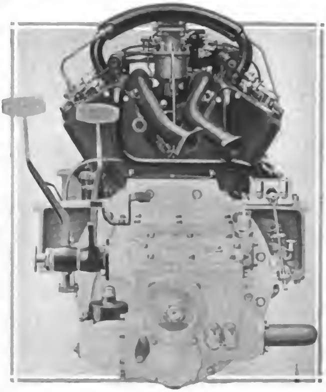


SUBSTANTIATING the many rumors concerning its plans for 1916, the Packard Motor Car Co., Detroit, Mich., has brought out a twelve-cylinder car under the name of the Twin Six. The motor is a completely new design having no connection with the 1915 product of the company and being of high speed capability, embodies the most recent practice in the way of light reciprocating parts, large valve opening, etc. The chassis is neat in appearance, accessibility of parts being an important feature, and the entire construction is the most noteworthy combination of racing motor power with the quietness of the highly developed six that has yet been produced in any part of the world. Never in the history of automobile engineering have the principles of high speed motor design been applied to so large a touring car engine and but little handling of the new Packard is required to prove the result in excess of all possible expectation.

There is no need to go into the pros and cons of twelve-cylinder versus six or eight, as the case was argued along one line of thought in the last issue of THE AUTOMOBILE. Suffice it to say, therefore, that there are several reasons which make a twelve-cylinder motor desirable for very high powers. Against it there is a variety of reasons but the balance seems so far as one can go in theory alone distinctly in favor of twelve smaller cylinders rather than a lesser number of large ones.

The dimensions of the new Packard are 3-inch bore by 5-inch stroke, giving a piston displacement of 424 cubic inches, and it will turn at 3,000 r.p.m. or even more, though the power at low speeds is such that the high end of the range is seldom needed. For the pistons an alloy of aluminum is employed, and the connecting-rods are machined all over so that the reciprocating weight is very small. The pistons weigh 17 ounces complete with rings, and the upper half of the connecting-rod, which is reckoned as a reciprocating mass, weighs 8.5 ounces only, this making the very small total mass of 1 pound 9 1-2 ounces. Now we know that the vibration which may be present in a six-cylinder is due to the weight of the pistons, etc., causing deflections in the crankshaft. Compare then this little piston weight with that in the Packard six-38. This car has a motor displacement of 414 cubic inches, or only 10 less than the present model, but each piston weighed 4 pounds 2 ounces and the total reciprocating mass was 5 pounds 8 ounces. Thus it is easy to see wherein lies the extraordinary smoothness of the twin six.

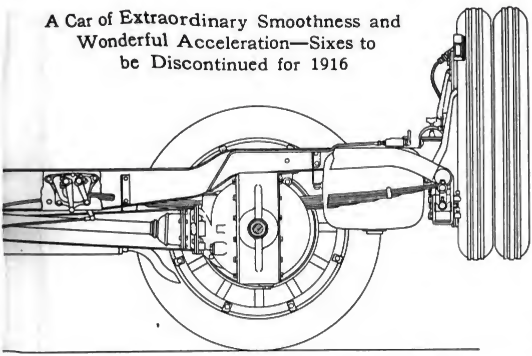
To appreciate this smoothness in combination with high power it is essential to ride in the car.



Rear end of Packard power plant. This shows the small width of the motor but does not do justice to the valve accessibility

Twin Six Chassis

A Car of Extraordinary Smoothness and Wonderful Acceleration—Sixes to be Discontinued for 1916



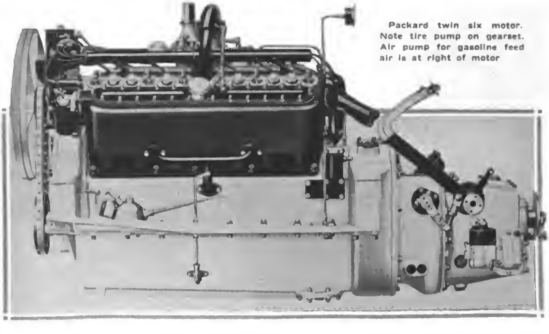
All that one can say is that the twelve is an attempt to combine the advantages of six and eight and to simultaneously eliminate many of the disadvantages of both. To what extent the attempt has succeeded is a matter for each man to decide for himself, but *for large engines*, a very short experience of the twelve on the road is enough to prove that there is much more in the system than anyone would have imagined.

Layout of the Motor

However, to return to the description of the new chassis; the motor has two block castings of six cylinders each set on an aluminum crankcase at 60 degrees, so as to give the best torque, which is obtained with even intervals between the explosions. The valves are located between the cylinders in ordinary L-head fashion, but they are remarkably accessible, because the narrowness of the 60-degree V motor allows the generator and starting motor and the other attachments to be mounted alongside the engine just as in an ordinary four. This clears the valves of all obstruction and the carbureter is placed high enough to be ideal for accessibility in itself and quite out of the way of the valves.

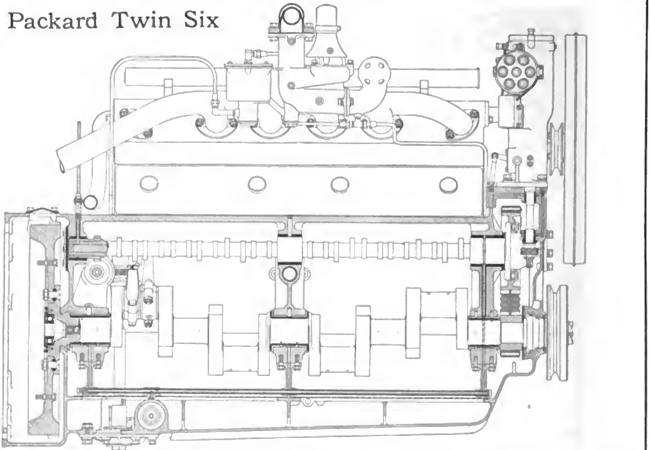
An advantage of small cylinders is that a high compression can be used and a good fuel efficiency obtained thereby. For example, on a recent run made in this car the average for nearly 200 miles in Michigan was 11 miles per gallon. To get this small cylinder with a high enough compression calls for a small combustion space, while the need for large valves demands the opposite. In order to reconcile these two warring conditions the valves are inclined as regards the cylinder bore which gives room for big valves and yet calls for only a small area of pocket. This has been done before, but it is troublesome on account of the separate setting on the machines needed to bore the two operations out of parallel. A great deal of difficulty and expense in handling is avoided in the Packard cylinders by making everything parallel except the cylinder bore, so all operations such as drilling and facing locate in the same jigs. A special setting for boring would be used in any case so nothing is lost in gaining the better-shaped cylinder head.

To allow the motor to be used at continued high speed, or to prevent such use from injuring it, a high pressure oiling system is essential. So that there shall be no risks run whatever oil is carried up to the piston pins by little pipes that lie inside the H section of the connecting-rods, but the outstanding feature is the provision of separate leads for oil within the crankshaft. As there are only three main crankshaft bearings, this being quite sufficient for so short a length, there is necessarily one crankpin in each half of the shaft that is not adjacent to a main bearing. To prevent the nearest connecting-rods getting all the oil the crankshaft and crankpins are drilled out with fairly large holes and these holes are divided by driving in lengthwise little strips of steel cut with saw edges so that they bite in and are tight when driven home. This divides the crankshaft interior into two parts and the small holes give each crankpin a separate feed.

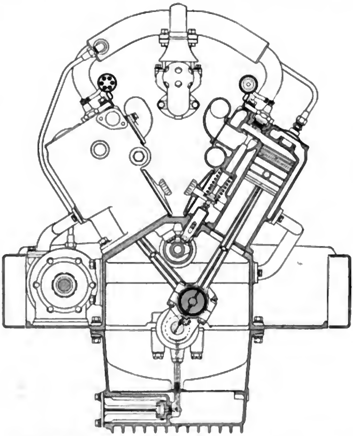


Packard twin six motor. Note tire pump on gearset. Air pump for gasoline feed air is at right of motor

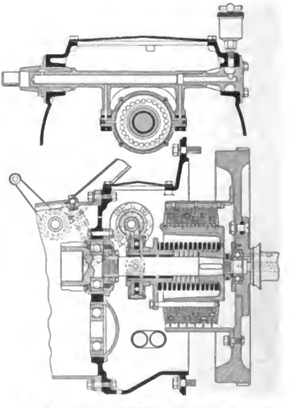
Packard Twin Six



Longitudinal section through Packard twin six motor, showing hollow crankshaft and oilways for main bearings and crankpins



Transverse section through Packard twin six motor, showing the light aluminum alloy piston and connecting rod of high tensile steel. Note how the cylinder bore makes an angle with the valve axis



Sectional view of Packard dry plate clutch. Note that the heavy member is attached to the flywheel and the lighter disks to the gearshaft. Also observe the very light flywheel

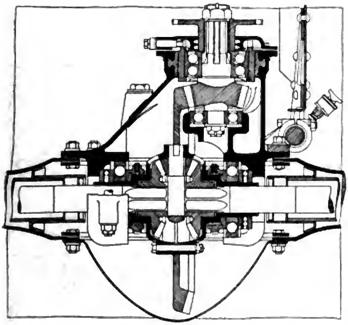
For the supply of oil there is a wide gear pump with helical gears, for quietness, and this has a by-pass within the pump itself. It is thought that the usual place for a relief valve, close to the end of the oiling system, is not so good as at the seat of pressure. Normally the oil registers from 20 to 30 pounds per square inch, but this rises with the motor speed because the by-pass feeds back into the pump intake. There are two screens, one covering the whole base of the crankcase preventing splashing and catching any carbon that might collect and drop from the underside of the pistons. The other is between the pump outlet and the internal manifold and this screen can be withdrawn for cleaning without losing any oil. Besides the crankshaft and piston pin leads oil under pressure is taken to camshaft, generator shaft, air and oil pump shafts and the timer shaft. Overflow from the generator shaft cares for the Morse chain at the front, and every other part is thought of.

Adjustable Chain Distribution

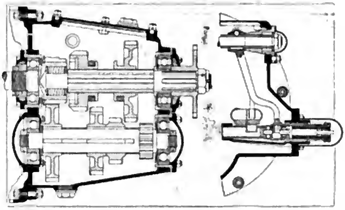
The chain used for the driving of camshaft and generator is adjusted in a unique manner without moving the generator or disturbing the other centers by the novel and somewhat daring method of allowing the generator sprocket to drive the generator through a large Oldham coupling. The sprocket rides on the outside of an eccentric bushing surrounding the generator driving spindle so that turning the bushing shifts the sprocket relative to the other sprockets but does not move the generator. To prevent the occurrence of slack in this coupling, which is always working over a small range, the tongues are tapered and wear is taken up automatically in the event of any wear taking place. This could not be beaten for neatness and, as the surfaces are large, it ought to work out very well.

The lightness thought essential for pistons and connecting-rods has been extended to the other reciprocating parts, as valves and push rods are as devoid of weight as high-tensile alloy steels can make them. This reduces any tendency to noise and, what is still better, permits the use of constant-acceleration, hollow-faced cams which give the best diagram. Only a light valve will follow this sort of cam with a reasonable spring that can shut the valve quietly. The total weight of valve, cotter and tappet is 9 1-2 ounces against 15 1-2 for the old six.

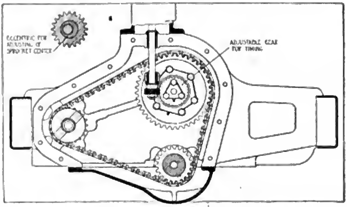
The valve diameter in the clear beneath the head is 1.5 inches, the method of adjusting the tappet is normal and the usual cover plate is employed.



Center of Packard rear axle, showing method of supporting the spiral bevel pinion and the large bearings



Section of gearbox which is integral with Packard motor. Note the very short shafts and the extremely large bearings


ECCENTRIC FOR ADJUSTING OF SPROCKET CENTER
ADJUSTABLE GEAR FOR TIMING

Method of adjusting camshaft and generator drive chain and chain layout

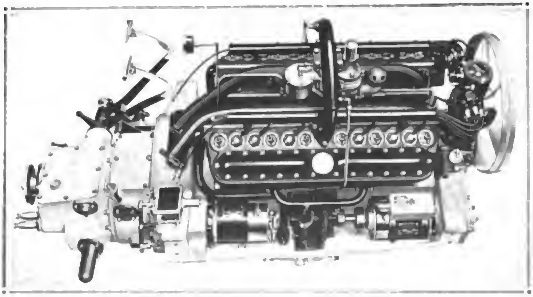
Thermostat Controls Cooling

There is a single water pump driven in tandem with and behind the generator, the supply reaching the other block of cylinders through a large passage cast in the crankcase. This passage is lined with a drawn tube forced in so as to prevent any porosity of the aluminum permitting entry of water to the crankcase. Made up with the pump is a large thermostat controlling two throttle valves on the radiator and by-pass systems, respectively. This is no novelty but it is carried out with great compactness.

In starting and lighting the Bijur constant voltage, two unit system is retained and the location of the parts is shown in the drawings. Ignition is by a timer with both automatic and hand advance, this being a special Delco product with one breaker cam operating two complete six-cylinder systems. This ensures perfect synchronization and good spark at high speed, long duration of contact that is obtained by having the breaker cam running at crankshaft speed. This timer is the only ignition apparatus but it can draw current from the main battery or from reserve dry batteries.

Motor Appears Small

The wiring is a two wire system and there is the usual Packard control platform on the steering column for switches, but this is now smaller and neater. The very useful feature of having one switch which gives head or side lights alternatively with a single finger movement is retained. Owing to the even torque of the twelve cylinders the starting motor cranks at a steady speed and very quietly; there is none of the rising and falling wail of gearing found with the four-cylinder.



Semi-plan of Packard twin six, showing generator, starter and water pump. This view gives a good idea of the carbureter and timer accessibility and also indicates the absence of encumbrances in the V, making for valve accessibility

One of the most surprising things about the motor is that it appears quite small when its piston displacement is considered. It is short, as a 3-inch bore six would be, and it is quite narrow. Despite the V shape and the fact that the frame is no wider than the old frame there is plenty of room at the sides to reach the electrical gear or the steering. Owing doubtless to the light pistons, for the crankshaft is not very big at 2 inches, no vibration was perceptible up to a road speed of well over 60 miles per hour and the motor is hardly audible even at full revolutions. Air entering the carbureter completely covers all small noises and, being a standard Packard instrument, this noise is not loud. It is possible to exceed 50 miles an hour on second gear and to run on high at 3 miles an hour.

In actual road operation perhaps the most remarkable feature of the running is that there is no sense of effort whatever in opening up from 3 miles on high gear. In a series of trials run against the watch it was found that it was easy to accelerate from 3 miles an hour to 30 miles in 12 seconds on a level cement road and on second speed in a much shorter time. Still, it is not likely that the lower gears would be used for more than a decimal percentage of the running.

Gearbox in Unit with Motor

For the first time the Packard company has broken away from the rear axle gearbox with which it has been identified so long and the illustrations show the small unit type which has replaced the old design. About the clutch there is little new, the dry plate working just as smoothly for twelve cylinders as for six. There is practically no more flywheel than is needed to carry the clutch and to take the gear teeth for the cranking motor and the front end of the clutch shaft runs in a ball bearing spigot housed in the flywheel. The rear end of this same shaft has integral with it the pinion of the constant mesh gears in the gearbox which is hollow and contains a Hyatt roller bearing that forms the gearshaft spigot. All other bearings in the gearset are large diameter ball, steel protecting flanges guarding the races against entry of dirt or other foreign bodies.

The selective gearshift lever and the emergency brake lever are still carried on the left side of the chassis and the gearset contains a simple but effective interlocking device which positively holds one shifting arm when the other is in use.

In coming to the unit power plant the makers point out that the even torque of the twelve eliminates all risk of rattle in the constant mesh gears and they are taking pains to lighten the axle as much as possible to reduce unsprung weight to a minimum and so get the best of the new arrangement in every way.

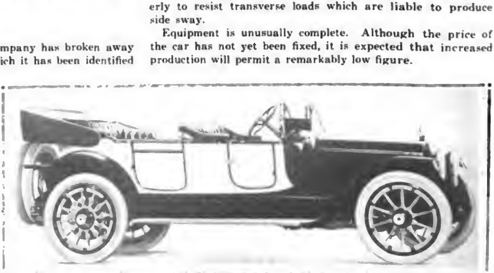
Novelty All Over

This lightness is obtained by using the simplest design of axle with a pressed steel casing and road wheels mounted on the ends of the drive shafts. Aluminum is used for the differential cage and all needless metal removed. Very large ball bearings are used and the mounting of the spiral bevel pinion is interesting because it is carried equally as much by the spigot bearing inside the axle case as by the compound radial and thrust bearing behind it. When spigot bearings of this sort are used they are often much too small to be of any real service but the Packard engineers have found plenty of room despite a gear ratio of a little more than 4 to 1.

There are two universals with telescopic motion, and a stamped steel torque stay is hung from a ball and socket carrier on the rear end of the gearbox.

As the rear suspension is platform type the drive is taken through the springs and the latter are attached above the axle so as to flatten the springs and render them able properly to resist transverse loads which are liable to produce side sway.

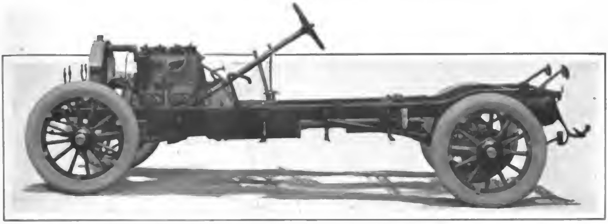
Equipment is unusually complete. Although the price of the car has not yet been fixed, it is expected that increased production will permit a remarkably low figure.



1916 Packard Twin Six, with ordinary open five-passenger bodywork. The general appearance is very like that of the 1915 Packard 38

Oldsmobile Eight Replaces Six—New Four

Larger Body, Longer Wheelbase and Price Reduction, Features of New Four

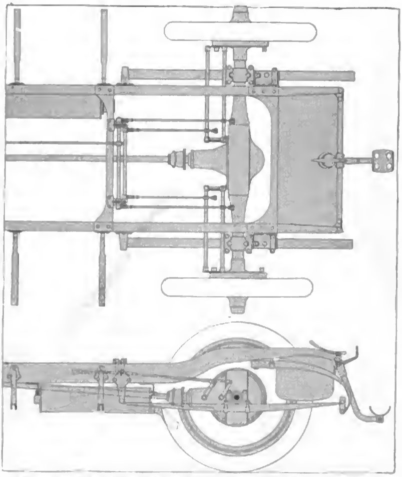


Side view of new Oldsmobile four-cylinder chassis, the wheelbase of which is 120 inches as compared with 112 inches on the 1915 four

FOR the 1916 season the Olds Motor Works, Lansing, Mich., has dropped entirely its six-cylinder model 55, and is to market an eight-cylinder design at $1,295 in addition to continuing its four-cylinder car at a material reduction from $1,285 to $1,095, and with a number of chassis improvements, along with a larger body and longer wheelbase.

The news of the Olds factory getting into the eight-cylinder field comes as a surprise, for it was thought that only the four-cylinder type would be built this season. No specific details of the new eight are given out at this time, but it will have much the same general appearance as the four, and wherever possible, to be consistent with the greater power, it will conform to the construction of the four. This standardization makes a better manufacturing proposition, with the result that price could be brought down to the level mentioned.

Deliveries on the eight are expected to begin in August, though with the factory working to capacity on the fours at this time, the outsider is impressed with the fact that the Oldsmobile plant is none too large for the contemplated two-car schedule. It is stated that within a short time the full details of the new eight will have been decided upon, and the public may look for an announcement of them some time before deliveries can begin.

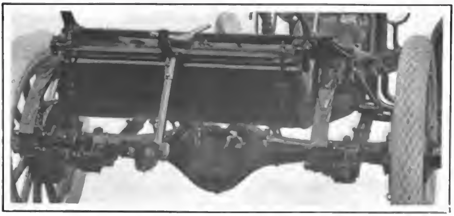


Plan and elevation of rear portion of new Oldsmobile four chassis, showing new axle design and open propeller shaft

The four-cylinder Oldsmobile, which for the 1916 season is designated as model 43, follows the same lines as its predecessor. The characteristic radiator of German silver, the cowl shape, and the design of the body, with its wide panel running along the top, still distinguish the car.

Chassis 8 Inches Longer

No change whatever has been made in the overhead-valve engine, but the chassis is lengthened from a wheelbase of 112 inches to 120 inches, giving more room for the body, which has been widened and lengthened. In the drive system, the inclosing of the propeller shaft with a torsion tube has been done away with and the open type of shaft is now employed. There is also a change in the frame, which, though as strong as before, is redesigned to require one less cross member. The result of all this chassis



A view of the pressed steel axle used on the 1916 Oldsmobile four. This axle is 48 pounds lighter than that used in the 1915 four, due to the pressed steel construction and the new design

alteration is to make a much lighter construction, and along with it a new rear axle is fitted, this having a pressed steel housing instead of the former malleable iron and tubing type. Therefore, although the car is considerably larger and roomier than the previous model, it is really about the same in weight, due to the clipping of so much from the chassis and axle.

The main specifications of the model 43 include 3½-inch cylinder bore with 5-inch stroke, the Delco combination electrical unit, Marvel carbureter, centrifugal pump cooling, splash oiling of the engine, three-speed gearset in unit with the power plant, left drive and center control, and 33 by 4 straight side non-skid tires, front and rear, on demountable rims. A new feature this year is the fitting of the Stewart vacuum fuel feed.

Axle 48 Pounds Lighter

The axle alone is 48 pounds lighter, due to the pressed steel construction and the new design. The former axle had a malleable housing for the differential, with tubing ends to house the drive shafts. The new type is a one-bearing, three-quarter floating construction with the entire housing of pressed steel in halves welded together. A web at top and bottom serves as a re-inforcing element. In its construction, the new axle incorporates the popular spiral-bevel gears instead of the formerly used straight bevel type, and the whole differential unit is mounted on a carrier to allow its removal without disturbing the axle proper. This design is not new, but is a commendable feature. There is the usual large inspection plate at the rear, through which the differential unit can be taken out. Directly under each wheel there is a Hyatt roller bearing, and the pinion bearing is a double-row ND ball bearing. Hyatts are also found on either side of the differential, with thrust bearings just beyond them.

Open Propeller Shaft

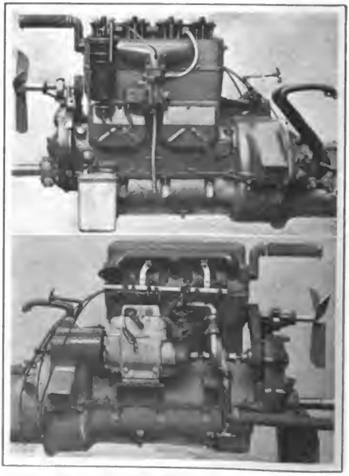
The new type of drive, wherein an open tubular shaft is used, is in accord with late American practice, and is a lighter construction than that in which a torsion tube surrounds the propeller shaft to take drive and torque. This new design, which is known as the Hotchkiss drive, provides for drive and torque to be taken through the rear springs with a cushioning effect, preventing jars and shocks being transmitted to the frame. To do this, the master leaf of each rear spring is made stronger, and their front brackets are increased in size. The rear spring front bolt is made 3-4 inch in diameter as compared with a 5-8-inch bolt with the old form of drive. The driveshaft formerly used was a solid section, and though the hollow shaft is lighter it is also stronger and prevents whipping to any extent.

In redesigning the frame, a slightly thicker stock is used. This is 5-32-inch material as compared with the ⅛-inch metal used in the old frame. The channel has also been deepened from 4 inches to 4⅝ inches, adding greatly to the rigidity. This new frame makes it possible to do without the cross member formerly placed just back of the motor. In the final analysis, therefore, the new frame, though much stronger than the old, represents a difference in weight of only a few pounds.

The spring suspension has come in for some of the development also. Both front and rear sets are mounted so as to be nearly flat under normal load. That is, the bow or camber usually found in springs is nearly lost sight of in these new springs. The idea is to cause easier riding along with better results on the springs. The usual spring bows upward enough so that when depressed it rarely becomes flat. If the spring is about flat in the first place, depression bends it slightly to the opposite side of the horizontal, and the action is therefore uniform on both sides of the horizontal, with the result of more equal strain. The spring with more bend usually has its range of action entirely above the horizontal with uneven treatment of the spring.

Springs Are 1 Inch Longer

In order to flatten the front springs they are made 36 inches long, or 1 inch longer than in last year's design

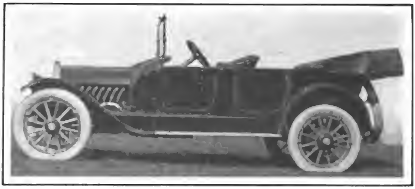


Upper—Intake side of Oldsmobile four-cylinder motor, showing mounting of Stewart vacuum fuel feed tank

Lower—Exhaust side of the motor, showing mounting of the Delco electrical unit and the front of the frame is bent down more to put the point of attachment nearly in line with the spring pad on the axle. For the rear set, the front hanger is designed to go down lower than it did, and the quarter-elliptic part also bends down further. These rear springs go under the axle. Perfections are used this year, and the leaves have diamond ends instead of round shapes.

Roomy Driving Compartment

In redesigning the body for more length and width, the Olds engineers have produced an exceptionally roomy driving compartment. The front seat width has been increased 3 inches, and the leg room is also enlarged 3 inches. Referring to the touring car, these increases give a length of 41 inches from the inside of the seat back to the clutch pedal. The tonneau measures 47⅝ inches from the back of rear to back of front seat, giving 3 inches more leg room. The width of the back seat has also been increased 3 inches. Doors are 23 inches wide—1 inch more than they were, and their height has been augmented by 1 inch also. Along with making the body sides higher, the hood has been lengthened 2½ inches so that it will conform with the general body increases and will preserve harmony of lines, a feature which is characteristic of the design.

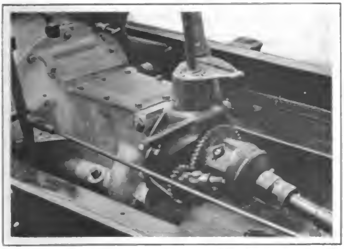


Four-cylinder Oldsmobile touring car which sells for $1,095

Oldsmobile runabout mounted on the four-cylinder model 43 chassis

The Oldsmobile motor has been described on several occasions before, but a review of its features will not be out of place here. With its dimensions of 3½ by 5 inches, it has a displacement of 192.4 cubic inches, and will deliver about 30 horsepower on the block, it is said. The cylinders are a block casting with the gearset and clutch in unit, and arranged for three-point mounting in the frame. The most uncommon point about the engine is the overhead valve construction. Though this is not uncommon in itself, the method of completely inclosing the valve rockers, push rods and springs is unusual. In fact, the push rods run up to the rockers through a cast passage in unit with the cylinder casting. When the aluminum top plate is in place over the valve mechanism the motor presents an exceedingly clean appearance, and on casual inspection might easily be mistaken for an L-head design.

The Delco unit and the centrifugal water pump are on the right side on the same shaft, which is driven through gear connection with the crankshaft at the front. The opposite side is taken up by the carbureter and the Stewart vacuum fuel tank, with the pressed-steel cover plates over the openings to the valve tappets left readily accessible. On the front of the same side is the oil reservoir which is a part of the lower half of the crankcase.



Rear view of gearbox used in four-cylinder Oldsmobile, showing speedometer drive off the propeller shaft

Detachable Cylinder Head

The cylinder head is detachable, and it carries the entire valve mechanism, together with the intake manifold. Distribution of the gases from this manifold is effected within the head casting, while on the opposite side are the four openings to the exhaust header, which is a separate piece. Thus the head is really the "business" part of the engine, and the construction makes it very nice when any work on the valves is to be done, or when it is desired to reach the cylinders or pistons.

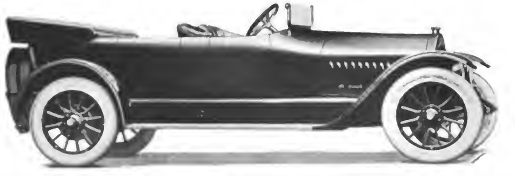
Both the crankshaft and the camshaft have three bearings, mounted in the upper part of the crankcase, which is integral with the cylinders. The crankshaft has a substantial flange, to which the 14-inch flywheel bolts, and the front gears are spirally cut to prevent noise. Drive for the propeller type of fan is by a flat belt from a pulley on the pump shaft.

The Delco apparatus is the standard single-unit type with the ignition distributer a part of the motor-generator. As a generator the unit is driven by the pump shaft, but when acting as a starting motor, gears are shifted by a pedal into mesh with the teeth in the flywheel rim in the usual way. There are two sets of gears in the train connecting starter to engine, but both sets are out of mesh when the unit is not required for starting. These afford a reduction of about 25 to 1, and permit the cranking of the engine at about 125 r.p.m. The reduction gears are housed compactly in an integral box on the right rear supporting arm of the powerplant. The electric system operates on 6 volts, and the storage battery is carried in a metal box under the front seat.

Lubrication by Splash

Lubrication is by splash, with a pump to force oil up to a dash gauge, from which point it runs by gravity to the

(Continued on page 950)



National Highway Six which sells for $1,690. Built as a four or five-passenger design, two auxiliary folding seats make it a six or seven-passenger car

National Adds a Twelve and a Six

Twelve Has V-Design 60-Degree Motor 2 3-4 by 4 3-4, Giving 339 Cubic Inches Displacement — Larger Six To Be Continued

THE National Motor Vehicle Co., Indianapolis, Ind., has a twelve-cylinder car as one of its new series models for the coming season. Nearly a year ago when the eight-cylinder motor was first announced as a stock production in this country it was at once hinted that concern or so would bring out twelve-cylinder designs for 1916. Little attention was at that time paid to these rumors but this week has substantiated them and the National is one of the first to announce a twelve as a stock model.

This new twelve will be manufactured entirely in the company's factory in Indianapolis and already has been on the road for some time. Shipments will begin in August. To date the motor has greatly exceeded the expectations of its designers in the matter of power generated and smoothness of running. It is much lighter, volume for volume than the six design and is as accessible as a four or six.

This new National will sell at $1,990 as a four or five-passenger car and can be had at slight additional expense as a six or seven-passenger job. It is made with 128-inch wheelbase and carries 36 by 4 1-2-inch tires.

The twelve-cylinder motor has cylinders of 2 3-4 by 4 3-4-inches bore and stroke, giving a piston displacement of 339 cubic inches. The motor is a V design, six-cylinders at one side and six at the other side being thus mounted in two groups at an angle of 60 degrees as compared with the 90-degree angle used in eight-cylinder V motors. This results in a narrower overall design. Compared with a six-cylinder power plant of approximately the same overall dimensions, this new twelve has 12 per cent. more piston displacement and weighs considerably less, a fact which goes to prove the argument that in twelve-cylinder motors it is possible to increase the number of cylinders and yet reduce the weight.

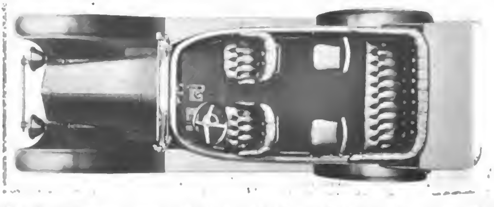
The motor is equipped with a Westinghouse starting and lighting system; and some chassis characteristics include three-speed gearset, cantilever rear springs, floating axle and a steering gear which permits of turning the car in a 33 foot circle. The body is an accentuated streamline design and the radiator a National with some modification in curves.

This new twelve is not a drafting-room creation but has been running for some time and has been well tested out on the block as well as in the chassis. A few details of designs have not been finally completed which prevents the reproduction of photographs in this description.

But the twelve is not the only new National model for next year. There is a new six, the Highway Six at $1,690 which is a lower price than National cars have ever been marketed at heretofore, in fact, it is the first time a National touring car has been listed below $2,000. This new Highway Six carries out practically all of the ideas of design set forth in the six which the company featured during the present year and which will be continued next season in practically the same form at $2,375.

The Highway Six, however, incorporates some features new in National design and in general is a long, low and roomy vehicle, accommodating four or five passengers and two additional tonneau seats converting it into a six- or seven-passenger car.

In appearance the new Highway Six is attractive, the body being what is known as the tumble-home-design, that in which the sides curve inwards at the top, giving a convex effect. Viewed from front to rear, the body lines are of the boat type



Plan view of the new National Highway Six, showing the aisle between the front seats, the two auxiliary folding seats and the movable driver's seat. The folding seat behind the latter is also adjustable to correspond with it. Note ample space in tonneau and driver's compartment with the widest part in rear of the front seat. The seats are placed low, that for the driver being adjustable so that it can be moved forward or backward on two slides, with a couple of thumb screws to hold it in the desired position. The auxiliary tonneau seat immediately in the rear of the driver is also mounted so as to be correspondingly adjusted fore or aft, according to the position of the front seat. The front seats are individual types with a passageway between them.

The motor, a block design with valves on one side, has cylinders 3 1-2 by 5 1-4 giving a total piston displacement of 303.1 cubic inches and an S. A. E. horsepower rating of 29.45. The motor is claimed to develop 48 horsepower. In design it is a smaller edition of the larger six of this season but differs in one respect, namely, in that a Stewart vacuum-gravity gasoline feed system is used, this being the only National model on which it is used for next season and marking the first use of it by this company. With it a 1 1-4-inch side inlet carbureter is used and the gasoline tank is located under the body at the rear, being so placed that the rear of the body is practically in the same vertical plane as the rear of the tank, this resulting in very little overhang of body or other parts back of the rear axle.

All through the car reduction of weight has been one of the primary objectives and it has been accomplished by a general cutting out of useless weight, this pruning process not being local to any particular points but general throughout. By this method over 600 pounds have been eliminated as compared with the weight, were the conventional practices of the present season followed out, bringing the total weight to 3,000 pounds.

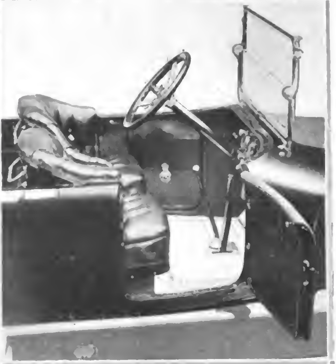
Throughout there has been a careful selection of materials, alloy steels playing a very general part. All gears in the gearset and rear axle are chrome-nickel alloys with the possible exception of the rear axle pinion which is of nickel steel. All shafts in the gearset and axle are of chrome-nickel. The front axle is a nickel steel forging and the frame a high-carbon steel product.

The body is hung approximately 1 1-2 inches lower than is common with such designs, this being partly accomplished by heavily dropping the front axle between the steering knuckles and the spring seats. By heavily bottle-necking the frame in front it is possible to turn the car in a 33-foot circle.

Returning to a more detailed consideration of the motor, for the first time it is noticed that the National company has mounted the electric generator and magneto on the same side. The usual National four-point motor suspension is used which obtains a flexibility to avoid twisting from the frame due to one bolt attaching each motor arm to the supporting bracket, these four bolts lying fore and aft and acting as swivels. This method of support has been used by the company for 5 years. Cast iron valves are used having a diameter of 1 9-16 inches in the clear and with a lift of 3-8-inch. The single camshaft is gear driven; a high-tension magneto giving a single ignition system is used and the Westinghouse starting and lighting system is fitted.

The three-speed gearset is a unit design with the motor and from it power is transmitted through a tubular propeller shaft with a universal joint at each end. The rear axle is a floating design with spiral bevel drive and tapered roller bearings used throughout. Annular ball bearings are used in the gearset. Spring suspension includes a set of semi-elliptics in front with the National design of flat cantilever in rear, the cantilever taking the driving effect of the rear axle and transmitting it to the frame. A torque arm is employed. Front springs measure 38 by 2 and rears 48 by 2 1-2 inches.

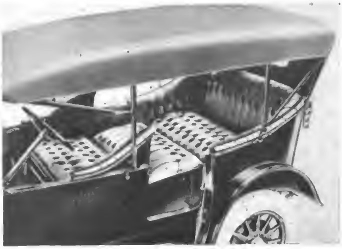
Service brakes are contracting types operating on 14 by 2-inch drums and emergencies are expanding designs. The wheelbase measures 128 inches; tires are 34 by 4 1-2 inches all around; and equipment is complete, including one-man top, Jiffy curtains, windshield, speedometer, electric horn, power tire pump, ammeter, gasoline gauge and the usual tool equipment which is carried in a special compartment in front at the driver's left. The adjustable steering column is on the left with change speed and brake levers in the center.



Driver's compartment of the National Highway Six. Note rounded body sides, aisleway seats and tool locker in front door

Jackson Builds Standard Touring Car Sleeping Body

JACKSON, MICH., May 20—There have been a good many makeshift bodies produced by amateurs with the idea of providing sleeping quarters when on tour. The accompanying illustration shows a standard type of car now being sold by the Jackson Automobile Co., this city. The back of the front seat is held in the upright or normal position by strong catches and is just as rigid when up as a body of ordinary sort. When lowered it rests on folding steel legs and the cushion of the rear seat is made of such a shape that when turned round it makes a level surface with the rest. This type of body will be supplied at an additional cost of $25.



Sleeping body manufactured as standard type by the Jackson Automobile Co., Jackson, Mich., and supplied for $25 additional cost

Governors for Motor Vehicles

Ideal Governor Must Control Power, Must Be Sensitive, Flexible, Regular and Steady and Should Co-operate with Valves for Proper Gas Delivery

By Theodore Douglas*

A Paper Read Before the Metropolitan Section of the Society of Automobile Engineers

IN power generating machines generally, whether large or small, the best engineering practice demands some form of automatic governor, to make them, broadly speaking, self-regulating. This requirement in a somewhat different form, the automatic self-limiting of speed, applies with special force to vehicle engines, and particularly to commercial vehicles, as power units, because of their high first cost, the trying conditions of their service, and the uncertain dependability of their operators. This opinion was forcefully expressed by A. J. Slade, Chairman of the Research Committee on Governors of the Metropolitan Section of the Society, at one of its meetings: "Any truck motor that has to stand up in service year in and year out must have a speed governor to restrain it from racing," etc. Truck engineers and truck users alike are demanding more and more some automatic form of protection against the misuse of their equipment. Ignorant drivers do not appreciate the destructive effects of the abnormal strains resulting from excessive vehicle and engine speeds to which trucks are constantly subjected, and to resist which they were never designed.

Small Motors a Factor

Apart from the protection of the vehicle against abuse, there are other very important considerations favoring an automatic control; these considerations are the employment of the efficient modern high-speed engine, the employment of smaller engines, and increased efficiency both in time and in fuel. However capable and conscientious the driver, there are limitations to the effectiveness of personal control, which are inherent in the method, whether the means employed are for hand or foot. If for the former, providing relatively non-vibrating parts, the limitations of personal action are serious obstacles to the success of the method. The pedal control of the engine will give the driver greater manual freedom to respond more quickly to the requirements of the service, but, on the other hand, owing to the constant vibration of the vehicle, particularly in commercial vehicles using solid tires and having spring equipments less able to absorb minor shocks, the foot of the driver is in constant motion, causing the pedal to vibrate in a greater or lesser degree, dependent on its design. However good the pedal design may be, the driver's foot will vibrate, and its slightest movement acts directly upon the throttle-valve and causes the gas flow to the engine to be uneven. This has a bad effect on the carburetion, as no carbureter has been designed which will deliver an economical mixture with a constantly vibrating throttle. Further, there must be considered the influence of the personal factor, since even the best of drivers in the course of a day's operation will seldom reach the high point in his efficiency curve, and, like men in other forms of employment, will generally work far below it.

The motor vehicle governors in commercial use today may be divided broadly into three classes, namely: First, gas-velocity governors; second, hydraulic governors, and third, centrifugal governors.

Of the first class, gas-velocity governors, I know of but one make offered commercially—the Kramer. The action of such governors is dependent on the inertia of the gas mixture, or its velocity, in passing from the carbureter to the engine, acting on an automatically regulating admission valve. They limit directly the maximum gas-velocity, and indirectly the engine speed. In considering the efficiency of such governors it should be remembered that a gas of given mixture at a given velocity has a definite thermal value. This thermal value may be sufficient to develop a high speed in an idling engine, whereas this same gas at the same velocity if admitted to the same engine laboring under load may not be sufficient to develop even an efficient engine speed when called upon for a real power effort. Such a design probably does not contemplate maintaining a uniform engine speed, as it cannot respond to the gas and horsepower requirements of the engine under greatly varying loads. This design rather contemplates limiting the maximum speed of an idling engine, and for that purpose is probably efficient.

Of the second class, hydraulic governors, also only one make is in use commercially—the Packard. This governor is dependent for its action on the head or pressure of the water in the circulating system of the engine, acting on a flexible leather diaphragm, the movement of which is transmitted to a gas-regulating valve located between the carbureter and the engine. Such a design permits of a definite throttle-opening for a definite engine speed, irrespective of load. The general efficiency of the design is, however, dependent very largely on the type of valve employed, the condition of the linkage and diaphragm, the normality of the water temperature at the engine speed, and the slippage in the pump as a result of wear.

Of the third class, centrifugal governors, there are many types, subdivisions and varieties, and this class probably includes 95 per cent. of all the governors employed today. Such governors may be subdivided broadly into two groups, namely:

a. Constant-engine-speed governors which limit the engine speed directly through curtailing the gas flow, and

b. Constant-vehicle-speed governors which limit the vehicle speed directly through its influence on the engine, and indirectly the engine speed, through curtailing the gas flow or by grounding the ignition. The non-ignition method, owing to the many and serious objections to it, can have only a very limited application. Other methods, such as a reversed control of the exhaust and inlet valves, have been employed, but have found slight acceptance.

Constant-Engine-Speed Governors

Governors of this group are driven directly from the engine, and are so connected to a governing valve, situated between the carbureter and the engine as to reduce the gas flow when the speed of the engine exceeds the speed for which the governor has been set. With these governors, when a gear is changed, the permissible speed of the engine is not altered; the engine is permitted to operate, as on the prior gear, at its fixed maximum. With such a governor set for a maximum engine speed of 900 r.p.m. a vehicle speed of 15 miles per hour on high gear, of 11 miles per hour on third gear, of 6 miles per hour on second gear, and of 3 miles per hour on first and reverse gears might result. The possible vehicle speed drops as the driving ratio, engine to wheel, is less. The maximum engine speed remains the same for each gear, and hence in the process of dropping into a lower gear, no power advantage results, except the mechanical advantage of an increased gear leverage. The commercial vehicle designer employing such a governor is forced to make a compromise between length of engine life and possible power development, and as he increases one he decreases the other proportionately. Within the limits of its design, other factors being equal, the power output of an engine is proportionate to its speed. In order to operate his engine on high gear at a reasonably low speed, to secure length of engine life, etc., the designer is compelled to sacrifice power on low gears where greater power is needed. It is a very common thing to see a commercial vehicle engine limited to a maximum speed of 900 r.p.m. by its governor, when the design of the engine has been such as to have made it perfectly safe, when greater power was needed on low gears, to speed the engine up to 1,200, or even to 1,500 r.p.m., thus adding 33 or 66 per cent. to its possible power output.

---

*President, Duplex Engine-Governor Company, Incorporated, New York.

By a careful study of the current consumption of electric vehicles in trucking service it has been found that the power requirement for the high gear service of commercial vehicles averages about 30 per cent. of the rated power capacities of their engines. It has been further determined that a commercial vehicle will operate, as an average, for 90 to 95 per cent. of its travel on high speed. It hence follows that the gear ratio on high determines, at least to the extent of 90 to 95 per cent., the average piston travel of the engine of any given vehicle. This average piston travel is an important factor in influencing its life, efficiency and upkeep cost.

If only 30 per cent. of the rated power capacity of the engine is required for more than 90 per cent. of the vehicle travel, it follows that the engine during that extended travel is operated on a very much reduced throttle, and at a low efficiency. It would seem good engineering to so adjust the gear ratio on high as to reduce the engine speed to a point more closely corresponding to the actual power required, operating the engine on a fuller throttle and at a higher efficiency; or to employ a smaller engine.

Constant-Vehicle-Speed Governors

To overcome the objections to the former group of governors, constant-vehicle-speed governors have been designed, which influence the permissible engine speed through the vehicle speed. Such a governor is operated from one of the vehicle wheels, or from the propeller-shaft, and permits the vehicle to attain its maximum speed on high gear at a moderate engine speed. This reduced engine speed tends to prolong the life of the total equipment, to lessen the cost of upkeep, and to increase the fuel efficiency. As the drive is stepped down through the gear train, however, such a governor, aiming at a constant vehicle speed, allows an increased engine speed inversely proportionate to the gear ratio, which is ordinarily such as to permit of a prohibitive engine speed on second gear, and an absolutely destructive speed on low and reverse gears. In neutral, the engine is entirely free from the influence of the governor, and is permitted to race.

The Butterfly Valve

In the various governors already referred to, with but one exception, the butterfly valve is the type of control valve employed. There are many objections to it. It is very sensitive to vibrating influences. In addition to the pedal influence upon the valve, it is also influenced by every suction impulse of the engine, giving rise to valve flutterings, and to a correspondingly irregular working effect. This type of valve has the further disadvantage of constituting a brattice (to borrow a term from the vocabulary of the ventilating engineer) in the gas passage, having a tendency, on deflecting the flow toward the walls of the gas chamber, to cause the ingredients of the mixture to separate through differences in skin friction. Other objections are the 70 to 90 degrees of angular travel required of the valve in moving from its open to its closed position and vice versa and further that in that travel the open area of the valve does not increase and decrease proportionately to its angular movement.

It is conceded generally that all of these governors have serious limitations, yet it has been the policy to employ them on the assumption that the disadvantages resulting from omitting them would be far more serious than those resulting from using them, and that they are at least a safeguard against many abuses.

The Ideal Vehicle Governor

The qualities which an efficient vehicle governor should possess can be summarized as follows: power, sensitiveness, flexibility, delivery, regularity, and steadiness.

Power. This is the most important quality of a governor, and upon it, and its proper balance, will depend very largely its efficiency. To possess this quality effectively the governor must be static, that is, be a one-speed, one-position governor.

Sensitiveness. This quality is dependent on a positive increase and decrease in power between small variations of position, and hence of speed, and the difference in speed between any two positions must be small.

Flexibility. The governor should be capable of maintaining the power output of the engine closely proportionate to the power requirement, regulating to low engine speeds for high gear service, where low power is required, and to higher engine speed for low gears when the maximum power capacity of the engine can be effectively employed.

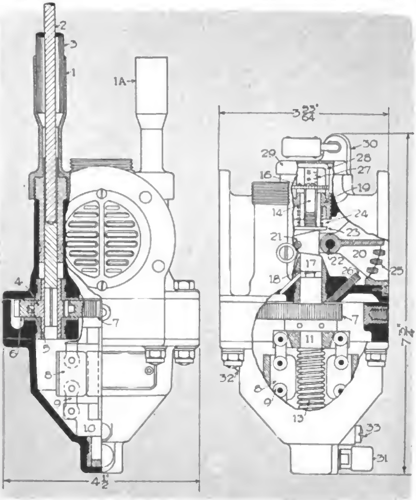
Delivery. This quality is dependent largely on the type of control valve employed. The governor construction should be such as to include, and to co-ordinate with, a valve of such design as to require but slight travel in effecting its extremes of position. The valve should be non-fluttering, of low resistance to the gas flow, and offer, in the automatic control of the engine, full throttle, when necessary, until practically the moment of required cutoff is reached.

Regularity. The governing influence, power and valve closure should vary proportionately as the speed; or, between the extremes of the governor range the differences in power and closure between any two required intermediate positions, should be equal.

Steadiness. By this is meant a smoothness of control, free from surge, valve, flutter, or hunting. The valve should glide, rather than be jerked, from one position to another. It is obvious that a vehicle governor should be fool-proof, tamper-proof, durable, and of reasonably low cost.

The Duplex Governor

This is no occasion for a discussion of the principles of the conical pendulum, or circular motion, or of the properties of centrifugal force. I will simply state relative to the mechanism of which I am the designer, that it is a static, spring-loaded, centrifugal governor provided with a valve and linkage of special design. By a static governor is meant that type of centrifugal governor which will maintain its revolving weights in a definite position for any given speed, and which is capable of resisting external influences which may tend to alter their position; in other words, a one-speed, one-position governor. Such a governor will assume a certain



Sectional views of Duplex governor. Left—Fig. 1. Right—Fig. 2.

position for each speed, and for each position it will develop a certain power. The power should be sufficient to quickly adjust the fuel admission valve, with a view to minimizing fluctuations in speed, thus giving the engine the property of self-regulation, within narrow or broad limits, depending on the design.

In this mechanism the centrifugal member, valve member, and adjusting member are all consolidated into a single unit within an inclosing shell which is interposed between the carbureter and the intake manifold of the engine so that the entire gas supply must pass through the valve. On each side of the valve chamber provision is made for the insertion of a speed terminal, 1 and A1, Fig. 1, one conveying to the governor a proportionate vehicle speed, and the other conveying a proportionate engine speed. The engine speed may be conveyed from the timing-gears, camshaft, magneto-shaft, etc., and the vehicle speed from the propeller-shaft, gearset, or jackshaft. The speed conveying means 2 consists of a one-quarter inch, sixteen strand, steel cable revolving in a hard fiber casing 3. Each terminal connects with an automatically one-way acting springless pawl clutch unit 4. The means for actuating the pawl is a drag piece 5 having sufficient frictional bind for that purpose. The floating members of these clutches consist of gears 6 in mesh with a third gear 7 mounted on the shaft of the centrifugal members. The clutch engaging speed, which is imparted to the centrifugal member, is the higher of the two speeds, whether of the engine or of the vehicle. When the engine is idling the engine speed will actuate the governor. The engine is always under governor control. As an example, consider a vehicle in which maximum vehicle speed on direct drive will be attained at 800 r.p.m. of the propeller-shaft. The drive being direct, the corresponding motor speed will also be 800 r.p.m. The speed relations may be so established that at a maximum governor speed of 1,000 r.p.m. the engine is controlled. Then if the governor drive for vehicle speed control be taken from the propeller-shaft and stepped up to 1.25 to 1 the maximum governor speed of 1,000 r.p.m. will be reached at the maximum vehicle speed which corresponds to 800 r.p.m. of the propeller-shaft and engine. This constitutes the governor drive from the vehicle. If the governor drive from the engine be taken from the camshaft at 1.33 to 1 of camshaft time, the speed of the governor drive from the engine would be only 533 r.p.m. at 800 r.p.m. engine speed. The engine speed would have to reach 1,500 r.p.m. before the governor speed would reach 1,000 r.p.m. and the engine be controlled. Thus when the vehicle is in motion, and is being propelled by the engine on high gear, the speed imparted to the governor by the vehicle will be the higher speed and will govern the engine. This may be also true of third gear, whereas on low gears the governor speed from the engine will be the higher and will hence control.

An analysis of the above example will show the following facts:

The engine is under governor control at all times.

The vehicle is always under governor control when propelled by the engine.

The difference between the maximum engine speed for high gear and low gears is 700 r.p.m.

The average vehicle speed for low gears will probably have been increased 40 per cent.

• The available horsepower, over high gear capacity, assuming a modern high-speed engine of good design, will have been increased 87 per cent.

The average commercial vehicle today is very much overpowered, and the use of the constant-engine-speed governor is very largely responsible for this tendency. It is also largely responsible for the needlessly low gear ratios for high-gear service in commercial vehicles. These high gear ratios have been made low in order to increase the engine speed to a point at which the engine will be capable of developing the amount of power judged necessary for low gear service. The conventional high-gear engine speed for commercial vehicles varies from 900 to 1,150 r.p.m. Had the vehicle above referred to been equipped with a constant-engine-speed governor, its engine would have been limited to 800 r.p.m. for all gears, and its greater power capacity might just as well have been absent, since it could not be utilized. If a 40 horsepower engine with its power limited to 25 horsepower is sufficient for a given service, why buy, operate and maintain one of 40 horsepower? Why not instead install one of 25 horsepower and operate it efficiently, thus producing a cheaper, better and more economical vehicle?

Detail Construction

The centrifugal member of the governor under consideration revolves in a chamber entirely separated from the gas chamber, and in an oil spray. This chamber contains all of the moving parts of the governor, excepting the valve and valve sleeve which are in the valve chamber. There are four weights 8, supported by toggle-links 9, and connected at one end to a collar 10 slidably mounted on the centrifugal governor shaft 11, Fig. 2, which is hollow. The other end of the weight linkage is rigidly connected to the shaft and to the gear 7. The shaft is provided with a transverse slot, not shown, in which moves a transverse pin 12, Fig. 3, carried by the collar 10. This linkage is held in its extended position by the spiral spring 13, the compressing of which constitutes 70 per cent. of the load of the centrifugal unit.

The valve stem consists of two parts, 14 and 15. Part 14 has a notched wheel head 16 by which it may be screwed into or out of the valve adjusting sleeve 17 at will. This part of its stem extends all the way through the valve chamber and into the end of the hollow centrifugal shaft 11. The second part of the valve stem 15 is a pushrod floating in the hollow shaft. The valve adjusting sleeve 17, which is made of a tin alloy, is supported at one end in the bearing 18 of the centrifugal shaft, and at its other end in the bushing 19. The valve adjusting sleeve 17, which has a short sliding motion in its bearings, is linked to the movable valve part 20 by means of the bronze pin 21. The movable valve part is supported on a transverse axis by a bronze shaft 22, its movement on this shaft being small. Between the bushing 19 and a shoulder 23 of the adjusting sleeve 17 there is a spiral spring 24 under approximately five pounds compression. The function of this spring is two-fold; first, to endeavor to always keep the valve 20 in a full-open position, and second, to provide an adjustable fraction of the load on the centrifugal member, approximating 30 per cent. of that load. This spring is set at the factory and its compression should never be changed.

The valve is of grid construction, and consists of two parts, 20 and 25, each having a latticed surface. The fixed member 25 is set into the upper part of the valve chamber and is provide with elongated slots, running parallel to the axis of part 20, with walls flaring from its under side upward. Below this fixed part is the movable part, having a corresponding series of slots with walls flaring from its upper surface downward. The movable part has an arc movement across the slots, and ia supported by means of a substantial bearing 22. The maximum travel of this movable part, in a size D governor, is approximately 1-16-inch, and in that small travel effects all degrees of aperture between full-open and full-closed valve. When the openings of the rigid part coincide with the openings of the movable part, the valve is open, and when the bars of the rigid part cover the openings of the movable part, and vice-versa, the valve is closed. The two parts of the valve have a ground fit, though their surfaces are not in contact. The movable part is held in open position by means of spring pressure, as shown, and its possible motion, in both directions, is limited by stop screws 26. This construction and support of the valve frees it from the influence of car vibration. The openings of the valve constitute elongated venturi. This design was adopted with a view to the wire-pulling of all the gas passing through the valve, to the keeping up of the gas velocity, and to the better mixing of ingredients.

Operation

On speed being imparted to the centrifugal shaft by means of one clutch gears 6, the weights expand, drawing forward the sliding collar 10 and the transverse pin 12. The only load carried by the centrifugal member up to this point is the compression load of spring 13. When, however, in its forward movement the pin 12 encounters the end of the floating valve stem 15, and pushes the part 14, held rigidly in 17 by means of the thread, part 17 is pushed forward, compressing the spring 24, and commencing to close the valve. Not until this point has been reached does the centrifugal member pick up its full load. The load characteristics are so proportioned to the centrifugal force developed as to make the governor almost isochronous for all governor speeds from 700 to 1,300 r.p.m. It will be observed that there is no positive connection between the valve linkage and sliding collar. If there were, any movement of the collar would alter the position of the valve and a full throttle would be impossible except for speeds below that speed at which the centrifugal force developed would be capable of carrying the load of spring 13.

Setting the Governor

The valve stem 14 may be screwed in or out of the adjusting sleeve by means of the notched wheel 16. The further it is screwed in toward the floating part 15 of the stem the less will be the travel required of the sliding collar to engage 15, and to close the valve. The further it is screwed outward the greater will be the travel required. Therefore, in setting the governor, the stem is screwed in for low speeds and out for high speeds, as required. The scale 27 indicates the valve or speed setting. After setting, the yoke 28 is so adjusted over the end of 16 as to engage two of its notches to prevent the stem from turning, yet permitting of its sliding motion with the adjustable sleeve 17. The cap 29 is then screwed into place, preventing any ingress of air, and protecting the adjustment by the pin 30, and a lock or seal.

All parts in the valve chamber are of aluminum, tin or bronze, while spring 24 is of phosphor bronze. All bearings thorughout the governor are of bronze, and all of the steel parts in the centrifugal chamber are specially heat-treated. The sufficiency of the materials and workmanship employed in its construction has been shown in its durability. Careful inspection after fourteen months of continuous service has shown no wear. There presumably was wear, but it was not visible. The lubrication required consists of a few drops of oil in the cup 31 daily, and the draining out of the old oil through the discharge 32, and the addition through 33 of one-quarter of a pint of medium weight machine oil every 2,000 miles. In one test the governor was operated for 1,500 miles without any lubrication whatever beyond the initial addition of one-quarter pint of oil. Inspection showed no harmful results and sufficient oil in the centrifugal chamber for an additional 500 miles.

The average increase in the efficiencies and capacities of the trucks of three companies which have adopted the type of governor under discussion as standard equipment, one of which companies had been using a gas-velocity governor, and two companies three types of constant-engine-speed centrifugal governors, was, as closely as could be determined, as follows:

Increased ton-miles-per-hour	27%
Increased available horsepower	42%
Increased gasoline efficiency	23%
Increased acceleration	40%
Decreased piston travel	7%
Decreased radiator temperature	15°

This governor makes possible the employment of engines 25 per cent. smaller than are now used on trucks with constant-engine-speed or gas-velocity governors. This was conclusively shown in the extended investigations of one company*, in which one of their small engines equipped with this type of governor, competed with a 25 per cent. larger engine equipped with a gas-velocity governor, one truck trailing the other on a cross-country run over hilly roads, in which all of the conditions of chassis, load and road were the same. In these competitive tests the little engine beat the big engine in ton-miles-per-hour 23 per cent., in gasoline efficiency 48 per cent. and in acceleration 50 per cent.

Comparative dynamometer tests for power and speed control have been run in the laboratories of two engine manufacturing companies with results showing no drop in power output, and with a speed variation of less than 5 per cent. in dropping and picking up the load at the rate of fifteen times per minute. This would represent thirty load changes per minute, or two seconds for each change. It is obvious that no vehicle operation could ever duplicate this adverse condition. The tests for maximum power showed a smoother engine operation with the governor than without it.

Advantages

The following are the more important advantages of the governing method under discussion:

It will provide a control of engine speed at all times.

It will provide a control of the vehicle speed when propelled by the engine at all times.

It will handle the vehicle under load more smoothly than the best operator.

It will use the compression of the engine on down grades to brake the vehicle, thus easing the wear and strain on the braking equipment.

As compared with all other governors it will increase the ton-miles-per-hour of the vehicle, its gasoline efficiency, and its acceleration. It will make possible a 5 to 15 per cent. decrease in the average piston travel, and will proportionately lengthen the vehicle life and lessen its cost of upkeep. It will make possible the employment of smaller engines and the using of high-speed engines at high efficiencies. It offers special advantages on fire apparatus where high engine speeds are required for pumping, and relatively low engine speeds for vehicle travel. On gasoline-electric machines where series windings of the electric motors and high engine speeds are used for low vehicle speeds, and the control employs parallel windings for high vehicle speeds, it is indispensable.

This governor is made in three sizes, suited to engines having piston displacements of 300 cubic inches, 300 to 500 cubic inches, and 500 to 800 cubic inches. It is contemplated that larger sizes will be added to this list.

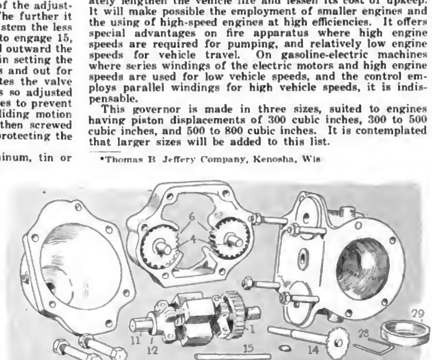
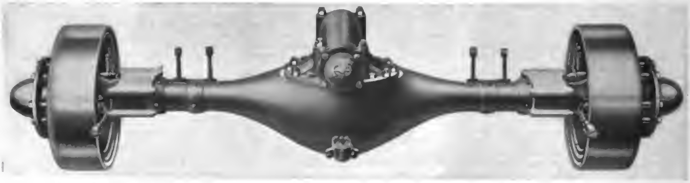


Fig. 3—Duplex governor disassembled

---

*Thomas B. Jeffery Company, Kenosha, Wis.



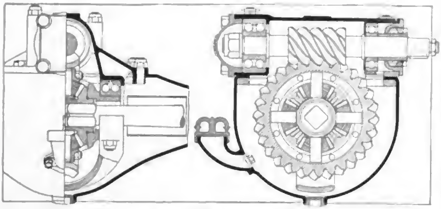
The new Sheldon worm gear drive rear axle designed for light delivery cars of 1,000 pounds capacity

A New Sheldon Worm Gear Axle

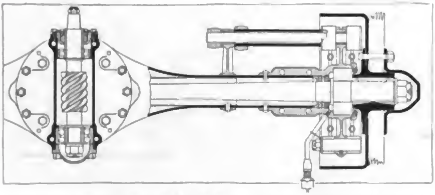
Design for Light Delivery Cars of 1,000 Pounds Capacity —Special Formula Metals Used for Worm and Wheel

THE Sheldon Axle & Spring Co., Wilkesbarre, Pa., has installed the tools, jigs and fixtures necessary to manufacture the new worm gear rear axle suitable for light delivery cars of 1,000 pounds capacity. This worm drive for this size car has been experimented upon for over a year with test trucks and the company is now ready to put it upon a production basis. Announcement is made that a large quantity has already been arranged for by a firm which will market a delivery wagon of 1,000 pounds capacity at less than $900 with full equipment ready for the road.

The axle is designed along the same lines as the larger Sheldon worm gear axle, incorporating the straight type of worm and wheels in a semi-floating axle construction producing a simple axle of relatively few parts and light weight. The housing is pressed steel and is pressed and riveted to cast steel spring seats and brake spiders. A special feature, as will be noted in the illustrations is the mounting of the hub on the axle shaft by means of taper bushings. This permits the wheels to be easily removed without the aid of a wheel puller which is often not at hand when most needed.



Vertical sections through new Sheldon worm drive rear axle



Plan section, showing mounting of hub on axle shaft by means of taper bushings, permitting the wheel to be easily removed

Double Internal Cam Brakes

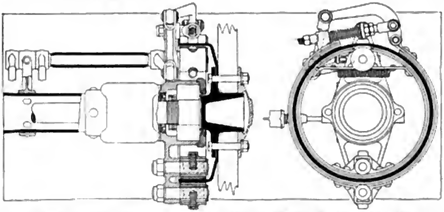
Double internal cam brakes are used 1.75-inch wide operating against 14-inch pressed steel brake drums. The use of the internal brake permits of a clean exterior appearance as all the parts are housed within the drum where they are also protected from mud splashed by the wheels. The shoes are malleable iron lined with Thermoid, and the arrangement has been designed so as to permit of the use of non-skid chains without any danger of interference with the brake lever. The latter are extended inside the frame and are mounted in hardened and ground bushings which, it will be noted from the illustration, are amply provided for in the way of lubrication.

Uniform Stress

The axle shafts are 2 inches in diameter at the outer bearing and are tapered from the bearing collar to the differential. The reason for this is to provide a uniform stress at all sections of the shaft. The materials used in the shaft are 3.5 per cent. chrome-nickel steel drop-forged. They are heat treated to give an elastic limit of 125,000 to 150,000 pounds per square inch.

A special secret formula of steel is used for the worm and after the heat-treatment has been accorded, the manufacturing process calls for grinding and polishing. This puts a smooth finished surface on the worm and at the same time eliminates any distortion that might have taken place during the heat treatment. As the grinding is done to within close limits, the finished worms are all of a size within very close tolerances, permitting of perfect interchangeability at this point. The worm has five starts, 3.75 lead, 30 degrees 50-minute lead angle, 30 degrees axial pressure angle, 26 degrees 22.5 minutes normal pressure angle.

A special formula is also employed for the bronze worm wheel which has thirty-one teeth of 1.75-inch space. Both the material in the worm and worm wheel have been selected as the result of long experiment in this direction and both the material and the heat treatment accorded are kept as secrets by the manufacturer. A forging is used for the differential case and the differential gears and pinions are heat-treated alloy steel.



Illustrating the double internal cam brakes used with the new Sheldon worm gear rear axle. Shoes are malleable iron and drums of pressed steel

Friction Resistance Minimized

Special attention has been paid to the bearing mounting of this axle in order to keep the frictional resistance as low as possible. Ball bearings are used throughout and as will be noted in the accompanying drawings the design has been such as to keep frictional resistance as low as possible and at the same time provide a large factor of safety in the bearing mounting. This provides a complete rear installation for a truck of this size and one which is essentially a high-class job with the additional feature of being economical in manufacture and assembly.

Splash Oiling for Step Piston Motor

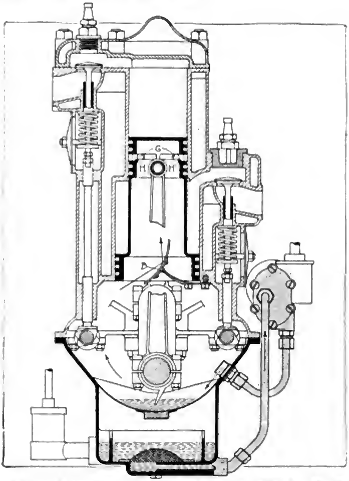
THE eight-cylinder engine in which the cylinders are vertical and arranged concentrically one above the other in tandem appears first in the U. S. patent office about 1884, and at various intervals since. In 1900 and up to 1905 several patents were issued here and in Europe showing this type of cylinder.

During 1901 and 1902, the type was tried in Europe extensively, but owing to the imperfect lubrication, particularly of the upper, or small, cylinder, and other difficulties, it was abandoned.

E. M. White, a consulting engineer, Detroit, Mich., who has invented several unique oiling schemes for splash lubrication which have proven successful, now offers a design of tandem eight, which he claims overcomes this inherent oiling difficulty and, though the general design is probably not new except in details of construction, the method of oiling is decidedly novel. The White is the only design of tandem eight, of which there is any record, to introduce the oil to the cylinder walls through holes in the pistons and between the two sets of rings. This is undoubtedly the first motor of the design to lubricate the upper piston by the splash system.

In order to lubricate it by this method, White makes use of the baffles, which he also fits to other types of engines, and the principles of which were explained in a recent issue. The lower cylinder walls are lubricated by the plain splash from these troughs, but the upper set have the special baffle provision. A part of the oil splashed is thrown around and onto the baffle plates B which act to shoot it directly up into the upper pistons, as shown by the arrows.

All around the inner side of the piston there is the ledge or pocket G, which catches this oil sprayed up by the baffles. Then it goes out through the comparatively large holes H and onto the cylinder walls.

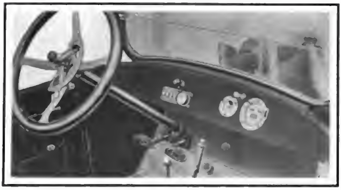


Section through tandem eight-cylinder motor designed by E. M. White, showing unique system of splash lubrication in which the oil is introduced to the cylinder walls through holes in the pistons and between the two sets of rings. The lower cylinder walls are lubricated by splash from the troughs. Part of the oil is thrown around and on to the baffle plates B which shoot it to the upper pistons, where it is caught by the pockets G and fed to the cylinder walls through the holes H

New York City, May 21—Gasoline consumption during 1915 will run over 1,000,000,000 gallons, according to an estimate based on the fact that the number of new cars purchased in 1915 is equal to the number purchased in 1914. The increase in gallonage, assuming the rate of increase in new cars is the same, will be around 300,000,000 gallons, or about 30 per cent.

1916 Oakland Four Larger—Price Lower

Hood and Radiator Are Higher—Power Plant 2 Inches Shorter—Underslung Springs Take Drive and Torque



Arrangement of instrument board and control members on four-cylinder Oakland model 38

SEVERAL slight mechanical improvements, an increase in the front size of the body and a material reduction in price to $1,050 for all three types—touring car, roadster and speedster—are the conspicuous points about the new four-cylinder model 38 of the Oakland Motor Car Co., Pontiac, Mich. Its general appearance and its features of design are the same as the model 37 which it supersedes. The old prices were $1,200 for the touring car and $1,150 for the roadster, so that in one case the reduction is $200, and in the other, $150.

Rear Springs Underslung

In looking at this Oakland model, one is impressed with the good lines and with the way in which the low hanging of the chassis has been attained. Oakland was one of the first to undersling the rear springs from the axle, and it has developed this feature until now a very racy appearance is given the cars with consequent ability to hang to the road at speed.

The outstanding feature of the new models over those of last year is the greater height of the cowl, hood and radiator, lending a suggestion of more power and size to the cars. While this increase is but 1 inch, it is an improvement. Along with this, the driving compartment has been enlarged 2 inches in width and the same amount in length. This makes a very roomy seat, and the extra leg room should be appreciated, especially on long runs.

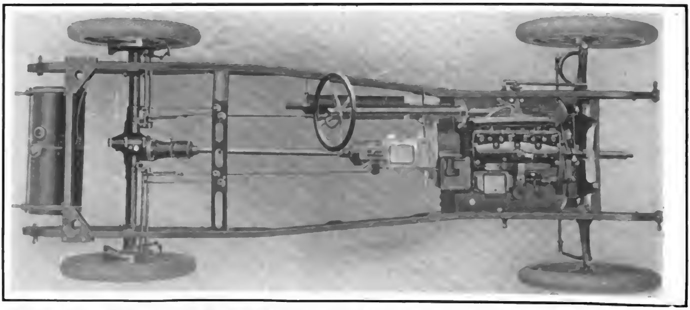
The Oakland four has a Northway unit power plant, the cylinder bore of which is 3 1-2 inches and the stroke 5 inches. The Delco electrical combination is continued, and the carbureter is an improved Marvel. The clutch is a cone, gearset a compact three-speed design, and drive to the rear through a tubular shaft. Springs in the rear are three-quarter elliptic, the axle is floating, and the propulsion of the chassis on the Hotchkiss principle. The wheelbase remains 112 inches, and the car is shod with 33 by 4 tires on demountable rims, the rear pair being non-skids.

Power Plant More Compact

Nothing has been materially altered in the engine design. It is really so similar to that of last year that the casual observer would not see any difference. However, the whole power plant has been made more compact by reduction in the space occupied by the clutch, and this allows a shortening of about 2 inches overall. Instead of using one large spring at the center of the clutch mechanism to hold it in engagement with the female member, six small springs are employed for the purpose, these being arranged equidistant from one another. This permits each spring to be shorter than a single large spring would have to be and at the same time it should tend to a better action, since the engaging force is distributed.

Dashpot Type Carbureter Used

The type of Marvel carbureter now fitted employs a dashpot to prevent fluttering of the air valve. That is, the valve is connected to the dashpot in such a manner that its action is dampened. Any change in suction has to be of sufficient



Plan view of four-cylinder Oakland 38 chassis showing layout of power plant and simplicity of design. Note tapered frame duration to make the valve open gradually, a feature preventing any jerkiness in the action of the engine at speed.

The motor is capable of running at moderately high speed, and may really be classed as a high-speed type in the generally accepted sense of the term. It attains a speed of 2,500 r.p.m. when developing 39.5 horsepower. This is a commendable output for an engine of its dimensions, and is said to be made possible principally through the use of large valves and special cam design, affording a good lift to the valves. They have a diameter of 1 5-8 inch, and are constructed of tungsten alloy steel.

The dimensions of 3 1-2 by 5 inches give a piston displacement of 192.4 cubic inches, and through the use of light reciprocating parts, there is no doubt that the engine develops its full quota of power. As last year, the manifolds are designed for least gas restriction, and the carbureter throttle valve is arranged parallel to the crankshaft so that there is no tendency for the throttle to act as a deflector and the distribution of fuel to each cylinder is equal.

Arrangement of Power Plant

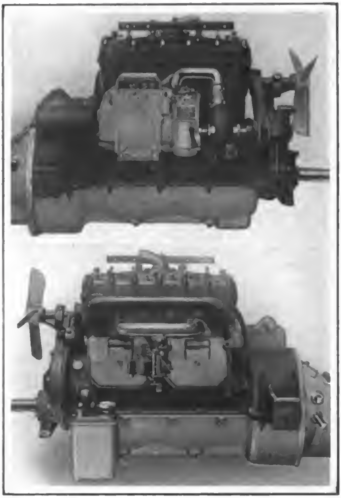
In the general arrangement of the engine, the valves and manifolds are placed on the left, with the Delco unit on the right. The cylinder head is detachable as a unit, allowing access to cylinders and pistons. The water pump is located just forward of the electrical unit, and driven from the same shaft. The latter also carries the fan driving pulley, and is operated by gear connection with the crankshaft in the conventional manner. Suspension is at three points with integral crankcase arms at the rear, and a center support at the front. The oil reservoir is at the forward left side and a part of the lower half of the crankcase.

Pistons Are Crowned

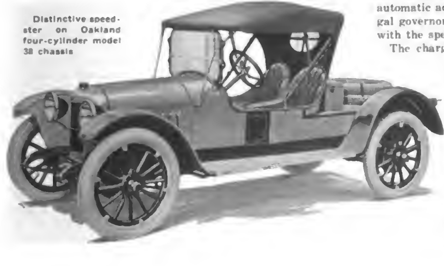
The pistons are crowned to make them as strong as possible without materially adding to their weight. They connect to the crankshaft through the conventional type of drop-forged connecting-rods. The crankshaft is a three-bearing type with the following bearing dimensions:

Front—1 5-8 by 3 3-8 inches.
Center—1 7-8 by 2 3-8 inches.
Rear—1 15-16 by 3 11-16 inches.
Connecting-rod lower bearings—1 5-8 by 2 1-4 inches.

These bearings are all of a special form of babbitt.



Both sides of Northway unit power plant used in four-cylinder Oakland model 38. By reducing the space occupied by the clutch the power plant has been shortened about 2 inches for 1916



Distinctive speedster on Oakland four-cylinder model 38 chassis

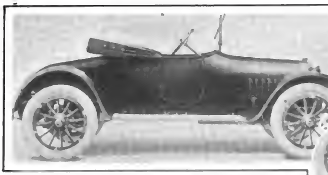
The Delco apparatus is the standard single-unit type manufactured by the Dayton concern, and incorporates the ignition distributer as an integral part of the main device. There is no alteration in its method of operation. When acting as a generator it is driven from the front gears by the shaft already mentioned, and when cranking the engine it drives the flywheel through a train of gears housed in an integral compartment on the right rear side of the flywheel case. A small pedal to the right of the control pedals is used to push the gear train into mesh with the flywheel ring gear, and through this connection a reduction of about 25 to 1 is attained. That is, the engine is turned at a speed one twenty-fifth that of the starting motor. These starter gears are so arranged that both sets are shifted out of mesh when the starting function is not required, causing all of them to be at rest until needed.

The electrical system is of the single-wire type and operates at 6 volts. By this method the wiring is minimized, and the return circuit is grounded. The ignition part provides an automatic spark advance within range of the set point of the manual spark lever on the steering wheel quadrant. This automatic advance is attained through the use of a centrifugal governor which controls the spark position in accordance with the speed within the limits as just mentioned.

The charging rate of the generator is also automatically regulated. This takes care of charging at low speeds, so that, with ordinary car speeds of from 10 to 15 miles an hour the battery is being charged at about the same rate as it would have were the car running at high speed. A compartment under the front seat conveniently houses the 80-ampere-hour Exide storage battery. In placing it here, accessibility has not been overlooked.

Gearset Is Unchanged

The gearset is still the compactly designed unit used on the previous model. Gears are of wide face and stub tooth form to give strength.



Above—Oakland four-cylinder model 38 chassis fitted with roadster body

Below—Five-passenger touring car mounted on the Oakland four-cylinder model 38 chassis

The shifting lever mounting and that of the emergency brake lever continue to be of the unique rocker type which requires no oiling, and is proof against rusting or binding. The brake operating system also uses these rocker bearings. Each lever and the brake rocker shaft get their oscillatory freedom through the compressibility of the springs which hold them to their positions. Small pressed-steel cups hold the springs in place, and these can be removed by turning them at right angles to their fastened position so that the larger pair of slots in their heads will clear the ends of the brake rod levers or the pins in the ends of the shifting or emergency brake levers, as the case may be.

Another clever part of these bearings is the provision for adjustment of the rod connecting the brake lever to the brake rocker shaft. The threaded end of the rod passes through the end of the lever, the front side of the part around the hole through it being grooved to receive the edge of a wedge-shaped piece screwed onto the rod end. A cotter pin prevents it from coming off, and the lever groove acts as a lock to prevent its turning. Thus the lever and its rod are free to oscillate sufficiently for all positions of each with respect to the other.

Hotchkiss Drive Employed

The Hotchkiss type of drive is retained. By that is meant that the drive and torque are taken through the rear springs instead of having any torsion arm or radius rods for the purpose. This makes for a light construction which is very satisfactory. The master leaves of the springs are of such size that they can take the shocks of the road with a cushioning effect, preventing them from reaching the general chassis mechanism.

The propeller shaft is tubular and fitted with two universal joints in the customary positions. The shaft has an outside diameter of 1 1-2 inches and an inner diameter of 1 1-4 inches. Such a shaft construction is much lighter than a solid type would be, and at the same time it is stronger against whipping.

The rear set of springs go under the axle, while the front pair remain above. This rear construction lowers the chassis considerably and is in part responsible for the general low lines of the car. The front springs are 35 1-4 inches long, while the rears are 48 inches.

The rear axle is of the type known as a one-bearing floating construction. That is, there is a single bearing directly in the center of each wheel to carry the load. These wheel bearings are Hyatts, as are those in the differential. New Departures are used in the pinion and as thrust carriers on either side of the Hyatts.

A commendable feature of the chassis is the tapered frame which follows the body line all along, affording good support throughout the body length and doing away with running board aprons, since the frame itself comes flush with the body and running boards. Some weight is also saved by the elimination of these aprons. This construction was new to the Oakland four of last year, and is continued without change.

In connection with the body, a neat feature this year is the combining of the instrument board with the body. It is made of metal and is so tilted that a clear view of all instruments is possible when in the drive seat. The running boards are covered with linoleum this year, the previous model having metal boards. This was done to follow the popular trend.

To Feature Speedster

For this season Oakland is to make a feature of the attractive speedster type of body with its bucket seats and rakish appearance. The sides of the body are low and the afterdeck flat to carry a spare tire. Due to a higher gear ratio in the rear axle than the roadster and touring models have—3 3-4 to 1—this speedster is a fast car, and is said to readily attain a speed of 60 miles an hour.

The Stewart vacuum gasoline feed is employed as standard this year, drawing the fuel from a 15-gallon tank at the rear.

Driving this car reveals a very comfortable design, for ample room is afforded for getting in and out on the drive side, and for having the legs at a comfortable angle. The gearset lever is convenient to the right hand, while a neat aluminum gearshift gate indicates the position of each speed. In a demonstration run, THE AUTOMOBILE representative was surprised at the flexibility of the car and its quick get-away. Convenient location of the control apparatus was also noticeable, the horn button on top of the steering wheel being a typical feature.

Oldsmobile Eight Replaces Six

(*Continued from page* 939)

individual troughs under the cylinders and to the crankshaft and camshaft bearings.

Of course, now that the vacuum feed system is employed, the pressure air pump of last year is eliminated. The fuel is drawn to the vacuum tank instead of being forced to the carbureter, and from the tank flows by gravity to the carbureter. A gasoline gauge has been fitted to the tank this year.

Speedometer Drive Off Propeller Shaft

The speedometer drive has been changed so that it is now off the propeller shaft instead of the front wheel. The driving gear is mounted on the front of the forward universal, and a bracket attaching to the rear of the gearbox holds the flexible shaft gear.

The same general refinement of appointments and finish which featured the car of last season are to be found on the new model. The Circassian walnut instrument board, with its small compartments on either side, and the steering wheel of the same wood do their part to touch off the leather upholstery and general finish. A good feature is the mounting of the Delco switch on a hinged door in the dash.

The Automobile

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, May 27, 1915 No. 21

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Ave., Phone Harrison 7707
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico -One Year, $3.00
Canada -One Year, 5.00
Foreign Countries -One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.

Member of the Audit Bureau of Circulations.

The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

New Speed Factors

THIS YEAR'S 500 mile race gives promise of ushering in a new era in American speedway racing, first because of the smaller motors and second because of lighter-weight cars and the more general use of American-made cord racing tires. Cutting the motor displacement from 450 to 300 cubic inches has instead of reducing the speed of the machines resulted in higher speeds than a year ago. This is primarily due to larger valve openings obtained either by using four valves per cylinder or making valves larger in proportion to the cylinder bore. The use of lighter reciprocating parts has played its part in increasing the possible crankshaft speeds of these motors.

Speed has been added to the chassis by the general cutting out of weight, made possible by a better adaptation of material to the work to be done. There are better steels used in the 300-inch racing cars this year than used on the average last year. Some makers are saving weight by using lighter metals than cast iron, or cast steel where strength is not the first consideration.

By using cord tires with lower air pressures several entrants look to less chassis vibration and the possibility of going through the race with lighter car parts and yet with little if any danger of them giving way. As to the merits of such, Saturday's race should furnish valuable lessons.

New Racing Problems

FIVE YEARS ago when the subject of the higher efficiency of small motors in Europe was a dominating topic one of our engineers gave the sound advice that if we were handed such motors at that time it would be impossible to use them without first strengthening all of the other parts of the car because the added power of the new motors would mean improved design in many car parts, in fact, a general redesigning of many parts.

The truth of this contention is being well demonstrated in the preparation for the present race. Engineers who set out to get more power by doubling the number of valves and reducing the weight of reciprocating parts have succeeded, but while accomplishing this have run into new troubles of motor lubrication, new troubles of bearings for connecting rods, and new fits for pistons and piston rings. Getting increased power is one thing but taking care of all of the other parts of your motor to care for this added power is equally necessary. The 300-inch cars are giving not a few engineers excellent lessons in the necessity for balanced design, telling them in unmistakable terms that it is poor judgment to build up one part unless all others are brought up in like proportion.

Enter the Twelve

THAT THE twelve-cylinder automobile is now a manufactured article must not be regarded so much as marking a new stage in development as rounding out the situation created by the success of the eight. Engineers have long known the theoretical advantages of the even torque which eight or twelve alone can give, but there has always been the question, is it worth while?

In the case of the eight applying up to date high speed motor principles showed that it certainly was worth extra pistons and cylinders to get the qualities of performance that characterize the eight. Now comes the twelve to carry the multicylinder principle to its logical conclusion, that is a fresh impulse at each 60 degrees of crankshaft movement and the perfect balance of the small six.

The torque of the twelve is hardly perceptibly better than that of the eight, but the balance of the latter has an imperfection which is absent in the twelve so the latter is an advance—in theory. Of course we cannot determine yet how small a twelve will pay; as yet we do not know the low limit of size for an eight even, but it is probable that a couple of years' experience will see the matter settled along well-defined lines.

That the twelve has come to stay is as little to be doubted as is the fact that the four-cylinder motor will satisfy the demand of the majority of motorists for many years to come; like most other articles automobiles must contain qualities of performance in proportion to price, and this the twelve-cylinder car is practically certain to do just so long as the price is high enough to pay for a really high class mechanical job.

Stearns 5-Ton First Knight Truck

Four-Cylinder 4 1-4 by 5 1-2-Inch Motor—Chain Drive—144 or 180-Inch Wheelbase

CLEVELAND, O., May 25—Marking the first appearance of a commercial vehicle of its kind on the American market, the F. B. Stearns Co., this city, has brought out a 5-ton truck equipped with a Knight motor. It will be made in two standard chassis lengths, one with a 144-inch wheelbase selling at $4,500, and the other a special long 180-inch wheelbase selling at $4,800. Both are equipped with a four-cylinder 4 1-4 by 5 1-2-inch Knight motor driving through a gearset and side chains. Front tires are 34 by 5 single and rear tires 38 by 5 dual.

Locomobiles Adopt Multiple Disk Clutch for 1916

NEW YORK CITY, May 24—The 1916 Locomobiles have arrived at a number of the branches and show many refinements over the 1915 models. The principal change is in the clutch, which is a multiple disk design so constructed as to require practically no attention as regards lubrication and adjustment. It is a dry disk design with nine driving and eight driven disks. Between these there are eighteen disks faced with fabric, which are idle on the clutch shaft. The effect of these is to distribute the wear over a large surface area and to give a very easy engaging clutch. In addition to this refinement it will be noted that the cars have a longer, lower appearance due to an increase in the wheelbase, the straightening out of the body lines and the method of attaching the body to brackets on the frame instead of to the frame itself.

No Break in Body Lines

By increasing the slope of the bonnet the line of demarcation between the bonnet and the cowl has been entirely removed and the bonnet line moulds gradually into the side line of the body without any perceptible break. The instrument board has been laid out in a different manner, providing greater accessibility to the switches, thereby enabling the driver to operate them with his foot. The upholstery has also been improved and is equipped with differential springs, which gradually absorb the shock by having a stiff spring take up the effort where a weaker spring has reached its capacity. Other points for which the new models will be noted is in the increased use of drop forging for such parts as the distance rods, etc. The result is to produce a lighter car, although more room has been gained by the longer wheelbase. The increased available space has been made use of to mount a seven-passenger body on the smaller of the two sixes manufactured, whereas last year only a five-passenger body was accommodated. The two chassis models will continue to be known as the 6-38 and 6-48, and the prices remain unchanged. The stock touring car on the smaller model as quoted for 1915 is $4,400, and for the larger chassis, with touring body, $5,100.

Pierce-Arrow to Concentrate on Sixes for 1916

BUFFALO, N. Y., May 20—A foreword of the 1916 policy of the Pierce-Arrow Motor Car Co. is contained in an announcement made by this concern in which it states that the Pierce company has at present no intention of building other than sixes and its announcement in December next for the year 1916 will contain nothing contrary to this policy. Series three Pierce-Arrow cars will be continued throughout the calendar year 1915.

S. O. Gasoline Price Raised 1 Cent

NEWARK, N. J., May 22—The Standard Oil Co. of New Jersey within the past week has advanced the price of gasoline delivered at garages from 9 cents to 10 cents a gallon. The Atlantic Refining Co. quotes 11 cents a gallon for gasoline delivered at garages.

The Standard Oil Co. of Indiana attributes the recent advances in gasoline prices in the East to the export demand. It states that this has strengthened the interior market also but not sufficient yet for a circular advance.

Leading independent dealers expect an advance in the Indiana territory soon. They say that the crude oil market is decidedly firmer. One producing company recently sold the Standard Oil Co. of Indiana 200,000 barrels at 40 cents a barrel, at the wells at Cushing, whereas previously the Indiana company had paid as low as 30 and 35 cents, although the market price was 40 cents.

Gasoline Substitute Called Charbo-Oil

HULL, QUE., May 20—A scientist in this city claims to have found a substitute for gasoline called charbo-oil. At a test before several officials of the public works department recently, two tablespoonfuls of the liquid, mixed with 2 quarts of water, proved sufficient to run a 2 3-4 horsepower engine 1 1-2 hours without stoppage. The discoverer, Gideon Charbonneau, asserts he will be able to manufacture the liquid in any quantity at 4 cents per gallon. The liquid does not give off any smoke.

Weed Wins in Patent Suit

Chicago Court Holds That E-Z On Chain Tire Protector Infringes Parsons Patent

CHICAGO, ILL., May 22—The E-Z On chain tire protector has been declared an infringement of the Parsons patent No. 723,299 owned by the Weed Chain Tire Grip Co., in a decision handed down by Judge Arthur L. Sanborn in the United States district court in this city. The E-Z On device was manufactured and sold under Frambach and Corrington patent No. 1,001,518 and under a pending application that has since developed into patent No. 1,096,101.

The suit was brought by the Weed Chain Tire Grip Co., against Edward D. Lewis, Thomas V. Garvin, Matthew J. Frambach, E-Z On Chain Tire Protector Co., and Hartley Manufacturing Co., and in March, 1913, Judge Carpenter granted a preliminary injunction after a hearing on a full showing by affidavits. The case has now had its final hearing.

In his decision Judge Sanborn states that the E-Z On chain tire protector made and sold by the defendant is a substantial reproduction of the Weed chain grips made by Weed under the Parsons patent. The sole defense according to the court, is non-infringement and the judge in his decision lays great stress on the fact that the E-Z On device would creep along the surface of the tire when fixed into position. Although affidavits were first made that there was no creep with the E-Z On grip, at the trial this position was decidedly modified and admissions were made that the device would creep to some extent.

Judge Sanborn held and cited previous decisions to the effect that the Parsons invention is not limited to any particular degree of looseness or any particular rate of travel, and that "Parsons' invention did not reside in creeping, which was old, but in his new mechanical structure by means of which creeping could be utilized, whereas in other or prior structures, creeping was undesirable." In another part of his decision the Judge said, "But even if defendants did in some way prevent the creeping of their device, they would still be utilizing the new construction patented by Parsons and would be getting many of the benefits made possible by his device." The decision called for the usual decree for an injunction and accounting.

Columbia Tire in New Plant

COLUMBIANA, O., May 22—The Columbia Tire & Rubber Co., of Columbiana, O., has taken possession of the new plant which was built last year for the Columbia Rubber Co., but never operated. This plant was built especially for the manufacture of automobile tires.

The product of the new company will include Columbia tires and tubes. One of the tires will be known as the Gem No-Skid-Tread model.

The officers of the Columbia Tire & Rubber Co. are as follows: President, Chas. Hoffman; vice-president and general manager, W. G. Henne; and treasurer, W. F. Henne; secretary, J. E. La Dow.

Rice Is Waverley President

INDIANAPOLIS, IND., May 24—H. H. Rice, for several years vice-president and general manager of the Waverley Co., has become president, succeeding W. B. Cooley, who retires from active business. W. C. Johnson, for some years with the company, has been advanced to vice-president. Mr. Rice has been with the company since 1904 and since 1908 has been vice-president and manager.

Reo Lets Truck Export Contract

NEW YORK CITY, May 24—Gaston, Williams & Wigmore, export agents who have been responsible for a great deal of the business which has been done by American manufacturers with foreign belligerents, particularly Russia, have made an arrangement with the Reo Motor Truck Co., Lansing, Mich., whereby it will handle all of the export business of that concern in Reo motor trucks for both commercial and military use.

Forbes Is Monarch Vice-President and Sales Manager

DETROIT, MICH., May 24—T. C. P. Forbes, formerly of the Reo and Overland companies, has accepted the appointment as vice-president and sales manager of the Monarch Motor Car Co., this city. Mr. Forbes will be located in New York City, from which point he is planning the Monarch eight sales campaign.

Kelly Takes Over Chas. H. Fuller Toledo Business

TOLEDO, O., May 21—Martin V. Kelly, well known in the automobile industry, has taken over the business of the Toledo office of the Charles H. Fuller Co., of which he has been vice-president, and his new concern, to be known as the Martin V. Kelly Co., will start business June 1. The Kelly company is incorporated for $200,000, its offices are in the Second National Bank Building, and its officers are: President, Martin V. Kelly; vice-president and treasurer, Ralph E. Kelly. The company takes all the advertising accounts formerly handled by the Toledo office of the Fuller company, including the Willys-Overland.

S. A. E. Summer Program Versatile

Professional Papers to Cover Wide Variety of Topics—Many Registrations

NEW YORK CITY, May 24—While the full program of the summer meeting of the Society has not been announced, and will not be until about June 1, it is known that about fifteen papers will be read and discussed at the professional sessions. The papers cover a wide range of subjects, the internal combustion engine being treated as not only applied to automobiles, but to farm tractors and aeroplanes as well. Other papers cover the subject of springs, wheels, tires, pistons, and spiral bevel gears. There will be a paper on the design and construction of motor-driven fire apparatus and another on the manufacture and use of lubricating oil. The war as referred to the automobile industry, will have a paper devoted to it covering the use of the motor truck; a method of scientifically testing vehicles will also be described.

As regards the social end of the meeting, plenty of time will be found in the intervals between the professional session. In order to gather the parties together, from the different sections, special trains will be operated from New York leaving this city at 5 p. m. on Sunday, June 13, arriving in Detroit, Monday morning. The general itinerary and program of the trip follows:

Leave Detroit, Monday, June 14, 2 P.M., S.S. Noronic.
Arrive Midland, Tuesday, June 15, 2 P.M., S.S. Noronic.
Through Thirty-Thousand Islands, Tuesday P.M., S.S. Waubic.
Arrive Parry Sound, Tuesday, June 15, 6 P.M., S.S. Waubic.
Picnic, Point Au Baril, Wednesday P.M.
Arrive Parry Sound, Wednesday, 6 P.M., S.S. Waubic.
Arrive Detroit, Thursday, 5 P.M., S.S. Noronic.

Professional sessions will be held Monday afternoon and Evening, Tuesday morning and evening, Wednesday evening and Thursday morning. Section nights, when entertainment will be furnished by the local Sections, will be held Monday, Tuesday and Wednesday evenings after 10 o'clock.

Texas Jitney Convention June 14

SAN ANTONIO, TEXAS, May 25—William Haensler, of San Antonio, has called a State convention of jitney car owners and operators to be held in that city June 14 and 15. The program which has been prepared provides for a general discussion of the various phases of the jitney business and the appointment of committees at the morning session of the first day. At the afternoon session Ed. H. Wicks, an attorney of San Antonio, will deliver an address on "Legislation and its Relation to the Jitney Transportation." Other addresses will be made by L. M. Emlet of Kansas City, Mo., on "Insurance"; by Dr. G. P. Stoker of San Antonio, on "Accidents"; by A. Burch of Austin, on "The Best Methods of Success," and by W. T. Farmer of Fort Worth, on "Our Duty in Protecting the Public and Ourselves." The second day's session will be devoted to considering the reports of the standing committees; the adoption of a constitution; the election of permanent officers, and the selection of a place and date for the next State convention.

Italy to Take Over Automobile Plants

LONDON, ENGLAND, May 20—Italian advices indicate that the government at Rome is prepared to take over all the private machinery shops in the Milan and Turin districts for the manufacture of war material. Many automobile shops having works at Milan, Turin and Genoa will be included in the list of works to be utilized for war munitions manufacturing, but for the present these plants will confine their efforts to turning out automobiles for the army.

British War Truck Order for Wichita Falls Motor Co.

WICHITA FALLS, TEXAS, May 25—The Wichita Falls Motor Co., Wichita Falls, is filling an order from the British Government for 300 motor trucks. A large number of the trucks have already been shipped via the port of Galveston.

Detroit S. A. E. in New Quarters

DETROIT, MICH., May 25—The Detroit Section of the Society of Automobile Engineers has moved into its new quarters 601 Kerr building, East Fort and Beaubien streets. The former location was in the Stevens building.

Up to May 15, a sum of $1,850 had been pledged towards the expenditure fund for the year. The total for the year, or for 12 months, it is estimated, will be $2,500. The following were the contributing concerns: American Auto Trimming Co.; Chalmers Motor Co.; Fisher Body Co.; Hudson Motor Car Co.; Hyatt Roller Bearing Co.; New Departure Mfg. Co.; Packard Motor Car Co.; Studebaker Corp., each $200; Gould Storage Battery Co., and Holley Bros. Co., each $100; Brush Engineering Assn., $50. It has been provided that no single subscription may exceed $500.

Will Build Falcon Truck

DETROIT, MICH., May 21—The Falcon Motor Truck Co. has been organized in this city to manufacture the Falcon 1,000-pound truck selling at $750. The incorporators are: A. B. Mallow, of Detroit; F. B. Houston, of South Charleston, O., and A. B. Hazzard, of Detroit.

The Falcon will have a four-cylinder motor with 22 horsepower, cooled by the thermo-syphon system. The radiator is set in a pressed steel shell. Ignition is Atwater Kent and automatic. A cone clutch is used. The carbureter has a final set adjustment and has a hot-air connection. Lubrication is constant level maintained with a positive action pump. This is connected with the dash where there is a sight feed. A selective gearset is used with sliding gears and control is from the center and connected in the unit with the motor and with three speeds forward and reverse. The springs are semi-elliptic in front and full platform rear. Pressed steel wheels are 30 inches with 3 1-2 inch pneumatic tires. The steering is on the left hand. The wheelbase is 106 inches and the tread 56 inches.

Century Tire Plant Sold

NEW YORK CITY, May 25—The plant of the Century Tire & Rubber Co., Plainfield, N. J., which went into bankruptcy last March, has been bought by Leon Jaffess, of New York City, for $29,000. The plant contains approximately 60,000 square feet of floorspace and has two floors.

Mr. Jaffess, who has a tire factory in Harrison, N. J., and who deals in tires in this city, will shortly announce a new stitchless tire which will be made at the Plainfield plant.

Xenia Rubber Buys Springfield Tire

XENIA, O., May 21—The Xenia Rubber Co., has taken over the stock equipment and business of the Springfield Tire & Rubber Co., Springfield, O., and will move it to Xenia, where a plant will be erected to house it. Machinery and equipment are valued at $20,000. The Springfield company sold out because it was ordered out of its present building and was unable to secure a new location. L. M. Bickett is manager of the Xenia Rubber Co.

McCulla in Paris

NEW YORK CITY, May 25—William R. McCulla, assistant chief engineer of the Knox Motors Co., Springfield, Mass., who recently sailed for Europe, has established his Paris headquarters at the Hotel Edouard VII, at which point his friends will be able to reach him by letter.

Lozier Opens New York Branch

NEW YORK CITY, May 26—A branch salesroom has been opened in this city by the Lozier Motor Co., Detroit, Mich. It is located in the New Hearst building at the corner of Broadway and Sixty-first street. Joe Horan, who drove a Lozier car in races years ago has charge of Lozier sales in New York. The service station at Forty-seventh street and Eleventh avenue is to be continued.

A. C. A. Tests Transcontinental Stutz

Few Worn Parts After 3,728-Mile Grind—Averages 10.6 M. P. G. at 25.2 M. P. H.

NEW YORK CITY, May 25—Reports have been issued by the technical committee of the Automobile Club of America covering the test on the Stutz Bearcat which made the coast-to-coast trip in record time as reported in THE AUTOMOBILE for May 20. The certificate shows that the total elapsed time was 11 days, 7.25 hours. The total running time on the road was approximately 148 hours. The total distance covered as indicated by the odometer was 3,728.4 miles. The gasoline consumed amounted to 352 gallons and the oil to 34 quarts. From the data given in the affidavit the miles per hour during the total elapsed time were 13.8. The miles per hour in net running time were 25.2, miles per gallon of gasoline 10.6, and the miles per gallon of lubricating oil 440.

The Automobile Club of America, through its laboratory, made a careful examination of the car and found that the motor was in excellent running condition, except for the following: The wristpins were all slightly loose but still in good serviceable condition except for the one in piston No. 3 which showed the most wear and was sufficiently loose to cause a distinct knock when the motor was running. The side of No. 2 cylinder wall toward the front of the motor was worn at the bottom of the ring slide. The main bearings showed no sign of being loose but the large end connecting-rod bearings showed more end play than is desirable. All the cylinders, piston heads and valves were found to be carbonized. Covering the balance of the car, everything was found to be in good condition with the exception of wear in the wheel bearings, two leaves broken in the left front spring, left and right front shock absorber brackets broken, bearings on the countershaft worn and worn tires. The balance of the car was in uniformly good condition.

1,235 r.p.m. for 1 Hour

At the conclusion of the examination the motor was removed from the chassis and placed on the testing stand, where it was first run with open throttle for 5-minute intervals at several different speeds and afterwards continuously at a speed of 1,235 r.p.m. for 1 hour. During the latter time the average horsepower developed was 37.8 and the average fuel consumption 0.65 pound per brake horsepower hour. A complete record of the data obtained in these tests is given in the tables herewith.

No adjustments were made on the motor before the above mentioned test except that the carbureter was found to be out of adjustment and this was corrected. It was found that the motor did not run steadily at speeds below 800 r.p.m., indicating a leakage in the intake valve.

In a sworn statement filed with the club, Harry C. Stutz, president of the Stutz Motor Car Co., states that the car is known as Bearcat Model F, No. 2746 and is a stock model in all particulars except: 1—That the clearance allowed between pistons and cylinders was slightly more than in stock cars; 2—That the car was fitted with two sets of Hartford shock absorbers in the front and two sets in the rear, whereas only one set in the rear is stock; 3—That the fenders regularly supplied on stock cars were not carried; 4—That the rubber bumpers used under the front spring are not regularly furnished with stock cars; 5—That the electric starting and lighting equipment generally supplied is not carried.

The motor is a T-head design with spark-plug over both valves. The nominal bore and stroke is 4.75 by 5.5 inches. Ignition is supplied by a Bosch two-spark magneto and the carbureter is a Stromberg model H-3. Wheels are Houk.

TABLE 1

	Horsepower at different r.p.m.		Gasoline (lbs. per B.H.P. Hr.)
R.P.M.	Torque	B.H.P.	
848	207.4	33.5	0.84
1052	209.5	42.0	0.71
1265	199.0	47.9	0.67
1472	178.5	50.0	0.65
1614	146.0	44.9	0.75

TABLE 2

Time		B.H.P. during continuous run of 1 hour	
Hr.	Min.	R.P.M.	B.H.P.
5	23	1236	48.2
	34	1211	47.0
	45	1231	47.9
	56	1230	47.8
6	07	1243	48.2
	18	1246	47.8
	23	1246	47.8

Average R.P.M., 1235.
Average B.H.P., 47.8.
Average gasoline, 0.65 lb. per B.H.P. hr.

Exposition a Mecca for Cars

LOS ANGELES, CAL., May 20—About thirty-one automobiles leave Los Angeles daily for the Panama-Pacific International Exposition at San Francisco. The San Francisco fair does not draw all the motor travel, by any means. It is estimated that there are thirty-six cars driven out of this city every day of the week for the Panama-California Exposition at San Diego.

Each car carries an average of four persons, and the total number of miles covered daily by the exposition tourists is estimated at approximately 21,000 by the experts of the touring department of the Automobile Club of Southern California. The present army of automobilists traveling between the two expositions is spending an average of $1,340 per day.

Trade Developments in Detroit

More Twelves and Eights Coming—Why Not a Ten?—Racing Gains Followers

By L. V. Spencer

DETROIT, MICH., May 25—If you had told people a year ago at this time that eight-cylinder and twelve-cylinder cars would be the latest thing in motoring circles a year hence, they probably would have advocated having your head examined. Yet it is even less than a year since eights were a thing unheard of in American factories. Now there are not only a score or more of makes of V eights, but there are likely to be several V twelves.

Naturally much interest centers in the new so-called Twin Six Packard, which is on view at the factory salesrooms of the company here. By lifting the veil from this new car, Packard steals a march on several other companies which are probably going to have them for the coming year. Indianapolis is not to be outdone, for National is already in line with such a motor, and it is understood that another Detroit concern is making haste to let the public know about its twelve.

It would seem that there is a place for twelves in the list of automobile types, but it is a development that was hardly looked for so soon. Sunbeam of England was the first to make such a multiplicity of cylinders for automobile engines, so America cannot claim to be original in the twelve movement. Like most other things, however, the adoption of twelves commercially has been left to this country.

It is quite a radical step for Packard to take—that of going over to the making of a twelve-cylinder car exclusively. It was hardly to be expected that the big plant would drop its sixes, but the move only illustrates the progressiveness of the maker of today.

Why Not Tens?

Now that we have concrete examples of what can be done with eights and twelves, when will some maker decide to steer an intermediate course and come out with a ten-cylinder car? Such a design is entirely feasible, and though it involves some nice engineering, it is not too much to predict that some motors of such a number of cylinders will be brought out before very long, judging from the way new types bob up these days.

Nor have we heard the last word on eights yet. Several other prominent makers are going to announce them for 1916, and it is going to be a busy year for the engine manufacturers if present plans materialize. In not a few cases it seems to be the policy to abandon large sixes in favor of lighter eights. The production of fours and sixes was the rule with a number of makers last season, but next year the lines which the dealers demand are fours and eights, in a number of instances. There will undoubtedly always be a place for good sixes, but room must be made for the types with more cylinders.

In the old days nearly every maker entered the various automobile races and hill climbs. The idea was to advertise the particular make of car and it was a fine idea. It is today, but many of the factories have given it up for one reason or another. However, there seems to be a growing tendency in some quarters to get back into racing to keep their names before the public. The Detroiter company and the Briscoe people are going to have racing cars to enter dirt track events this summer, and they may go into some of the other race meets. It is going to do a lot to keep both of these names in the limelight if the cars make good showings, and the concerns are to be congratulated for the policy.

Workmen in the Detroit car plants seem mightily pleased with the Eastern time that the city has just recently adopted. Now that it has been here long enough to allow the men to become accustomed to it, they appreciate the daylight that greets them on leaving their work at night. It seems to create a more cheerful feeling, and has no doubt been a good move.

Detroit Section Has Home

The Detroit Section of the S. A. E. is congratulating itself on the fact that it now has a permanent home with a paid assistant to the secretary.

To defray the expenses of the section under the new scheme, a budget of $2,500 was decided upon, and to May 15 over half of the needed amount has been pledged. The idea is to have the pledges come from manufacturers in this city or vicinity or from other concerns having offices here. It was only about a month ago that the idea was first announced, and now $1,850 is assured. In another month the section will have its welfare guaranteed for a year hence.

Many Detroiters are going to Indianapolis for the race, which as a meeting place for the engineers and factory men, is somewhat like the national shows.

Coffin Returns to Detroit

DETROIT, MICH., May 26—Howard Coffin, chief engineer of the Hudson Motor Car Co., has returned to this city after spending the winter on Sapeleo Island, off the coast of Georgia.

Hoover Steel Ball Doubles Plant

Machinery To Be Installed in 60 Days—Buyer of Crescent Plant To Build Cars

DETROIT, MICH., May 26—*Special Telegram*—The Hoover Steel Ball Co., Ann Arbor, Mich., has completed an addition to its manufacturing plant which will double its present capacity and make it one of the largest manufacturers in this line in the world, it is claimed. Within 60 days it is hoped to have all of the new machinery installed in the addition.

Crescent Plant Sale Confirmed—To Reorganize and Build Cars

CINCINNATI, O., May 21—The sale of the plant, stock and equipment of the defunct Crescent Motor Co., Carthage, O., to Col. F. B. Enslow of Huntington, W. Va., has been confirmed by the court. The purchaser has paid the second and last installment of the purchase price. This installment was $63,000 in bonds which he surrendered to the trustee, L. J. Huwe and $4,000 in cash. Col. Enslow is taking steps for the reorganization of the company and expects to manufacture automobiles.

$170,000 Bid for Detroit Body

DETROIT, MICH., May 22—At the sale of the property of the bankrupt Detroit Body Co., a bid of $170,000 was made by the Fisher Body Co., and it is now subject to confirmation by the U. S. district court. The property consists of 2.85 acres of land, the buildings, machinery and equipment, also stocks of materials, the whole having been appraised at $234,000.

Burd Gets Packard Contract

ROCKFORD, ILL., May 20—The Burd High Compression Ring Co., this city, has secured the contract from the Packard Motor Car Co., Detroit, Mich., to supply its entire 1916 requirements with the patented Burd high compression piston rings.

The increased business of the Burd company has necessitated doubling the floorspace and facilities of the factory more than twice within the last 6 months.

Hulett-Law to Handle Hudson

INDIANAPOLIS, IND., May 25—R. V. Law, assistant sales manager of the Pierce-Arrow Motor Car Co., Buffalo, N. Y., who has been with the company 7 years and J. B. Hulett, assistant sales manager Chandler Motor Car Co., Cleveland, O., formerly with the Pope interests, have formed the Hulett-Law Motor Car Co., this city. They will handle the Hudson as distributor for Indiana.

Export Bureau Established

To Foster Relations Between American and Foreign Organizations

NEW YORK CITY, May 24—THE AUTOMOBILE in cooperation with the trade and technical papers with which it is affiliated, has organized The United Export Bureau for supplying information and giving other aid to American manufacturers who are seeking export trade.

This action was taken, in part, because of the number of inquiries—and, in some cases, actual orders—which have come to our organization from distributers in foreign countries, more especially South and Central America.

This bureau, then, will act as an intermediary between foreign distributers and American producers, and also between foreign producers of raw materials and the manufacturing plants in this country by which such products are consumed.

The bureau will also assist American manufacturers in placing their advertising in newspapers and magazines published in Latin America. It will prepare photographs for United States concerns desiring to introduce their lines in Latin America, and will assist in the preparation of catalogues and other circular matter and the printing of them in Spanish, Portuguese or other languages. The bureau's accurate lists of merchants in the countries in question will enable us to duly take care of the mailing of such publicity.

The bureau will further aid in the introduction of U. S. A. products by supplying the press in South and Central America with illustrations which have been presented in THE AUTOMOBILE and in the other affiliated publications.

The charges for these various services and such other as may develop have not yet been fully determined. They will, however, be made as moderate as is compatible with the production of results.

The bureau is now in charge of a gentleman who has had wide experience in Latin America and is thoroughly familiar with the requirements of distributers and consumers there. Competent assistants have also been employed, and others will be added as the bureau's various activities require. Agents in the various countries of Latin America will also be appointed.

Chalmers Heads Detroit A. C.

DETROIT, MICH., May 22—At a banquet tendered by the charter members of the new Detroit Athletic Club to the officers and directors of the club, Hugh Chalmers, president of the Chalmers Motor Co., and president of the club, was the principal speaker. He dwelt on the great industrial future of Detroit as typified by the growth of the automobile industry.

Among the officers and directors of the D. A. C. are some of the best known men in the automobile industry. In addition to President Chalmers, there are Henry B. Joy, president of the Packard Motor Car Co., who is first vice-president; R. D. Chapin, Hudson Motor Car Co.; H. M. Jewett, Paige-Detroit Motor Car Co.; John Kelsey, Kelsey Wheel Co.; W. E. Metzger; Eugene W. Lewis, Timken-Detroit Axle Co., all of whom are directors.

American Automobile Sales in Venezuela Growing

CARACAS, VENEZUELA, May 20—Sales of American automobiles in Venezuela have increased materially since the outbreak of the European war, despite unfavorable economic conditions due to prompt reduction of all Government salaries and the paucity of markets for exports. More than 90 per cent. of the automobiles imported come through the port of La Guaira. From July, 1914, to March, 1915, both inclusive, only four European cars were imported, as compared with 97 new American cars.

Dollar Exchange Initiated in S. A.

BUENOS AIRES, ARGENTINE, May 20—Actual headway has been made in Argentine and Chile in the introduction of the dollar exchange. The National City Bank, through its branch in Buenos Aires, has been successful in establishing the dollar in Argentina, and in Chile the American Smelting & Refining Co. has been instrumental in having the matter of quoting bills drawn in U. S. dollars considered by the Valparaiso Stock Exchange.

The subject has been largely discussed, and eventual world's pre-eminence of the American dollar, according to authorities, is not improbable, provided that there is essential co-operation between bankers, shippers, exporters and manufacturers.

To Classify Technical Literature

NEW YORK CITY, May 22—Delegates from about twenty national technical and scientific societies met in the Engineering Societies Building yesterday for the purpose of perfecting a permanent organization whose duty would be to prepare a classification of literature of applied science which might be generally accepted and adopted by technical organizations. The officers elected were: Chairman, Fred R. Low; secretary, W. P. Cutter; and members of the executive committee, Edgar Marburg; H. W. Peck, Samuel Sheldon. The Society of Automobile Engineers was represented by Coker F. Clarkson.

10,282 Studebakers in 8 Weeks

Production from March 20 to May 15 over 50 Per Cent. Ahead of Last Year

DETROIT, MICH., May 20—With all its plants working to full capacity and with so many orders coming in from dealers and distributors all over the country, the Studebaker Corp. anticipates that 1915 will be by far the biggest year in its history since the manufacturing of automobiles was started by it.

Production and sales have been 50 per cent. ahead of those of last year, thus far. Just to show how conditions are at the big plant the figures of what happened during a period of 8 weeks will tell the story.

Beginning with the first of the week ending March 27 and including the week ending May 15, there were made and shipped 10,282 Studebaker cars, as compared with 6,841 during the corresponding 8 weeks in 1914. This means an increase of 3,441 cars disposed of, or 50 per cent. more than last year. While the average production and sales were 855 cars per week during that period in 1914, the average increased to 1,285 this year, an increase of 430 cars per week, or over seventy more cars per day.

Following is the official record of production and sales:

Week Ending	1914	1915	Increase
March 27........	805	1,275	470
April 3........	931	1,168	237
April 10........	1,002	1,063	61
April 17........	956	1,208	252
April 24	625	1,409	784
May 1........	819	1,518	699
May 8........	808	1,415	607
May 15........	895	1,226	331
Total	6,841	10,282	3,441

Pfeiffer, Miller Rubber Head, Delayed on Beached Ship

AKRON, O., May 20—Reports received from the West Indies contain the information that Jacob Pfeiffer, president of the Miller Rubber Co., this city, was on a ship that was beached off St. Kitt's Island. He notified his family in Columbus by cable that he would be home about a week later than scheduled because of the accident. He was a passenger on the steamer Byron.

Ohio Automobile Plants Doing Large Business

NEW YORK CITY, May 21—Reports from Ohio state that the commercial activity in the big cities there is at maximum capacity. At the present time the different automobile plants in Cleveland are working right up to schedule turning out cars, principally trucks, for European use. Large numbers of finished cars can be seen at each factory, the result of working night and day.

The territory around Cleveland is also a virtual bee-hive, particularly Akron, where the large tire factories are located. Like the factories in Cleveland, the shops in Akron are also working at capacity both day and night.

All this activity has created a practically unanimous feeling of prosperity and optimism in Ohio, which has been given further impetus by the indications that the crops in that state will equal, if not surpass, those of last year. The locating of a Federal Reserve Bank in Cleveland has, of course, brought considerable money and prestige to the city. The presence of the bank has facilitated the furnishing of funds which the various lines of manufacture have needed.

Leece-Neville Buys Factory

CLEVELAND, O., May 22—The Leece-Neville Co., this city, manufacturer of electric starting and lighting systems, has purchased a two and three-story factory, located at 5353 to 5363 Hamilton avenue, N. E. The various departments, together with additional up-to-date machinery, will be gradually moved into the new plant without any interruption to the production of the company. The new building has a frontage of 150 feet, and is 312 feet deep, and the acquisition of this enlarged manufacturing space and additional machinery will give the company adequate facilities to take care of its rapidly growing business.

The new factory is located on the main line of the Pennsylvania Railroad, with switching service connecting all the other railroads entering Cleveland.

Richardson to Represent Studebaker in South America

NEW YORK CITY, May 20—To assist in developing the rapidly growing business of the Studebaker Corp. in South America, D. B. Richardson sailed from New York City the week of May 17 for Buenos Ayres. He will be located for some time in the capital of the Argentine Republic while giving attention to the work of the Studebaker organization in that territory. Mr. Richardson speaks Spanish fluently, and is in entire accord with the civilization of Spanish-America.

Trustee Named for McIntyre

SOUTH BEND, IND., May 24—At a meeting of the creditors of William H. McIntyre, head of the McIntyre automobile works, at Auburn, Ind., held in the office of S. A. Wood, Referee in Bankruptcy, Willis Rhoades, of Auburn, was named trustee. Judge Wood also appointed Hugh Culbertson, Mike Boland and W. C. McNabb to appraise the property of Mr. McIntyre. They will have nothing to do with the automobile works.

Cal. Registrations 131,123

More Cars in Southern Half—Northern Portion Leads in Sales and Is Gaining

SACRAMENTO, CAL., May 21—According to the figures issued by the cashier of the State motor vehicle department at Sacramento, Northern California is selling more cars than the southern portion of the state which previously boasted 55 per cent. of the car business.

California has two registration offices, one at the State Capitol at Sacramento, and a branch in Los Angeles. The latter office takes charge of the registration from Tulare county south, and the main office looks out for the remainder of the state.

Within the last 2 months the Sacramento office of the department has been collecting $1,000 a day more than the Los Angeles office, and is now within $33,000 of being even with Los Angeles in registration collections.

The total collections of the motor vehicle department to the closing hour of the first half of May were $1,749,133.75, of which Los Angeles collected $891,221.75 and Sacramento branch $857,913.

The total number of automobile registrations is 131,123, or 6,000 more than the total at the close of the year 1914. They are divided as follows: Los Angeles, 67,525, and Sacramento, 63,598. It is believed that at the present rate the Sacramento division will pass the Los Angeles figures before July 1. Chauffeurs are divided as follows: Sacramento, 8,601, and Los Angeles, 5,975.

Van Speedometer for Chevrolet, Hupp and Jeffery

DETROIT, MICH., May 22—The Cutting, Armstrong & Smith Sales Co., Michigan representative for the Van Sicklen speedometer, has closed contracts with the Chevrolet Motor Co., Hupp Motor Car Co., and the Thos. B. Jeffery Co., for their 1916 equipment.

New York Dealers Win Test on License Tags

NEW YORK CITY, May 22—The right of automobile dealers to use manufacturers' number plates on their cars when the cars are being used for purposes incidental to the sale of cars, has been decided by the Court of Special Sessions in favor of the Automobile Dealers' Assn., which undertook the defence of T. P. Patterson, a chauffeur employed by the A. Elliott Ranney Co., who was arrested for driving a car bearing a manufacturer's number.

The association attorney, Charles Thaddeus Terry, defended the case in court, and contended that the law permits any dealer in motor vehicles to make use of the manufacturer's number plates on any of his cars when the car is in use for any purpose connected with the business of manufacturing or selling, including demonstrating, the operation of the cars on the streets for advertising purposes and the use of the cars by salesmen and managers in connection with business trips around the city or elsewhere. On consideration of Terry's contention the court acquitted Patterson.

To Use New Alloy for Spark Plugs

SOUTH BEND, IND., May 24—Dr. F. R. Carson, of this city, is interested in a company which will put a new spark plug, different from all others and for which strong claims are made, on the market in a short time. The new plug will be manufactured in Laporte, Ind. A new alloy, the discovery of H. M. Fetters, of Laporte, is the feature of the new plug, and it is said gives the new plug advantages possessed by plugs of no other make. The alloy resembles platinum and possesses many advantages of that metal at a very much lower cost. The points of the plug are made of this alloy and are in the form of half-spheres with the convex sides together, which, it is claimed, gives a larger and more intense spark, and tends to prevent the collection of oil and consequent carbonization.

English Financier Visits Plants

NEW YORK CITY, May 20—A. M. Sayer, Birmingham, Coventry, England, well-known English capitalist and probably one of the largest individual stockholders in the English automobile industry, is now making a 2 weeks' tour visiting all the American automobile factories. Mr. Sayer predicts a large market for American products on the continent.

Indiana Registrations Over 75,000

INDIANAPOLIS, IND., May 22—Previous records for issuing automobile licenses are being broken in Indiana. Thus far the Secretary of State has issued more than 75,000 licenses for 1915, and it is believed the total number for the year will be in excess of 75,000. There were 66,500 licenses issued during 1914.

National Used Car Market Report

CHICAGO, ILL., May 20—The Chicago Automobile Trade Assn. has, for the past year, been publishing the Used Car Central Market Report. This has been supplanted by the National Used Car Market Report. The title has been changed because of the report having become National in its scope.

Field for Taxicabs in Argentine

United Export Bureau Points Out That Promising Field —Cars Should Be Light

New York City, May 24—According to statements of the United Export Bureau about one-third of the automobiles in Buenos Aires are taxicabs. The street roads in that city are in splendid condition, but the suburban roads are bad and require very strong cars. The taxicab business in Buenos Aires, however, is good, as everyone travels in them. On Sunday it is not an uncommon sight to see working men and their families going about in automobiles.

The taxi rates are not high, it costing about 72 cents for the first mile and about 32 cents for each succeeding mile. The seven-seated touring cars are preferred to the taxicab. It is the belief of the United Export Bureau that there is now a very good opportunity for the American manufacturer to begin at once and send his representatives. In order to succeed the American manufacturer must be content with the same profit he makes here and it is very essential to have large showrooms centrally situated. A stock of several machines is advisable as when the Latin American decides to buy he wants the goods at once; orders are rarely given. Furthermore, it is indispensable that the representatives speak Spanish fluently.

The fact that American manufacturers have unsuccessfully attempted to introduce their products on several former occasions should not be discouraging, because if the matter is taken up correctly and not with a view of making an exorbitant, quick profit, success should result. The importation of European cars has come to a standstill and there is now a good opening for the American machine in the Argentines. The cars must be light, have high wheels and large tires. The cars which would be expected to sell best would be priced at from $1,000 to $1,400.

U. S. L. Plan Well Received

New York City, May 22—The reorganization plan for the United States Light & Heating Co. is meeting with favorable response. It is expected that the new company will have bought all assets of the old concern and should be in full operation by July 1. Opportunity for participation by stockholders in the reorganized company, which will carry the same name as the present one, but will be incorporated in New York instead of Maine, has been extended to June 1.

Preferred stock is now quoted, with none offered, at 28 bid, assessment paid. The issue of $2,500,000 preferred stock by the new company was underwritten without commission, but practically all holders of the preferred stock of the present company, totaling $2,500,000, have paid the $15 assessment on $100 par. This entitles them to an amount of new preferred corresponding to their present holdings. In connection with their assessment, common stockholders are being allotted $5 in new preferred and $20 in common for each $100 par turned in.

Optimism at McCord Plant

Detroit, Mich., May 22—With day and night shifts working for the last 3 months, and a total number of nearly 750 men on its pay roll, the McCord Mfg. Co., maker of automobile radiators, gaskets, stampings and other automobile parts, is hardly able to cope with its rushing business.

The first quarter of 1915 did not show a decided increase over the corresponding period in 1914, but ever since April there has been a steady and big increase in business, and indications are that the next 6 or 8 months will show a volume far in excess of any previous year's business in the history of the concern.

Manufacturers, who heretofore never placed big orders far ahead and who seldom gave specifications for over 1 or 2 months' output, have this year given all such information for many months to come, which is a condition never before experienced in the industry.

Pullman Ships 150 Cars a Week

York, Pa., May 22—Operations at the plant of the Pullman Motor Car Co., since the reorganization of the company several weeks ago, have been increased considerably. A number of changes were made at the plant. The office quarters have been enlarged and the capacity of the body department has been increased. Night work is being done in a number of the departments. On an average of 150 cars are shipped from the factory every week. A shipment of Pullman cars was made this week to the company's representative in London, England.

101 Case Cars for Russia

Seattle, Wash., May 20—The Japanese steamer Kagoshima Maru sailed from Seattle during the past week with a cargo valued at $975,000 and consisting of eighty cases of war automobiles manufactured by the J. I. Case Threshing Machine Co. The total consignment of automobiles was 101 and will be landed at Vladivostock for the use of the Russian army.

Increase of 43% for Sheldon Worm

From Sept. to Date Gain Was 42 Per Cent.—Increasing Equipment

Wilkesbarre, Pa., May 24—Reports from the Sheldon Axle & Spring Co. covering the fiscal year ending September, 1914, show an increase in the business of the worm gear axle department of 43 per cent. over the preceding year which in turn was 23.5 per cent. higher than the year 1912. From September, 1914, to date an increase of 42 per cent. over the corresponding period of 1914 has been shown. In order to meet the increasing demands added space and equipment have been gradually added and during the past week two 92-inch grinders have been received as well as two additional oil fires in the drop forging department. Within the next 30 days a considerable run of floorspace will be added to the worm gear department to take care of the enlarged line. Announcement also was made at the factory during the past week that the 5-ton capacity worm gear axle will be ready for delivery early in June.

Maxwell's Daily Output Averages 250—Payroll Numbers 6,391

Detroit, Mich., May 22—During the last 4 months the Maxwell Motor Co. has averaged an output of 250 cars a day, as compared with a daily average of 100 cars during the corresponding period in 1914. From January to end of April 2,268 men were added to the company's payroll, totaling 6,391.

Will Make Top Bows and Sockets

Pontiac, Mich., May 20—The American Forging & Socket Co. has been organized to make bows and sockets for top makers. The plant formerly occupied by the Hardwood Electric Co., has been secured as the home for the new concern, which will be incorporated, and will have a capital stock of $100,000. Those connected with the company are H. W. Wiley, president; E. W. Rathbun, treasurer; E. P. Heaton, secretary; Warren W. Stoler, consulting engineer, and E. J. Stoler, superintendent.

Favary Tire Incorporates in Canada

Toronto, Ont., May 22—The Favary Tire Co., Ltd., has been incorporated. The head office of the company is in Toronto. The capital stock is $500,000, divided into 50,000 shares of $10 each.

The company has an agreement with the Favary & Cushing Co., of New York, to purchase the Canadian patent granted in December, 1909, for cushioning devices and will pay therefor $50,000 in cash, and $250,000 par value of fully paid stock.

Directors of the company are: Walter Page, H. C. Appleton, R. P. Powell, James Crang, A. S. Hamilton, C. H. Rooke and A. W. Hunter, all of Toronto.

N. Y. Automobile Trade Assn. Re-elects Officers

NEW YORK CITY, May 20—At a meeting of the directors of the Automobile Trade Assn. of New York State yesterday in this city, R. H. Johnston, of the New York Automobile Dealers' Assn., was re-elected president; C. D. Hakes, of the Albany Automobile Dealers' Assn., was re-elected vice-president; R. E. Brown, of the Buffalo Automobile Dealers' Assn., was re-elected treasurer, and C. A. Stewart, of the New York Assn., was re-elected secretary and general manager. All the elections were unanimous.

Golden, Belknap & Swartz Show 15 Per Cent. Increase

DETROIT, MICH., May 20 — From January to April the business of Golden, Belknap & Swartz, manufacturers of light car motors, shows 150 per cent. increase over the first 4 months of 1914. May, thus far, shows the same condition, and it is worrying the officials as the plant is being run to its full capacity, and they are behind in deliveries.

There are about 125 men in the shops now and the output has been thirty-five, or more, motors a day, or twice as many as last year.

It is not improbable that either a new plant or the considerable enlargement of the present one will have to be decided upon shortly to meet this increasing business, said an official of the company.

New Anderson Electric at $2,450

DETROIT, MICH., May 26—*Special Telegram*—The Anderson Electric Car Co., this city, has brought out a new $2,450 electric passenger model known as Model 55 Special, which is a development of the present Model 50 brougham. The new model has glass windows in the rear quarter panels which were formerly of solid aluminum. This gives a better vision. The new model has new Perfection lifts for the door windows.

Arndts Joins Western Spring & Axle Co. as Metallurgical Engineer

DETROIT, MICH., May 24—E. C. Arndts, of the Cleveland-Canton Spring Co., Canton, O., has been appointed engineer of the metallurgical department of the Western Spring & Axle Co., which has just moved into new quarters in the Garfield building, Woodward avenue. This latter company is in reality the representative here for the following concerns: Cleveland-Canton Spring Co., Canton, O.; Ansted Spring & Axle Co., Connersville, Ind.; Cincinnati & Hammond Spring Co., Cincinnati, O.; Hess-Pontiac Spring & Axle Co., Pontiac, Mich.; Hess Spring & Axle Co., Carthage, O.; J. B. Armstrong Mfg. Co., Flint, Mich.; Spears Axle Co., Wheeling, W. Va., and the Champ Spring Co., St. Louis, Mo.

G. H. Russel Passes Away

DETROIT, MICH., May 18—George H. Russel, one of Detroit's most prominent business men, died yesterday. He was founder of the Russel Wheel & Foundry Co., and secretary-treasurer of the Russel Motor Axle Co.

Vincent, of Remy, Dies

CHICAGO, ILL., May 20—E. R. Vincent, manager of the Chicago branch of the Remy Electric Co., died suddenly at his home at 4033 Drexel boulevard, Chicago, May 14. Mr. Vincent had many friends in the automobile and accessory industries.

Washington's New Law in Force June 10

SEATTLE, WASH., May 21—Washington's new motor vehicle code goes into effect Thursday, June 10, supplanting the legislation of 1905 which has been amended from time to time to meet changed conditions in the industry. The new code is entirely different from its predecessor. It is thoroughly up to date and among its new provisions are those covering jitney bus lines, joy-riding and weight limits on vehicles that may traverse public thoroughfares.

According to the new law the cars will be licensed by county auditors instead of by the secretary of state and a graduated tax on horsepower will be used. Jitney bus drivers are required to take out $2,500 surety bonds and the heaviest vehicle allowed on public highways is limited to 2,400 pounds. The law also specifically states that upon the sale of a car the vender must remove the license number.

Michigan Garagemen Organize

DETROIT, MICH., May 22—The garagemen of the state have formed an association known as the Garage Owners' Assn. of Michigan. The organization plans to work for the promotion of good roads and also plans activity in insurance, banking and co-operative purchasing. The initiative in the work of promoting the association was taken by the Detroit Garage & Station Operative Assn., of which F. A. Bean is president. The association will be affiliated with the national organization.

Tripp Is Singleton Vice-President

CLEVELAND, O., May 20—W. H. Tripp, well-known in the automobile industry, has been elected vice-president of the J. F. Singleton Co., Cleveland, O.

Brazilian Rubber Duty in Abeyance

WASHINGTON, D. C., May 24—Owing to the impracticability of enforcing the Brazilian budget law for 1915 as regards the increased import duty on rubber goods, it has been decided to hold in abeyance these provisions. It is stated that the matter will again be submitted to the Brazilian Congress which is now in session and pending further action. The former rates of duty will apply on rubber tires and insulated wire. The concession will be made only upon condition that the importer obligates himself to pay the difference in duty in case the provision is not repealed.

Monitor to Continue Eight

COLUMBUS, O., May 22—The Cummins Auto Sales Co., formerly Krit dealer in this city, will not drop the production of its Monitor eight-cylinder model, as was stated in THE AUTOMOBILE for April 29. It is the intention to continue this model as well as the smaller four-cylinder model, which will sell for $795, with complete equipment, including electric lighting and starting.

Insurance Cos. Responsible for Safety of Policies

ST. LOUIS, MO., May 14—The ruling that automobile insurance companies are responsible for the safety of their policies was upheld by Circuit Judge Cave here a few days ago when he quashed the indictments against two men who had been charged with attempting to obtain money by false pretense from the Maryland Motor Car Insurance Co.

The indictments charged that the defendants had placed a valuation of $2,750 on an automobile which in reality was worth only $1,000 and that they had represented that it was a 1913 model when the machine was a 1911 model. The suit grew out of the automobile owners' attempt to collect damages from the insurance company after the machine in question had been destroyed by fire.

In announcing his decision Judge Cave ruled that even if the charges in the indictment had been proved they would not constitute a legal offense, as other courts had held that it was the duty of the insurance company to safeguard its own policy.

New Pathfinder Automobile Co.

Concern Reorganized with Capital of $250,000—Lower Prices—Output 1,000

INDIANAPOLIS, IND., May 24—With an authorized capitalization of $250,000, the Motor Car Mfg. Co. has been reorganized under the name of the Pathfinder Automobile Co. Articles of incorporation for the new concern were filed with the Indiana secretary of state last Friday and a charter has been granted.

In the reorganization the company has been strengthened. C. W. Richards and Leo Raminsky have bought stock in the company and these men and G. I. Lufkin, California agent for the Pathfinder, are named as the incorporators.

A cut in price and an increased manufacturing schedule are planned for this season. Officials of the company state that it intends to produce from 1,000 to 1,500 cars during 1915. This has necessitated an increase in the working force.

It is announced that the officers of the new company will be the same as those of the old concern, except that George Drawe has become sales manager. Mr. Drawe is well known in automobile circles.

A new name has been taken for the company in order that it may be more indicative of the business. Plans are under way for increasing the output and the present season promises to be the most successful that the company has ever had.

New Caterpillar Truck

MILWAUKEE, WIS., May 21—Applying the caterpillar traction device to a motor truck for the first time commercially, the Allis-Chalmers Co. has taken the first step towards its active entry into the motor truck field. The new vehicle is not intended for city work, of course, but rather for the service of road builders, contractors, for farmers, lumbermen, and others who have to do heavy hauling over poor roads or no roads. The vehicle consists of a substantially standard motor truck chassis whose front wheels are of the farm implement type with ribbed steel tires and the rear wheels displaced by caterpillars. These comprise nests of wheels and rollers inclosed in continuous flexible belts built up of links with sectional steel treads. On the inside is a track upon which the wheels run. A sprocket at the rear end drives the flexible belts or caterpillars. The gearbox affords four speeds forward, giving speeds of from 1 1-2 to 10 miles per hour, and a draw-bar pull varying from 2,370 pounds to 9,000 pounds. The truck carries a body for 5 tons.

Market Prices Steady

NEW YORK CITY, May 25—Changes this week in market prices were for the most part in metals. The majority of the other products remained unchanged. The oils and lubricants were steady with a moderate demand and activity. Crude rubber was steady with a light demand from the manufacturers.

The metal changes this week were of the usual type. Aluminum, which went up to 22 cents on Thursday and held at that price to the closing on Monday, was firm; its gain was 2 1-4 cents. Copper showed no improvement in demand. Producing interests are still asking 18 1-2 cents a pound for electrolytic. The domestic situation is without improvement and temporarily all foreign orders for manufactured products have been covered. Lake copper showed improvement in tone, closing at 18 1-2. A weaker tone developed in the tin market. There was a general disposition to hold off from purchasing by both consumers and dealers. Tin went down $1 per 100 pounds.

The rubber market has passed through a dull and uneventful week. Offerings were light. Few manufacturers seem disposed to purchase beyond their current needs.

Reo Co. To Enlarge Factory

More Room for Men—Two Three-Story Additions and Several Improvements

LANSING, MICH., May 21—Enlargement of the Reo Motor Car Co. has been decided upon and the new buildings are to be ready in September. One three-story building, 100 by 250 feet, will be erected on the south side of the plant. Its first floor will be an assembling room for chassis, the second floor will be the chassis painting department and the third floor will be the trimming department.

A three-story addition, 50 by 50, to the engineering building, will provide additional floorspace for the testing laboratory and drafting rooms, a pattern vault, a body designing department and a photograph gallery.

Two stories will be added to the receiving room and conveyors will be installed to carry stock from one floor to another.

New loading and unloading docks connecting with a receiving room and a warehouse for incoming materials will also be put up.

According to general manager R. H. Scott, these additions are not being made to increase the production materially but to give more room to the men and thus render working conditions more agreeable.

The big warehouse which was erected at a cost of $250,000 last year and which has room for 2,000 cars will probably also be transformed or changed to suit for manufacturing purposes. This building was put up to store cars but the Reo company says that not a single car has yet been stored in it, or in any other building, as the production has never been up to the demand this season.

Jobbers Form National Association

CHICAGO, ILL., May 21—The National Assn. of Automobile Accessory Jobbers was formed in this city recently to serve as a national organization for the general improvement of the accessory jobbing business. Twenty jobbers, representative of the industry, and coming from different parts of the country, met at the Union League Club in this city for the purpose of organization and the general discussion of a program of activities. After the adoption of the constitution and by-laws, and the election of officers, subjects pertinent to the accessory jobbing business were discussed. Price maintenance was one of the pertinent topics handled, and it was the consensus of opinion that it is advisable to keep accessory prices to the consumer constant, regardless of the purchasing

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum	.19¾	.21½	.21½	.22	.22	.22	+.02¼
Antimony	.34	.34½	.34½	.34	.34	.35	+.01
Beams & Channels, 100 lbs	1.31	1.31	1.31	1.31	1.31	1.31	.....
Bessemer Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	.....
Copper, Elec., lb.	.18¾	.18⅝	.18½	.18½	.18½	.18½	—.00¼
Copper, Lake, lb.	.18¼	.18½	.18½	.18½	.18½	.18½	+.00¼
Cottonseed Oil, bbl	6.25	6.28	6.35	6.36	6.38	6.35	+.10
Cyanide Potash, lb.	.24	.24	.24	.24	.24	.24	.....
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	.....
Gasoline, Auto, bbl	.12	.12	.12	.12	.12	.12	.....
Lard Oil, prime	.90	.90	.90	.90	.90	.90	.....
Lead, 100 lb	4.20	4.20	4.20	4.20	4.20	4.20	.....
Linseed Oil	.67	.67	.67	.67	.67	.67	.....
Open-Hearth Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	.....
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	.....
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	.....
Rapeseed Oil, refined	.82	.82	.82	.82	.82	.82	.....
Rubber, Fine Up-River, Para	.61	.60	.60	.61	.61	.60	—.01
Silk, raw, Ital.	..	..	3.90	..	..	3.90	.....
Silk, raw, Japan	..	..	3.55	..	..	3.50	—.05
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb.	38.50	37.50	37.75	37.88	37.88	37.50	—1.00
Tire Scrap	.05	.05	.05	.05	.04½	.05	.....

source. The new organization will make it one of its works to promote the interest of the legitimate accessory jobber by the proper handling of accounts, and putting the business in its proper field. The organization also has for its object the removal of many evils with which the business is constantly confronted. The adjustment of slow and bad accounts is one of these abuses. The organization will aim to harmonize the various factors in the trade, thereby promoting the general welfare of its members.

The officers elected were: President, T. M. Brooks, The Automobile Supply Co., Chicago; vice-president, S. P. Dean, Nichols, Dean & Gregg, St. Paul, Minn.; chairman Board of Directors, Chas. E. Faeth, Motor & Mechanics Supply Co., Kansas City, Mo.; and four directors: W. L. Ferrier, Fred Campbell & Co., St. Louis, Mo.; H. P. Andrae, Andrae & Sons Co., Milwaukee, Wis.; A. R. Thompson, Automobile Supply Co., Detroit, Mich., and W. W. Low, Electric Appliance Co., Chicago, Ill. W. M. Webster, 139 North Clark street, Chicago, is secretary.

It is the general feeling among several of the officers that the garageman should handle accessories and that in order to carry this out successfully he must look after his business in a business-like manner, otherwise this field of business will sooner or later be absorbed by mail order houses.

17,200 Licenses Out in Oregon

SALEM, Ore., May 8.—Over 17,200 licenses have so far this year been issued in the state of Oregon, as compared with only 16,347 for the entire 12 months of 1914.

Securities Firmer in Tone

Prices Higher Despite War Developments—Italy's Action Favorable

NEW YORK CITY, May 22—Automobile security prices, despite the entrance of Italy into the European war and the keen interest in the forthcoming reply of the German Government to the American note, were higher last week. The Italian move seems as a rule to be interpreted as a favoring influence for the general market. Quotations throughout the week were for the most part steady, showing a firm undertone.

Changes this week ranged from gains of 1-4 to 7 points and losses from 1 to 19 points. Most of the changes were gains. Tire issues showed a declining tendency; Goodyear common dropped 19 points; Kelly-Springfield common went down 7 points, its first preferred 2 points and its second preferred, 15 points. Both the common and the preferred of the United States Rubber went up 1 and 1-4 points respectively. Goodrich common and preferred went up 4 and 3-4 points.

Most of the automobile securities showed small changes. J. I. Case preferred went down 4 points; General Motors common went up 7 points; Maxwell stocks all went up, the common 3 points, first preferred 3 1-2 points, and the second preferred 4 points; both Reo issues rose, the truck 1-2 point, and the passenger car, 1 7-8 points; Stewart-Warner common rose 4 points; Studebaker common went up 4 points; Texas stock went up 2 points, while Vacuum oil rose 1 point. Willys-Overland common showed a gain of 2 points.

A strong tone developed in the Detroit securities, most of the issues showing gains. The largest gain was that of the Canadian Ford in inactive stocks, which was 200 points. In the active stocks the gains ranged from 1 to 9 points.

Lack of Uniformity in Texas Gasoline Prices

AUSTIN, TEX., May 22—The lack of anything like uniformity in gasoline prices in Texas and Oklahoma may bring about a joint investigation of the refined oil trade of the two States by their Attorneys-General departments. It is alleged that the refining companies arbitrarily fix the prices of gasoline without regard to the conditions surrounding the industry. It is pointed out in support of this contention that the fuel may be selling for 10 or 12 cents per gallon in Austin, Tex., and on the same day the price is perhaps 14 to 16 cents per gallon in some other town of the State which takes the same freight rate. Recently citizens of Poteau, Okla, filed complaint before the Corporation Commission of that State against the Pierce Oil Corp., the Gay Oil Co., the Texas Co., and the Magnolia Petroleum Co., alleging that the price charged in that town for gasoline is excessive as compared with many other places in Oklahoma. The complainants point out that the retail price of gasoline is 16 cents per gallon. The case was set for hearing June 8.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co. com	215	..	300	..	..
Ajax-Grieb Rubber Co. pfd	99	..	101	110	..
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	84	87	76	82	—4
Chalmers Motor Co. com	92	95	90	93	—1
Chalmers Motor Co. pfd	90	92½	95	98	..
Electric Storage Battery Co.	52	53	..	..	..
Firestone Tire & Rubber Co. com	302	307	..	485	..
Firestone Tire & Rubber Co. pfd	108	110	110	112½	..
General Motors Co. com	83½	85	135	137	+7
General Motors Co. pfd	93	93½	97	100	..
B. F. Goodrich Co. com	25¾	25¾	44	45	+4
B. F. Goodrich Co. pfd	89	90	101¾	102½	+ ¾
Goodyear Tire & Rubber Co. com	177	182	225	235	—19
Goodyear Tire & Rubber Co. pfd	98	100	105	106½	..
Gray & Davis, Inc., pfd	95	102½	..	..	..
International Motor Co. com	..	5	12	14	— ½
International Motor Co. pfd	3	10	30	33	—1
Kelly-Springfield Tire Co. com	..	..	124	128	—7
Kelly-Springfield Tire Co. 1st pfd	..	..	81	83	—2
Kelly-Springfield Tire Co. 2d pfd	..	..	115	130	—15
Maxwell Motor Co. com	11½	12	39	41	+3
Maxwell Motor Co. 1st pfd	18½	19	82	83	+3½
Maxwell Motor Co. 2d pfd	44⅞	45	34	36	+4
Miller Rubber Co. com	..	..	180	188	..
Miller Rubber Co. pfd	..	..	104	105	..
New Departure Mfg. Co. com	122½	124	136	141	..
New Departure Mfg. Co. pfd	105	107	106	..	..
Packard Motor Car Co. com	103	..	..	104	..
Packard Motor Car Co. pfd	97½	..	98	..	—1½
Peerless Motor Car Co. com	18	25	..	..	..
Peerless Motor Car Co. pfd	..	62½	..	..	..
Portage Rubber Co. com	..	40	35	38	..
Portage Rubber Co. pfd	..	90	85	88	..
*Reo Motor Truck Co.	8¼	9¼	15	15⅜	+ ½
*Reo Motor Car Co.	26½	28½	32⅞	..	+1⅞
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	47	49	64	65	+4
Stewart-Warner Speed. Corp. pfd	97	98½	102	105	..
Studebaker Corporation com	32⅛	34	65	67	+4
Studebaker Corporation pfd	89¼	†90¾	96	98	—1
Swinehart Tire & Rubber Co.	65	70	80	90	..
Texas Co.	140	141½	123	124	+2
U. S. Rubber Co. com	58½	59	61	63	+1
U. S. Rubber Co. 1st pfd	102⅜	102⅞	104⅜	106⅝	+ ¼
Vacuum Oil Co.	217	220	195	205	+1
White Co. pfd	107	110	103	108	..
Willys-Overland Co. com	69½	73	111	113	+2
Willys-Overland Co. pfd	92	94	99⅝	102	— ⅜

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Chalmers Motor Co. com	101	..	89	92	..
Chalmers Motor Co. pfd	92	..	94	97	—1
Continental Motor Co. com	150	180	..	185	..
Continental Motor Co. pfd	..	75	84	85½	+ ½
General Motors Co. com	83	84½	137	139	+9
General Motors Co. pfd	93½	95	98	101	+1
Maxwell Motor Co. com	13¾	14½	40	42	+4
Maxwell Motor Co. 1st pfd	46	47½	83	84½	+6½
Maxwell Motor Co. 2d pfd	20	21	35	36½	+4
Packard Motor Car Co. com	†103	..	..	104	+3½
Packard Motor Car Co. pfd	98½	100½	..	100½	..
*Reo Motor Car Co.	27½	28¼	32¼	33¼	+ ½
*Reo Motor Truck Co.	9⅜	10¼	15	15⅜	+ ½
Studebaker Corporation com	..	..	66	67½	+4¼
Studebaker Corporation pfd	..	..	..	99	—1

INACTIVE STOCKS

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
*Atlas Drop Forge Co.	..	21	..	26	..
Ford Motor Co. of Canada	..	555	900	..	+200
Kelsey Wheel Co.	..	193	200	..	+5
*W. K. Prudden Co.	..	20½	19½	21	..
Regal Motor Car Co. pfd	..	30	..	25	..

BONDS

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
General Motors, notes, 6s, 1915	101	102	..	..	..
Packard Motor Co., 5s, 1916	95	98½	98½	..	..

---

*Par value $10; all others $100 par value

†Ex. dividend

Twin City Speedway Plans

Total Investment About $603,000—Track to Be Cement—50,000 Spectators

MINNEAPOLIS, MINN., May 22—President F. H. Wheeler of the Twin City Speedway Co., who spent a few days in the city this week, is confident that by August 15 all of the work of constructing the 2-mile motor oval will be completed and ready for a race which it is hoped will be staged towards the end of September. Work was started 2 weeks ago and night gangs will soon be started.

The total investment will approximate $603,000, made up as follows: Land, 343.5 acres, $142,000; concrete track, $181,000; grading of land for track and stands, $80,000; covered steel grandstands to seat 50,000 spectators, $100,000; four 60-foot tunnels under track, $50,000; fence, $10,000; garages and other buildings, $40,000.

The track is to be a cement oval 80 feet wide at all points and with 500-foot straightaways on each side. The banking on the curves is for a speed of 120 miles per hour, this banking being as a paraboloid curve rather than a straight incline. On both sides of the track is a 2.5-foot cement wall extending all the way around. The grandstands are set 30 feet back from the track on the stretches and 40 feet back on the curves.

To Stage 200-Mile Event at Hamline

HAMLINE, MINN., May 22—Plans are made for a 200-mile automobile race at the Minnesota state fair at Hamline. The first leg, 100 miles, will be run September 8 and the second September 11. The purse will be $5,000, divided as follows: First, $2,500; second, $1,000; third, $500; fourth, $300; fifth, $100. Of the total $600 is reserved for a consolation race, the first money being $350; second, $150; third, $100. As the International Motor Contest Assn. limits starters to ten an elimination trial over a 2-mile course may be necessary. Cars failing to enter the big event may enter the consolation sweepstakes race of 25 miles. Entries for the race close August 10, entry $100. To best the Hamline and world 1-mile and 5-mile circular dirt track records trials will be run the first day. Five hundred dollars is offered to break the world record and $200 for the track record of 4:17.

Columbus May Build Speedway

COLUMBUS, O., May 21—Because of the large crowd which attended the race meeting held in Columbus, May 15 and 16, when about 20,000 paid admission on one day, several Columbus men have started a movement to build a motor speedway similar to the one at Los Angeles. One plan discussed is to have the owners of the Columbus Driving Park build up the turns and make the track more suitable for automobile racing.

Spokane Holds First Show

SPOKANE, WASH., May 20—Spokane's first automobile show held the attention of the dealers and also thousands of interested spectators, who thronged the Davenport Hotel, which had been changed to a luxurious garage, and which made an ideal setting for the cars.

Although held late in the season the show was a success, the sales made being far beyond the expectation of the dealers. The Seven-Seven Co., agent for the Dodge, received deposits on fourteen cars the first day the show opened.

Another feature of the show week was the hill climbing contest. The course was 2,074 feet in length and the average grade 8.05 per cent., the maximum pitch being 17 1-2 per cent. In other words the cars were required to rise 168 feet in two-fifths of a mile with a running start of a little more than 100 yards.

A stripped Ford, driven by Harry Bell, made the best time going over the hill in 40 seconds flat, a speed of 36 miles an hour. It was the free-for-all race in which the Ford was victorious. A National car, driven by George H. Beck, was second, making the distance in 41 3-5 seconds and a Cadillac eight, third in 44 3-5 seconds.

Event No. 1—Stock cars costing less than $1,000—Dodge first, 49 2-5 seconds; Buick, second, 54 2-5; Maxwell third, 55.

Event No. 2—Cars costing between $1,000 and $1,500—Buick, first, 50 2-5 seconds; Paige, second, 51 2-5; Chandler, third, 52 1-5.

Event No. 3—Cars costing more than $1,500—Cadillac, first, 45 2-5 seconds; Cole, second, 49 3-5; Franklin, third, 55 2-5.

Twelve Tacoma Entries to Date

TACOMA, WASH., May 21—Entries for the Tacoma races, July 4 and 5, have received a boost during the past week, the latest to come in being the Maxwell team of three cars with Endicott and Carlson nominated as drivers, with Arthur Klein a possibility for the third car. Besides these Capt. Kennedy has been entered with the Edwards Special, and Jennings with the Keeton. This will give to the Tacoma races two cars which have never yet appeared here, as well as some new drivers.

The Edwards Special was built in California for the Vanderbilt and Grand Prix, while the Keeton is the car with which Bob Burman made a record at the Tacoma races in 1913. The machine has been entirely rebuilt. The Tacoma entry list is as follows:

Car	Driver
Mercer	Pullen
Mercer	Ruckstell
Mercer	Thomas
Stutz	Earl Cooper
Stutz	Lewis
Maxwell	Carlson
Maxwell	Endicott
Maxwell	Unnamed
Peugeot	Burman
Parsons Special	Parsons
Keeton	Jennings
Edwards Special	Kennedy

Briggs-Detroiter Builds Four-Cylinder Racing Car

DETROIT, MICH., May 22—The Briggs-Detroiter Co., which makes the Detroiter four and eight, will go into racing. A car is now in course of construction and is expected to be ready to take part in dirt track races in July. The racer is to have a special high powered four-cylinder motor, but the chassis is to be a regular stock Detroiter. It has not yet been decided who will pilot the car.

Wager of $1,000 on 315-Mile Endurance Run to Minneapolis

CROOKSTON, MINN., May 22—A race of 315 miles to Minneapolis is announced for June 5. Walter J. Hill, son of J. J. Hill, whose business address is Northcote, Minn., will race A. F. Harland, of Chicago, for $1,000 against $500. It will be an endurance run, replenishing of gasoline tanks and necessary repairs being allowed. Hill will drive a Packard and the Chicago man a Marmon.

Demand Sends Benzol Price Up

NEW YORK CITY, May 20—Increasing demands from the purchasing agents of the allies for benzol has resulted in further advances in prices of the product. Domestic inquiries for benzol and toluol have found few producers able to fill the orders, because the output of practically every available plant has been contracted for by the war agents for a long period ahead. Benzol is now being sold in bulk anywhere from $1 to $1.50 a gallon and is being used by the allies mostly for explosives.

The Lackawanna Steel Co., the Republic Iron & Steel Co., the Laclede Gas Light Co., of St. Louis, and the Woodward Iron Co., of Alabama, are among the companies which have completed large benzol plants within the last week, or are rushing new establishments to completion to meet the extraordinary demand.

Titus with N. Y. Hudson

NEW YORK CITY, May 25—E. S. Partridge, sales manager of the R. M. Owen Co., Hudson distributor in New York City, has added Fred J. Titus to the staff. Titus was recently with the Simplex company.

Jitneys Regulated in New York

Thompson Bill Signed—Developments in Other Parts of the Country

ALBANY, N. Y., May 22—New York State's first law regulating jitney buses became operative today, when Governor Whitman signed the Thompson bill placing them under the jurisdiction of public service commissions and municipal authorities.

At a recent hearing on the measure jitney owners told the Governor his approval of the bill would drive them out of business, as it was worded so that it would require each one to file a $5,000 bond. The Governor then announced that if he found this assertion well grounded he would veto the measure.

In a statement accompanying his approval today the Governor did not comment on the bond question.

New Ruling on Jitney in Wash.

OLYMPIA, WASH., May 16—In an opinion by assistant attorney general E. W. Allen it is ruled that a stage operating between a first class city and some outside point, even though passengers are not carried between points within the first class city, is a jitney bus so far as the 1915 law is concerned, and must therefore post the statutory $2,500 surety bond.

It is also held that a jitney must post the bond, whether it follows a regular route and runs under regular time or not, and that a personal surety bond is not sufficient. The surety bond must be guaranteed by a company licensed to do business in the state.

Jitneys Exempt from Pennsylvania State Control

HARRISBURG, PA., May 20—Jitney buses do not come under the provisions of the law creating the Public Service Commission, and certificates of public convenience are not necessary, according to the general opinion expressed at the commission headquarters recently.

Jitney Union In Minneapolis

MINNEAPOLIS, MINN., May 24—Fifty jitney bus drivers in Minneapolis have formed the Jitney Bus Men's Union. Opposition to unfriendly legislation was the motive. The union condemned overcrowding of the machines and careless driving. Transfer of passengers was opposed, also a proposed $10,000 liability bond. Purchase of accessories in Minneapolis was pledged and a uniform sign was agreed upon. Taxicab rates will be charged only off the regular routes for any car. Officers were elected as follows: President, J. C. Wallace; vice-president, F. C. Strasburg; secretary-treasurer, H. Belitz; recording secretary, A. E. Higby; executive committee, W. A. Johnson, C. E. Lind, F. H. Anderson. Membership has already reached seventy-five.

Washington Recognizes Jitneys

WASHINGTON, D. C., May 22—An important report on the jitney bus has been made to the public utilities commission by Conrad Syme, corporation counsel of this city, who recently made an extensive trip around the country investigating the jitney bus situation. That the jitney bus has become an important factor in modern city transportation, that the people of Washington have a right to this form of transportation and that "any further extension of street railway tracks in or near the business section of the city may be very unwise," are the three principal conclusions reached by Syme in his report. The report is based on a study made by Syme of conditions in New Orleans, Los Angeles, San Francisco, Kansas City and St. Louis.

Other of Syme's conclusions are that the jitneys strike directly at the short-haul revenues of the street railways, that, though the cars have caused considerable congestion in the streets, this has brought about little trouble and that the jitney systems are dependent on a minimum of restrictions in order that they may be run profitably.

Providence Jitney Ordinance Passed

PROVIDENCE, R. I., May 20—The Common Council on May 17 passed the jitney ordinance adopted by the Board of Aldermen. The main features of the ordinance are: a license fee of $5 per passenger seat; bond of $500 per passenger seat; drivers must be 20 and pass road test; jitneys may wait 5 minutes downtown for passenger; passengers limited to seating capacity of machine; no smoking or drinking by drivers; no advertising on outside of machine; and takes effect July 6, if approved by mayor.

Pacific Coast Jitneers Discouraged

TACOMA, WASH., May 20—A review of the jitney situation on the Pacific Coast shows that there was an average of 290 machines in operation in Portland, Ore., during April, while in March there were 320 in operation. Of this number 275 are members of the Auto Transit Welfare Assn. The jitney people are becoming discouraged. Owing to the financial condition of most of the owners it will be with difficulty that they will be able to wage a campaign to defeat the referendum ordinance regulating them.

In Seattle the courts have upheld the validity of the jitney state law which requires that jitney drivers are to operate under a license and a personal bond of $100 a year.

In San Francisco members of the street car men's union who have been discharged by the United Railroad, propose to get into the jitney business and compete with their former employers. About 100 of these men propose to operate jitneys.

Virginia Railroad Earnings Hit by Jitneys

RICHMOND, VA., May 20—In its report of earnings for April, 1915, the Virginia Railway & Power Co. shows clearly the effect of the jitney competition in Richmond on its revenues. Gross for April was $9,638, or 2.29 per cent. below April, 1914.

Previous to the advent of the jitneys in Richmond, the gross of the company was showing a good gain over the preceding year, but it did not take long for the jitneys to turn this increase into a decrease. In April, 1915, operating expenses increased $8,148, or 4.22 per cent.

Lose in Oakland, Cal.

OAKLAND, CAL., May 20—That the people of the Pacific coast have decided that the jitneys require regulation is indicated by the adoption by over 9,000 majority at the special election in Oakland of an ordinance imposing heavy restrictions on jitney operation. At the same time an ordinance changing the annual license fee for jitneys from $60 to $10 was defeated.

$25 a Year in New Albany, Ind.

NEW ALBANY, IND., May 21—The city council of this city has adopted an ordinance aimed to regulate the jitney bus business by imposing a license fee of $25 a year on motor-driven vehicles used for transportation of passengers for hire and prohibiting them from standing in front of stations. It is asserted that the receipts of the traction company show a falling off of nearly 50 per cent. in the last 2 months.

Railroad Engineers Run Buses

RUTLAND, VT., May 22—Starting today a cross-state line using steam automobiles driven by railroad engineers began operations between this city and Stockbridge in Eastern Vermont. It is not competing with the railroad, for it makes a connection between the White River Road and the Rutland. Vice-president E. S. French of the former railroad is at the head of it. By using the motor road it means a saving of $2.05 in fares and a couple of hours between Rutland and Randolph, and it provides an easy way to reach Montpelier, the capital, by changing at Bethel. Busses carrying 15 are used, and one round trip a day is made at present. The service will be increased later. It is not a jitney line, for the fare is $1.50. Trucks will be used to carry freight and baggage if conditions warrant it later.

Must Carry Rear Sign

PHILADELPHIA, PA., May 22—To lessen the risk of accidents an order has been issued requiring jitneys to have a placard or metal sign bearing the words Jitney Bus on the rear of the machines as well as on the front.

An order was also issued prohibiting automobiles using dealers' license tags for the jitney traffic.

Baltimore to Washington

BALTIMORE, MD., May 21—The motorbus service between Baltimore and Washington started recently and the new line bids to be very successful. The buses leave the Hotel Emerson in this city at 8 and 11 a. m. and 2 and 5 p. m.

Baltimore is now connected with Taneytown by a motorbus line started today.

Must Have License in Indianapolis

INDIANAPOLIS, IND., May 21—Mayor Joseph E. Bell has declared war on unlicensed jitney buses in Indianapolis. He wrote a letter to Samuel V. Perrott, chief of police, directing that officers be assigned to patrol the streets of the business district to ascertain if all the buses have city licenses and to arrest the drivers of all machines not having such licenses.

Jitneys Numerous in Wilmington

WILMINGTON, DEL., May 24—Jitneys have become so numerous in Wilmington that the city authorities have taken under consideration the matter of regulating their use of the streets. The matter was a subject of a conference a few days ago between city council and the street and sewer department, which has control of the streets, and at the last meeting of the latter department it was announced that some action would be taken as soon as it was determined what ought to be done. The jitneys have been curtailing the trolley revenue, but this is not the reason for their proposed regulation.

159 Violations of Pennsylvania Law

HARRISBURG, PA., May 22—A statement of the fines collected for violation of the automobile law in 1914 shows 159 violations in the several counties of the state with total fines collected amounting to $19,853.89. Of this amount $16,242.48 was paid to city, borough or township treasurer, $3,611.41.

The violations and fines collected for each were as follows: Operating when intoxicated, $731; operating without registration, $290; operating without consent of owner, $64.41; failure to sound horn, $1,067; failure to stop when signalled, $30; passing car discharging passengers, $702; failure to display badge, tag or lights, $727; violation of speed limit, $16,242.48.

Cook Kelly-Springfield Tire Director

NEW YORK CITY, May 20—At a special meeting of the board of directors of the Kelly-Springfield Tire Co., O. R. Cook, Cleveland, O., was elected a director.

Ford Gives 20 Acres for Athletic Field

DETROIT, MICH., May 21—One-third of a 60-acre tract of land belonging to Henry Ford and located to the north of the Ford Motor Co.'s plant, has been donated by Mr. Ford to the employes of the company and also to the people of Highland Park, upon whose territory it is located.

The ground is to be used as an athletic field and will have four baseball diamonds, a dozen tennis courts and other playgrounds, also dressing rooms and shelter stations. Eventually more of the land may be fitted up for the same purpose. At the present time Chief Construction Engineer R. Brown, of the Ford company, has all plans ready for starting a force of men to fix up the field.

The land was bought by Mr. Ford several years ago and is estimated to be worth now over $500,000.

Bad Bills in Illinois

CHICAGO, ILL., May 24—There are three distinct measures now before the state legislature at Springfield, all of which will be detrimental to the interests of the automobilists of the state if they are enacted as laws. The most serious of the three measures is a bill which will exactly double the present license fees. That is instead of paying the present fee of $6 for a car of 25 to 35 horsepower, the registration annually will cost $12. Fees for other sizes of cars are raised in proportion, except for those over 50 horsepower, in which case the registration is increased from $10 to $25.

The present law governing the speed of a motor vehicle in this state sets the lower limits at which cities and towns may establish speed limit by ordinance. There is a bill now before the legislature which provides that any city, village or incorporated town may make such legislation as to the speed of motor vehicles as it deems proper, but in no case authorizing a higher speed than provided in the bill. That is, the towns can make the legal limit as low as they please, which would result in wholesale arrests and gross abuse. Another bill would make it necessary for motorists to stop within 50 feet of any unprotected railroad crossing.

150,000 Cars for Iowa in 1915

DES MOINES, IA., May 21—Iowa already has registered over 100,000 automobiles for 1915 and the state automobile department states that the number will go above 150,000 before the end of the year. The registration is already 20,000 ahead of what it was at the corresponding date last year. The number of machines registered in 1914 did not pass the 100,000 mark until late in August. About two-fifths of the machines now being registered are new cars. Applications for registration are pouring in at the rate of 1,000 a day and the state department is two weeks behind in shipment of plates. The new registration law which goes into effect July 4 and which provides that plates shall be good for 3 years does not affect plates and registrations for the current year.

Nebraska to Use Convicts on Roads

LINCOLN, NEB., May 21—Among the important laws that were passed by the recent Nebraska legislature and of keen interest to the automobilists of this state, were two road laws which will go into effect in July. One has to do with the use of convicts on roads, and the other creates a new state advisory highway board.

The first provides that the county commissioners shall make a requisition on the board of control for as many convicts as are wanted for the work on the highways. The board of control is given authority to arrange the financial part of it.

The law for the advisory highway board provides for the appointment of this board of three by the state board of irrigation, highways and drainage, to assist the latter board in an advisory capacity in the taking up with the county boards the building of roads, culverts and bridges, or when the county board so requests, to assist in the preparation of plans and in the supervision of the work of construction or repair and maintenance of any public highways in the state.

More Cars in Missouri

JEFFERSON CITY, MO., May 20—Statistics covering the months of February, March and April of this year show that 2,388 more automobiles were registered in Missouri in these three months than during the entire year of 1914. The money received by the state for automobile licenses during these three months totalled $239,293 against $245,873.50 for the entire registration year ending January 31, 1915.

Factory Miscellany

Whitney to Enlarge—The Whitney Mfg. Co., Hartford, Conn., has planned for immediate work on an addition to its plant.

Truck Plant for Altoona, Pa.—The Monarch Machine Co., Altoona, will build a plant for the manufacture of motor trucks.

West Bend Co. Adds Equipment.—The West Bend Plating Co., West Bend, Wis., is installing considerable new equipment, including four 100-gallon vats, enabling it to handle larger plating jobs, including radiators and motor car accessories of large size.

Cleveland Gauge Acquires Machinery.—The Reliance Gauge Column Co., Cleveland, O., has taken over the Cleveland Clutch Co., and the machinery of the latter will be removed from its plant at Urbana, O., to the new Reliance factory, 5902 Carnegie avenue, completed in January.

New Falls Rubber Plant—Plans have been prepared for a new factory for the Falls Rubber Co., Cuyahoga Falls., O. The building will be 80 by 40 feet, three stories high, of brick and steel construction. Bids for the construction will be invited in the near future. It is planned to erect a power plant later.

Wayne Increases Working Hours.—The Wayne Oil Tank & Pump Works, Fort Wayne, has increased its factory hours from 60 to 72 a week and is hiring a great many more men. The firm is doing much more business than ever before. Under its present schedule 4 days in the week all departments work from 7 o'clock in the morning until 9 o'clock in the evening.

Kissel Gets Gets Repeat Ambulance Order.—The Kissel Motor Car Co., Hartford, Wis., has booked a repeat order for ambulance trucks from the government of Servia. The deal was closed in New York City by President G. A. Kissel and calls for thirty ambulances. The Kissel company shipped a number of trucks to Servia last fall. The Hartford shops have reached the greatest capacity ever attained and are employing nearly 1,000 people.

Overland Plans Body Plant for Indianapolis—The building formerly occupied by the Willys-Overland Co., Toledo, O., at 15th street and the Big Four Railroad, Indianapolis, Ind., will be converted into a plant for special automobile body construction work, according to plans outlined by J. N. Willys, president of the company. Modern machinery will be installed and employment will be given to approximately 500 men.

Sommer Plant to Be Enlarged.—The Sommer Motor Co., Bucyrus, O., will build a $10,000 addition, which will more than double its output of motors. The buildings will be of brick construction and will contain approximately 7,500 feet of floor space. Plans for the buildings have already been made, and the company expects to occupy the new structure before September 1. Clutches and transmissions have been added to the product of the factory and preparations are being made to turn out the motors, clutches and transmissions for at least 4,000 cars for 1916.

Mogul Truck to Build.—The Mogul Truck Co., now at 6100 Maple avenue, St. Louis, Mo., has purchased a tract 125 by 187 feet on Forest Park Boulevard, where the erection of a new factory for the company will begin as soon as the architect's plans are completed. Besides manufacturing quarters, the new building will contain a storeroom for truck parts and accessories, a showroom for the display of finished trucks, machine shops and the general offices of the company. The size and cost of the building have not yet been determined. Grading of the lot already has been started.

The site of the new factory is the center of renewed building activities. The Linde Air Products Co. of New York is erecting a $100,000 building directly across the street from the Mogul company's site and the Ford Motor Car Co. a half block away will add a large unit to its assembling plant there this summer.

The Automobile Calendar

May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind., H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
May 29	Philadelphia, Pa., Stone Harbor Memorial Day Run from Philadelphia.
May 29-30	Seattle, Wash., Track Races; Northwest Automobile Assn.
May 31	Newark, N. J., Track Race, Olympic Park, Matty Matthews Auto. Racing Assn.
May 31	York, Pa., Track Race, York Fair Grounds, York Motor Club.
June 3	New York City, 11th Annual Automobile Outing for Orphans; Orphans' Auto. Day Assn. of N. Y.
June 3	New York City, N. A. C. C. Annual Meeting.
June 7-11	San Francisco, Cal., National Electric Light Assn.
June 9	Galesburg, Ill., 100-Mile Race, Galesburg District Fair Assn.
June 11-12	Effingham, Ill., Hillclimb and Fuel Economy Test. Salt Creek Hill, Effingham Automobile Club.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 15-17	Chambersburg, Pa., Run to Atlantic City.
June 19	Chicago, Ill., 500 - Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
July 5	Visalia, Cal., Road Race, Tulare Co. Auto. Assn.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Races.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 8-11	Hamline, Minn., 2-Day Meet at State Fair Grounds between Minneapolis and St. Paul, State Fair.
Sept. 13	Oakland, Cal., Pan American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct.	St. Louis, Mo., Show, Forest Park Highlands, St. Louis Automobile Manufacturers and Dealers' Assn.
Oct. 1	Minneapolis, Minn., Track Race, Twin City Motor Speedway Co.
Oct. 1-2	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 2	New York City, Sheepshead Bay Motor Speedway Track Meet.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show; Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.

The Week in the Industry

Bell Columbus McNaull Mgr.—The McNaull Tire Co. has opened a branch in Columbus, O., located at 81 South Fourth street. B. K. Bell is manager, with F. L. Beebe sales manager.

Wallace Portland Metz Mgr.—W. D. Wallace, one of the best known automobile men on the Coast, has been named as sales manager of the Oregon Metz agency, with headquarters in Portland.

Morris Moon's N. W. Sales Mgr.—J. C. C. Morris is the new Northwestern sales manager of the Moon Motor Car Co. and makes his headquarters in Seattle, Wash. He has jurisdiction over all sales in Idaho, Oregon, Washington and Nevada.

Hull Retires.—F. L. Hull has retired from the Junction Garage Co., Milton Junction, Wis., and the business will be continued by R. Leon Burdick and Herman Harte, the other partners. The garage has just moved into new and permanent quaters.

Brick Succeeds Lane.—W. J. Brick, formerly of the Campbell & Brick Heating Co., Winnipeg, Man., has taken over the management of the Canadian Motor Co., succeeding A. T. Lane, who previously held the post. Mr. Brick has been a director of the company for some time.

Dealer

Polack Tire in Cincinnati—The Polack Tire and Rubber Co. has established a branch office in Cincinnati, O., in the Union Central Bldg. A completely equipped service station was also established. The company's business is in charge of J. M. Briceland.

Midgely Tire in Baltimore—The Tire Service Co., Baltimore, Md., will have the exclusive handling of the Midgely tire for Baltimore and the state. It is located at 204 St. Paul street, and A. P. Mosby, formerly of the Knight tire agency of this city, heads the new concern.

Case Erects New Addition.—The J. I. Case T. M. Co., Racine, Wis., has started construction work on its new branch house and garage at Madison, Wis. The building will be fireproof, 100 by 140 feet, two stories high, with a basement 100 by 184 feet, to be devoted to the automobile business exclusively. It will cost about $50,000. C. C. Doring is manager.

Motor Men in New Roles

Rafter Milwaukee Winton Mgr.—W. A. Rafter has been appointed manager of the Milwaukee branch of the Winton Motor Car Co., Cleveland, O.

Gall Goes to Denver.—F. J. Gall, formerly sales representative for the Mayo Mfg. Co., Chicago, Ill., resigned to accept a position as sales manager for the Colorado Motor Co., Denver.

Cowan Appointed Mgr.—E. E. Cowan, formerly with G. W. Shroyer & Co., Dayton, O., has been appointed general manager of the Guarantee Tire and Rubber Co., an accessory and tire concern of Indianapolis.

Boyer Heads Detroit Springfield Body.—The Springfield Metal Body Co., Springfield, Mass., has opened offices in the Whitney Bldg., Detroit, under the management of Joseph Boyer, Jr.

Huff Joins Simms.—E. S. Huff, formerly connected with the Maxwell Motor Co., Detroit, Mich., has joined the Simms Magneto Co., East Orange, N. J., and will work on the development of the starting and lighting systems.

Krause Joins Champion. — G. A. Krause, formerly connected with the engineering department of Jeffery-De Witt Co., has resigned and will take a position with the Champion Spark Plug Co., of Toledo, as traveling service representative.

Perlitz Joins Bromfield & Field.—A. O. Perlitz has become identified with Bromfield & Field, Inc., advertisers, in New York City. Mr. Perlitz was formerly with the Electric Vehicle Co. and the Locomobile Co. of America in Chicago and Minneapolis.

Fassnacht Makes Change.—G. A. Fassnacht, formerly branch manager of the B. F. Goodrich Co. in Toronto and Omaha, has taken charge as manager of the Sixth City Tire Repair Co., a new incorporation of Cleveland, O. It is located at 1737 Euclid avenue.

Eib Makes Change.—C. C. Eib, for years assistant manager of the Pioneer Motor Car Co., San Francisco, Cal., and later holding a like position with the Oakland Motor Car Co., has joined the J. W. Leavitt Co., Overland distributor. He will act as executive supervisor.

Gutelius Stull Starter Distributor.—Nelson T. Gutelius, formerly advertising manager of the Motor Car Equipment Co., New York City, has resigned to take a position as metropolitan distributor of the Stull mechanical starter for Ford cars. Sales offices have been opened at 103 West 16th street, New York City.

Haggerty and Earle Transferred.—W. E. Earle, who has been manager of the Indianapolis sales branch of the Ajax-Grieb Rubber Co., has been transferred to a traveling position in the New England territory. C. J. Haggerty, who has been with the company at Brooklyn, N. Y., has become manager of the Indianapolis branch.

Sweeney Maxwell Publicity Mgr.—C. F. Sweeney, of York, Pa., for 3 years advertising manager and later sales manager for the Kline Motor Car Corp., Richmond, Va., has been appointed a publicity manager for the Maxwell Motor Co., Detroit, Mich. Mr. Sweeney for a number of years has been engaged in newspaper work, having just resigned the position as managing editor of the *Star* and *Sentinel*, Gettysburg.

Read Heads Puritan Engineering Dept.—S. R. Read has assumed charge of the engineering department and machine shop of The Puritan Machine Co., Detroit. The company tendered a banquet to its department heads May 19, at the Hotel Griswold, Detroit. Those present included H. G. Gremel, O. R. Taylor, F. M. Eldredge, E. W. Hawley, C. H. Albright, W. J. Ripley, S. R. Read, O. C. Flatter, A. Courrier, W. Cavan, A. Shoup, M. Gaucher and Misses V. M. Klie and E. L. Melick.

Garage

Electric Garage for Baltimore.—June 1 will mark the opening of a new electric garage in Baltimore, Md. It will be run by A. W. Beam, Jr., Baltimore distributor of the Detroit Electric and will be located on Cathedral street near Chase street. At the same time the name of the present concern—the Detroit Electric Car Co.—will be changed to the Beam Motor Car Co.

New Automobile Bldg. for Queens.—One of the largest additions to the automobile center in Queens, N. Y., has been planned by the Everett Realty and Construction Co., which has filed plans for a twelve-story building to be erected on a 23,000 square-foot plot at Jackson avenue and 10th street. A large automobile elevator, 10 feet wide and 21 feet long, accessible from 10th street, will enable trucks to drive up to and on their respective floors.

Nassau

Performance—Not Words—Offers Tangible Evidence of a Tire's Worth

We have often told you that NASSAU TIRES were the best tires made, regardless of reputation or price; but practically every other tire maker substantially claims the same thing.

To claim to make the best is one thing; to make it is another.

Performance—not words—offers the only tangible evidence of a tire's worth.

It is not a matter of what we say, or others claim.

But What Does Performance Prove?

The record of NASSAU TIRES during the past year has been one of truly remarkable performance.

The army of NASSAU USERS who measure the value of a tire in mileage *per dollar expended*, will unanimously tell you this.

Everybody who saw Ralph De Palma win both the Cobe and Elgin trophies on one set of NASSAU TIRES will vouch for it.

Everybody who saw Bob Burman smashing all the world's dirt track records of from 10 to 100 miles on NASSAU TIRES will tell you so.

Everybody who saw Dario Resta at the Panama Exposition win the 400-mile Grand Prix race and a week later win the 300-mile Vanderbilt Cup Race, using the same identical tires in both — NASSAU STOCK TIRES, mind you—will tell you that such a performance has never been equalled in all the history of tiredom.

For it is a truly remarkable thing for a tire to go through even one long race without mishap—

But it is little short of phenomenal for the same tires to go through *two big long distance races without mishap* and still be in good condition.

No other tires have ever equalled such performances—and actual performance, remember—is the only tangible evidence of a tire's worth.

The Choice of Those Who Know

The Speed Kings have found *through actual performance* that regular NASSAU STOCK TIRES endure terrific strain and abnormal wear better than any other tire made.

You will do well to equip your car with NASSAU TIRES. Get acquainted with the NASSAU dealer in your town. You will find him a good man to do business with, and he is waiting now to serve you.

DEALERS: There are a few exclusive territories still open

Thermoid Rubber Company

Factories and Main Offices: Trenton, N. J.

BRANCHES

Chicago, Philadelphia, Pittsburgh, St. Louis
Boston, Indianapolis, Detroit, San Francisco
London Berlin Paris

Recent Incorporations in the Automobile Field

Illinois

Chicago—Midgely Tire Sales Co.; $2,500; tire manufacturer. A. C. Walker, F. A. King, J. L. Bynum.

Chicago—Motor Equipment Co.; $30,000; dealer in supplies. I. K. Davidson, H. M. Lautmann, J. W. Leonard.

Kentucky

Louisville—Central Garage; $1,000. C. J. Epping, Loretto Staggenberg, E. J. Cooney.

Louisville—Southern Tire Co.; $10,000. F. W. Potts, H. E. Harrold, L. W. Hewitt.

Michigan

Detroit—D. A. C. Garage; $30,000. J. H. Thompson, John Kelsey, W. F. Metzger.

Detroit—Detroit Stamping Co.; $10,000; to make sheet metal stampings, etc. W. H., E. W. and T. H. Roberts, Fred Haskel.

Detroit—Reliable Auto Service Co.; $2,500. A. J. and A. M. Unger, E. J. and G. L. Curry.

Grand Rapids—Mechano Gear Shift Co.; $10,000. Albert Dickinson, B. E. Richardson, Espey Stanton.

Missouri

St. Louis—Bleeck Automobile Co.; $10,000; to manufacture automobiles. J. N. Bleeck, A. M. Bleeck, Eugene Herr.

Nebraska

Lincoln—Werts Auto Co.; $30,000. W. W. Werts, L. H. De Brown, G. E. Smith, C. F. Goddard, G. Saville, Jr.

New York City

New York City—Louis R. Adams & Co.; $5,000; manufacture tires, rims, etc. L. R. Adams, M. B. Adams, H. W. Soul.

New York City—Alford Transport Co.; $3,000; garage and livery business. Harry Lichtenstein, Robt. Bloch, Wm. Muschel.

New York City—Bender-Robinson Co.; $25,000; automobile painting business. John Bender, J. H. Robinson, James Forsberg.

New York City—Bendix Oil Co.; $1,000; dealer. A. M. Levy, Harriet Feldman, Olga Bendix.

New York City—Dey Electric Corp.; $20,000; developing electric motor vehicles. H. E. Dey, H. W. Hillman, M. E. Schmidt.

New York City—Duplex Auto Hood Corp.; $30,000; manufacturer. F. W. Keegan, J. P. Bissell, W. H. Wooley.

New York City—Greater N. Y. Auto Cover Co.; $500; covers for automobiles. Chas. Richter, Batney Stengel, William Stengel.

New York City—Gotham Emergency Service; $50,000; garage. J. A. Ward, G. M. Garratt, D. B. Sugarman.

New York City—Hart-Bell Carbon Remover Co.; $2,000; manufacturer carbon remover. G. D. Bartlett, Geo. Littman, Samuel Copeland.

New York City—Rodney K. Haines Co.; $2,500; supply business. L. J. Jaccard, Ferdinand Cimiotti, I. J. Ablowich.

New York City—International Automobile Co.; $5,000; garage. Harry Lipschuetz, W. Krauss.

New York City—Manuel Bergman; $500; manufacturer automobile specialties. Manuel Bergman, Esther Bergman, Samuel Bergman.

New York City—New Departure Service Station; $10,000; parts and sundries. J. T. McLean, W. H. Thacher, W. F. Williams.

New York City—One Hundred and Fifty-Seven West Eighteenth Street Garage Co.; $1,500. F. G. Brunella, Cesare Farina, Felix Kofler.

New York City—Paramount Rubber Products Co.; $1,000. B. V. Bacon, W. F. Bacon, E. B. Becker.

New York City—Pullman Supply Stores Corp.; $25,000. F. B. Wood, W. J. Murray, T. C. O'Connor.

New York City—Quintard Co.; $50,000; manufacturer automobile supplies and accessories. A. K. McCanless, W. H. De Fontaine, G. W. Quintard.

New York City—Realty & Motor Corp.; $1,000; real estate and automobile business. David Scher, Jos. Marx, Morris Rosenzweig.

New York City—J. B. Salmon & Co.; $10,000; dealer. A. W. Gaebelein, F. P. Stanton, H. A. McArdle.

New York City—Stonebridge Sales Co.; $25,000; spark plugs, lanterns, etc. C. R. Gulick, R. W. Tietjen, V. W. Stockell.

New York City—Thoroughfare Garage Co.; $5,000. Henry Moller, H. J. N. Lehman, J. P. Lehman.

New York City—West 65th Street Garage Co.; $10,000. Stephen O'Brien, Daniel Houston, W. H. Kron.

New York

Albany—Du Bois Machine Shop; $25,000; repair shop. G. C. Du Bois, F. J. Du Bois, Benj. Carson.

Brooklyn—Double Life Tire Co.; $5,000. L. A. Fawcett, Henry Gruenhut, L. A. Goldstein.

Brooklyn—Fox Gauge and Specialty Co.; $1,000; manufacturer gasoline gauges. John Fox, T. F. McKelvey, A. H. Pefeile.

Brooklyn—Mandodt Motor Co.; $100,000; motor manufacturer. Henry Mandodt, A. W. Behrens, Jacob Schaefer.

Brooklyn—Mercerford Auto Co.; $500; dealer. J. H. Kinney, Arthur Rollin, A. J. Fredericks.

Brooklyn—Sandman Auto Renting Co.; $500. Milton Sandman, Benj. Sandman, Henry Sandman.

Buffalo—National Limousine Top Corp.; $25,000; manufacturer. E. L. Kuns, W. L. Grove, F. Dohmeier.

Buffalo—Universal Carbureter Co.; $75,000; manufacturer. Harry Treglown, E. J. Stratton, M. J. Harlowe.

Granville—Granville Gasoline & Oil Co.; $5,000; dealer. D. H. Cowles, F. M. Starbuck, O. P. Munson.

Hancock—Hancock Transfer Co.; $10,000; bus line and freight and baggage transportation. B. C. Anderson, M. J. Gales, F. M. Woolsey.

Middletown—M. E. Slawson Co.; $3,000; dealer. H. N. Slawson, M. E. Slawson, A. C. Ogden.

Mt. Vernon—Hercules Instrument Co.; $2,000; manufacturer dynamos, electric motors and other electrical apparatus. G. J. Wise, E. I. Kleinfeld, Harry Rubenoff.

Mt. Vernon—Telephone Motor Service Co.; $15,000; taxicabs. E. A. Robinson, G. C. Appell, J. A. Henning.

Phoenix—Phoenix Auto Sales Co.; $3,000. O. E. Chillingsworth, J. H. Klock, J. J. Carney.

Rochester—Flower City Jitney Co.; $1,000. W. W. McClelland, F. W. Cottrell, J. B. Ehrhart.

Rochester—Rochester and Suburban Jitney Co.; $1,000. W. H. Mikel, J. W. Gould, R. R. B. Powell.

Rye—Lowden's City Cab Co.; $1,000; taxicabs. A. B. Lowden, I. Lowden, G. Roselle.

Saratoga Springs—Hamm's Garage Co.; $8,000. A. S. Hamm, Nettie Hamm, B. K. Walbridge.

Syracuse—Van Dyke & Nolan Taxi Co.; $2,400. F. A. Van Dyke, M. B. Nolan, G. R. Fearon.

Troy—The Avenue Garage Co.; $1,000. J. N. Bussey, David Putnam, Earl Coons.

Utica—Utica Jitney Bus Co.; $5,000. G. A. Kirkland, C. V. Kirkland, T. M. Fitchard.

Oklahoma

Sapulpa—Sapulpa Auto Co.; $3,000. T. B. Bliss, G. L. Farris, C. W. Bliss.

Ohio

Akron—Ceylon Tire Co.; $10,000; dealer. H. W. Holcomb, E. R. Purviance, C. C. Stoffer, O. A. Cheney, W. F. Kelley.

Cincinnati—Cincinnati Speedway Co.; $10,000 to $500,000.

Cincinnati—Fisher-Griffin Storage Battery Co.; $10,000; dealer. S. M. Griffin, C. A. Fisher, R. A. Le Blond, C. N. Terry, C. O. Hearn.

Cleveland—Auto Specialty Co.; $1,000; accessories. L. W. Harg, Peter Cresser, R. E. Rummel, H. C. Lesseberg, Emily Cresser.

Cleveland—Cleveland-Ford Tire Co.; $10,000; tire dealer. R. E. Elvidge, E. R. Cook, C. S. Ronds, M. A. McManus, L. B. Bacon.

Cleveland—De Moey Machine Co.; $10,000; dealer. H. O. Evans, G. W. Heinkel, J. K. Matthews, Arnold Boetschi, G. H. Knippenberg.

Cleveland—Schiner-Merritt Co.; $15,000; dealer. J. R. Schiner, A. Flannery, C. M. Woodside, J. G. Hartwell, J. L. Greer.

Cleveland—Standard Starter and Specialty Co.; $15,000; manufacturer. C. K. Fanver, H. E. Downing, M. C. Russ, M. H. Gallagher, W. L. Vance.

Dayton—Cadillac Motor Co. to Central Motor Sales Co.

Dayton—C. W. Hoffrits Sales Co.; $10,000; dealer. C. W. Hoffrits, M. A. Thomas, A. S. Shuey, E. Hoffrits, H. M. Wolfe.

Toledo—A. W. Kirk Tire & Supply Co.; $10,000. A. W. Kirk, J. F. Parson, Jr., W. O. Gulm, H. N. Fraser, J. B. Clark.

Youngstown—Youngstown Jitney Co.; $1,000. E. F. Carpenter, J. H. Lyon, H. B. Mitchell, G. F. Hammond, J. B. Lafferty.

Pennsylvania

Philadelphia—Walsh Tire and Rubber Co.; $100,000; to manufacture tires. F. R. Hensel, G. H. B. Martin, S. C. Seymour.

South Dakota

Pierre—Key Auto Co.; $25,000. Horace Key, F. L. Holbrook, E. J. Miller.

Texas

Houston—Overland Sales Co.; $1,000. G. W. Graham, J. E. Hero, D. Riegel.

Texas City—Texas City and Galveston Auto Line; $1,000. J. L. Corbett, G. E. Whitney, W. J. Lingel.

Virginia

Newport News—Peoples' Jitney Bus Corp.; $10,000. W. H. L. Kent, G. W. Hogge, S. S. Archibald.

Norfolk—Brown Jitney Corp.; $10,000. A. D. Hudgins, J. J. Burke, E. W. Browne.

Richmond—Fisk Rubber Co. of New York; $100,000. J. A. Horner.

Richmond—Talman Auto Supply Co.; $5,000. D. T. Talman, R. W. Payne, N. E. Pate.

Roanoke—Roanoke Jitney Bus Co.; $50,000. W. N. Dook, W. M. Shickle, R. H. Willis.

Roanoke—Virginia Auto Transfer Corp.; $25,000; to act as credit association. S. S. Burch, B. A. Markle.

Rosslyn—Arlington Barcroft Auto Co.; $10,000. C. R. Pritchard, R. E. Bender, Albert Ashton.

Automobile Agencies Recently Established

Nebraska

Benkelman	Studebaker	J. F. Richardson
Cairo	Auburn	Peters Bros.
Chambers	Oakland	F. A. Bernard
Clarks	Moline	Walter Chamberlin, Jr.
Elba	Auburn	A. P. Delecki
Farwell	Auburn	C. S. Lukasiewicz
Fremont	Cartercar	Hall & Steele
Fremont	Chandler	R. B. Schurman
Fremont	Metz	Hall & Steele
Fremont	Stearns	Oscar Pollock
Howells	Oakland	Mestl Bros.
Julian	Oakland	S. E. Wilberger
Loma	Oakland	J. B. Bartek & Sons
Nebraska City	Oakland	H. B. Swalley
Omaha	Hollier	T. G. Northwall Co.
Oshkosh	Oakland	Oshkosh Auto Co.
Palisade	Studebaker	D. H. Farmer
Petersburg	Oakland	Three F Garage
Red Cloud	Oakland	Wm. C. Prevost
Scottsbluff	Oakland	Bennett Catlow Imp. Co.
Stromsburg	Oakland	C. W. Carlson
St. Legory	Auburn	T. Cordes
Superior	Hollier	Wait Auto Co.
Thayer	Oakland	W. C. Heiden
Ulysses	Oakland	Ulysses Imp. Co.
Valentine	Oakland	Fischer Bros.

New Hampshire

Berlin	Studebaker	City Garage Co.
Claremount	Saxon	C. H. Bailey
Manchester	Cadillac	Brodie Electric Co.
Meteghan Center	Saxon	J. S. Robichaud

New Jersey

Asbury Park	Studebaker	John Thompson
Newark	Saxon	Haag & McLaren
Trenton	Saxon	Trenton Auto Sales Co.

New Mexico

Albuquerque	Metz	F. E. Dearth
Hayden	Metz	F. M. DuBois

New York

Albany	Oldsmobile	The Tri City Motor Co.
Angelica	Saxon	H. F. Cooley
Auburn	Premier	Auto Sales Co.
Bath	Oldsmobile	City Garage
Binghamton	Marmon	Binghamton Motor Car Co.
Cobleskill	Chandler	C. Hallenback
Dunkirk	Saxon	H. Schaefer
Ellenville	Saxon	Van Wyck & Crookston
Elmira	Premier	Southern Tier Motor Co.
Glens Falls	Chandler	Empire Auto Co.
Hicksville	Studebaker	Abrams & Minch
Hornell	Saxon	Peters & Kittell
Huntington	Premier	W. Flowell
Jamestown	Saxon	Peterman Garage Co.
Kerhonkson	Oldsmobile	Marshall Jansen Co.
Newburgh	Saxon	I. H. Cowley & Son
Northville	Chandler	W. L. Kested
Norwich	Oldsmobile	Chenango Auto Co.
Oswego	Saxon	J. E. Coatta
Seneca Falls	Saxon	G. A. Gargin
Schenectady	Studebaker	Frank Fonda
Silver Creek	Oldsmobile	W. K. Miller
Troy	Saxon	Wagar & Grant

Ohio

Albany	Saxon	Whitlach Brothers
Bellefontaine	Saxon	J. B. Hornberger
Canton	Premier	Quality Car Co.
Chillicothe	Oldsmobile	O. Climer
Chillicothe	Saxon	Drummond Fence & Wire Co.
Cincinnati	Chandler	Fulton-Colwell Co.
Cincinnati	Monarch	E. C. Edgell & H. C. Henry
Cleveland	Hollier	W. H. Barger
Columbus	McIntyre	Auto & Accessory Co.
Elyria	Buick	Elyria Auto Sales Co.
Galion	Buick	The Galion Motor Car Co.
Gibsonburg	Oldsmobile	Debe & Gerwin
Hamilton	Saxon	Heck Motor Car Co.
Lima	Chandler	J. M. Devore
Lisbon	Saxon	Lisbon Auto Co.
Liverpool	Chandler	Swaney & Wilmet
Lorain	Buick	Lorain Garage
Mantua Station	Buick	H. Wilcox
Marion	Ford	Newton H. Davis
Medina	Buick	R. A. Loehr
Mt. Vernon	Saxon	F. J. Harris
Norwalk	Buick	W. M. Lofland
Norwalk	Chandler	C. S. Bateham
Ruggles	Buick	O. C. Beach
Sandusky	Saxon	Muelhauser & Letts
Steubenville	Paige	Hunter & Son
Toledo	Monarch	J. E. Cunningham
Uhrichsville	Saxon	J. W. Lytle & Co.
Wakeman	Chandler	Wakeman, O.
Warren	Chandler	W. S. Hunn
Washington Courthouse	Pilot	J. H. Allen
Wellington	Buick	Baumgartner Bros.
Wellsville	Oldsmobile	Automobile Machinist Co.
Wooster	Buick	Champion Garage
Youngstown	Saxon	The Albaugh Motor Sales Co.

Oklahoma

Oklahoma City	Premier	Thompson & Brunagton

5
LEADING OAKLAND SUPERIORITIES
Great Strength with Light Weight
High Speed Motor with Great Power
Low Center of Gravity with Usual Road Clearance
Flying Wedge Lines with Least Wind Resistance
Economy with Luxury

Reconstructing Car Values

THE order was: "Build a new Oakland Four. Build it to a new standard of quality and service—at a new price. Build a Four which is more than ever the *Master* of any hill or road task." And now after months of planning and building and testing, this Oakland is ready for you—a new model, a new standard of service—every inch a monarch of Fours!

"Make it extra *powerful*—for power has been a big asset in building up the new Oakland prestige. Build it *light*—so it will be easy on tires and fuel."

This new Oakland has surplus power—not an ounce excess weight.

"Make it *durable*—our reputation is based on *sturdiness* with simplicity."

"Make it *comfortable* for five—no crowding."

So—while this Oakland has the air of having been designed for brilliant dashes of speed—it is made to last and do real *plugging* service—and the "comfort" order was carried out to the letter. "We are going to sell the new Oakland Four for $1050."

With Oakland standards of uncompromising quality this means only one thing—*Volume*.

Already the bell of public opinion has rung with the enthusiasm that is following Oakland initiative.

The essentials which round out this car are—Four Cylinder Oakland-Northway High Speed Motor, 39 H. P.; Delco Electric starting, lighting and ignition system; Oakland Stewart Vacuum Gasoline Feed; Comfortable roominess for 5 passengers. Also one man top, crown fenders, extra rim, speedometer. In short, *complete* equipment. This new 1916 Oakland is now ready for delivery. Other important additions to the 1916 Oakland line will be announced soon.

DEALERS: Wire for Allotment. New Territory Apportioned in Order of Application.

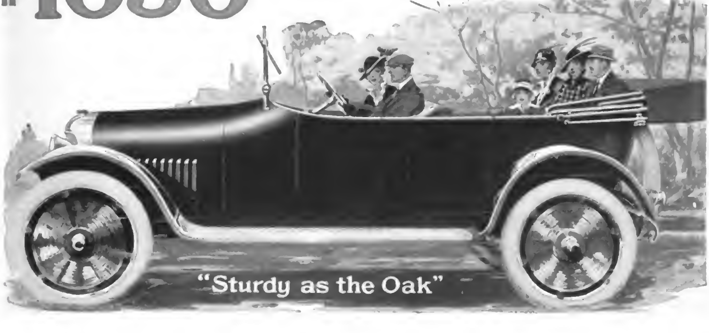
Oakland Motor Company, Pontiac, Michigan

Model "38"

Speedsters, Roadsters, Touring Cars

Oakland

$1050



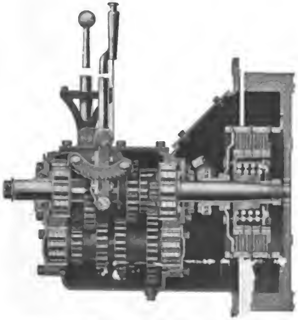
COVERT

TRANSMISSIONS

This is the name used by designers and engineers when they wish to typify the highest standard in transmissions for automobiles and trucks.

Experience, experiments and comparative tests have alike shown that this product of fifteen years of specialized effort to produce unqualifiedly superior transmissions stands alone in its class for quality, silence, durability and all-around efficiency.

The name COVERT TRANSMISSIONS makes it easier to sell cars or trucks because it establishes confidence regarding quality in the minds of buyers.



The new Covert unit power plant tran[illegible]sion—made in various capacities

COVERT TRANSMISSIONS are made [illegible]ll line of types and sizes. Am[illegible] you will find one just ada[illegible] our product. Our engineers will [illegible]dly assist you in selecting a type th[illegible]st meets your needs.

COVERT MOTO VEHICLE CO.

SALES OFFICE: Detroit, Mich. **FACTORY: Lockport, N. Y.**

Automotive Industries

JUN 7

Ho

MAGAZINE LOAN COLLECTION

The AUTOMOBILE

Vol. XXXII
No. 22

NEW YORK, JUNE 3, 1915

Ten cents a copy
Three dollars a year

MAGAZINE LOAN COLLECTION

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

:TURE
?INGS
ierican Trade

The New Departure Mfg. Co.
Bristol, Conn., U.S.A.
Distributors in Trade Centers Throughout the United States
Western Branch: 1016-17 Ford Bldg. Detroit, Mich.
Sole British Agents: Brown Bros. Ltd. London Manchester

WHO IS THE LEADING SPARK PLUG MAKER?
A C
TITAN
CICO

Over *Two Million* A C Plugs on contract to supply these firms:

Buick
Cadillac
Chalmers
Chase
Chevrolet
Cole
Dodge
Dort
Federal
G. M. C.
Haynes
Harley-Davidson
Hudson
Hupp
Jackson
Knox
Lexington-Howard
Moline
Monroe
Moon
National
Oakland
Olds
Packard
Paige
Peerless
Pierce-Arrow
Reo
Saxon
Scripps Booth
Stearns
Stutz
Touraine
Velie
Westcott
Wilcox

The number of plugs we have on order to supply these requirements aggregates a total of over 2,000,000. One of these contracts alone specifies 280,000 A C Titan plugs. Eight others are for considerably more than 100,000 plugs each. In addition to this we furnish a great many plugs to help out factories contracted with other makes that are giving trouble. This statement is published to shed light on the claim made by another plug manufacturer to the effect that he has 80% of the equipment business; also on a recent advertisement claiming that a contract for 75,000 plugs is the largest one ever placed for a high grade plug. **A C TITAN Plugs are the most efficient and we are prepared to back up this claim with comparative tests on the dynamometer or on the road.**

Remember that the manufacturer who makes mendacious claims in his advertising will also try to fool you on the quality of his product.

Play safe. Use the plug that has been endorsed by the leading engineers and forget spark plug trouble.

We manufacture only A C, Cico and Titan plugs. Do not be misled by a similarity of names.

Champion Ignition Co. Flint, Mich.

VOL. XXXII NEW YORK—THURSDAY, JUNE 3, 1915—CHICAGO NO. 23

The AUTOMOBILE

De Palma, in Mercedes, Wins at 89.84 m.p.h.

Breaks Record—Resta in Peugeot Second —Stutzes Third and Fourth

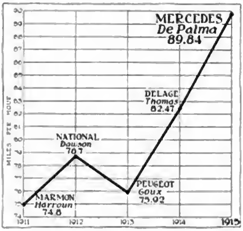
Dividers of the Spoils

Car	Driver	Time	M.P.H.	Speedway Prizes
Mercedes	De Palma	5:33:55	89.84	$22,600
Peugeot	Resta	5:37:27	88.91	10,900
Stutx	Anderson	5:42:27	87.6	5,600
Stutz	Cooper	5:46:19	87.11	3,700
Duesenberg	O'Donnell	6:08:13	81.47	3,000
Peugeot	Burman	6:13:19	80.36	2,200
Stutz	Wilcox	6:14:19	80.11	1,800
Duesenberg	Alley	6:15:08	79.33	1,600
Maxwell	Carlson	6:19:55	78.96	1,500
Sunbeam	Von Raalte	6:35:23	75.79	1,400

RALPH DE PALMA, WHOSE MERCEDES WON AT INDIANAPOLIS

INDIANAPOLIS, IND., Motor Speedway Official Stand, May 31—*Special Telegram*—Speeding at an average of nearly 90 miles per hour, Ralph De Palma today overcame his spell of bad luck on the Indianapolis Speedway and shot his Mercedes over the line a winner in the most spectacular race ever seen on the local speed arena. Three years ago he led to the third last lap and then fell out, but today he fought his rivals off one by one, an average speed of 89.84 miles per hour being necessary to do this, but when he had covered 350 miles he had his last rival back of him and for the last 150 miles led the way in one of the greatest races ever seen on this speedway.

When he crossed the tape with an average of 89.84 miles per hour he set a mark that may stand for some time on the Indianapolis track, for the Fates were kind to him, the bricks of the track being cold with scarcely a ray of sunshine from start to finish, so that all blinding glare was cut out. Compared with the record of 82.47 established a year ago the mark of today is phenomenal, and particularly as one made by a motor under 300 cubic inches, whereas the limit a year ago was 450 cubic inches.



Winners' speeds for each year

De Palma won today by real fighting, the fighting that always wins if there is an even break with the car. He had the stoutest rivals in veteran drivers of international fame. From the drop of the starter's flag he had to fight Dario Resta, fresh from winning the Vanderbilt and Grand Prix races on the coast, every foot of the way and had Resta not barely escaped a serious accident at 342 miles De Palma might not have had a margin of 3 minutes and 26 seconds over Resta in his Peugeot. When coming into the stretch on his 137th lap, Resta burst the right rear tire and skidded around on the course, fortunately not upsetting though he had to stop at the pit and change all four tires, allowing De Palma, who was then trailing him a lap, to jump into the lead. Before Resta was back on the course, De Palma had gained a lap and was setting a pace of over 90 miles per hour. Resta's steering gear had worked loose and he was not able again to catch up with the flying Mercedes, his pace slowing several seconds per lap.

An Uphill Fight

To win it was necessary for De Palma to fight an uphill battle for the first 350 miles. It was a struggle against the Stutz organization and against Resta's Peugeot, if not one, then the other, with scarcely a let-up and positions often changing every few laps due to stops being made for tire troubles.

From the drop of the flag, Resta, who was in the front row in starting, took the lead and held it for only a lap, when Wilcox driving No. 1 Stutz, jumped into the lead and held it by a small margin for 10 miles. Then his running mate, Anderson, took it and held it for 70 miles. Anderson set one of the hottest of paces for his half dozen pursuers who were bunched never more than a few lengths back of him, hungry for his honors as the hounds are when after the hare.

Resta to the Front

It was the irresistible Resta who finally overtook him when 82 miles were covered and held to the fore for 17 miles. It was in lap 58 or at 145 miles before De Palma ever got a chance to show in front. All of the time up to this point he was battling for position in the first group. In one lap he was third, the next he was back to fourth, then he was up to third or second, but never in first place. It was not until nearly the 100-mile mark was reached that he got firmly established in second place and it took nearly 50 miles more before he got into first place, for Resta was leading at 150 miles. De Palma displaced him at 175 and held first until 325 miles were covered when a stop for tires placed Resta again in front, but it was only for a short time, the skidding accident soon putting De Palma again in the lead and he was never headed off afterwards.

DARIO RESTA

Who finished second in the Indianapolis race, sending his Peugeot over the 500-mile course in 5 hours 37 minutes and 27 seconds, or at an average speed of 88.91 miles per hour, which, though it brought but second place in this year's race, was much faster than the best previous record

GIL ANDERSON

Driver of the first American car to finish in the 500-mile race. His Stutz finished in 5 hours 42 minutes and 27 seconds, making an average of 87.6 miles an hour

Anderson's Stutz hitting the high spots in the elimination trials for the 500-mile race at Indianapolis

A Narrow Margin

De Palma was playing in the greatest of luck to finish and win. When he finished amid the deafening cheers of tens of thousands, few knew that on the third last lap a connecting-rod had let go and punched two holes in the crankcase. He slowed up perceptibly but gave no evidences of distress other than the usual sound of a missing cylinder. It is a coincidence that 3 years ago he went out in the third last lap and that misfortune should pursue him in this lap today. His troubles 3 years ago were due to a connecting-rod letting go.

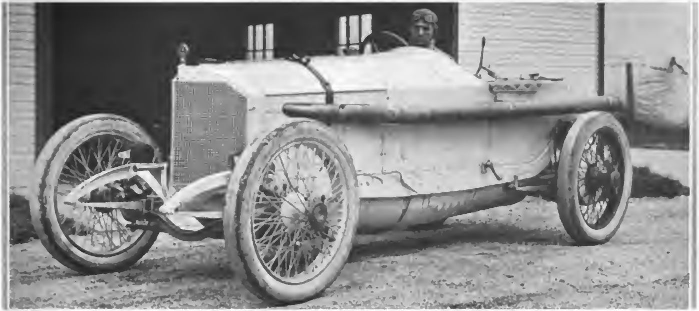
America's Showing Better

America came out much better today than a year ago when all of the first places were captured by the foreign contingent. Today the team of three Stutz cars gave a most amazing account of themselves, all three finishing within the money and two of them finishing third and fourth, a record for new cars which stands unequalled in racing history. Gil Anderson finished third a little over 8 minutes back of the leader and at an average of 87.60 miles per hour, while his team-mate, Earl Cooper, landed in fourth place, six minutes back of him.

Anderson's performance was spectacular, as he led for 70 miles in the earlier stages of the race, and then battled at every turn until the starter's flag ended the race. After taking the lead in the sixth lap he set a pace that soon put him well out in front, and maintained this until lap 34 when he stopped to change two outside tires and allowed the other leaders to pass him. When he got on the track again the leaders, Resta and De Palma, were nearly a minute ahead of him and he never got back into grst or second place though he was always within close striking distance. The hoods were not raised on either of these two Stutz cars from start to finish and they ran with spectacular regularity.

The third Stutz, piloted by Wilcox, met with early difficulties and did not maintain the reputation it made for itself in eliminations, when it made the fastest lap. Wilcox was close behind Resta at the end of the first lap and was in the lead in the second lap and held it until the end of the fifth when he dropped back with valve trouble, it being reported that a valve spring had broken. Thus handicapped he drove to the end of the race and finished in seventh place, averaging 79.65 miles per hour.

For the first time in its history dry



The winning car—De Palma at the wheel of his Mercedes which won the Indianapolis 500-mile race at 89.84 miles per hour, breaking all previous records

speedway weather was not on the calendar and the race which was to have been run on Saturday was postponed until today. Indianapolis for the last week has been a rain zone, rain falling nearly steadily day and night. It was doubtful if it would be possible to run the race today. A Scotch mist was blowing across the track before starting, but as the day progressed the wind rose and finally an hour before the finish the sun began breaking through the clouds. Attendance was not up to a year ago, perhaps scarcely more than one-half. Much of the parking space being too soft for cars grandstand privileges were extended to them.

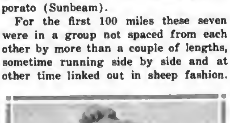
Duel Between Leaders

Today's battle between De Palma's Mercedes and Resta's Peugeot brings to mind the Grand Prize race a year ago in France, where these two cars did battle in one of France's greatest road races and when the Mercedes triumphed as it did today. From point of speed, Resta had a slight advantage on De Palma, being able to pass him on the stretches but losing out on the turns which De Palma drives in a superior way. For lap after lap these two veterans circled the 2 1-2-mile brick track not a length apart, one lap Resta leading in the stretch, losing it in the turns and again gaining it before crossing the tape. Lap after lap those in the grandstand rose and cheered as their favorites took the leadership. It was one of the grandest speed duels ever seen on the speedway, a duel fought at the pace of over 90 miles an hour. Had Resta not skidded on the turn entering the home stretch it might have continued much longer, but tires can only endure such a pace for a limited time, and first De Palma had to stop and change tires, and then Resta stopped and changed all four, taking on supplies at the same time.

Record-Breaking Pace

Before the race started it was known there were eight or ten cars that were capable of setting a pace hotter than any ever known on the Speedway and from the start this was apparent. These were De Palma (Mercedes); Resta (Peugeot); Wilcox (Stutz); Cooper (Stutz); Anderson (Stutz); Rickenbacher (Maxwell); and perhaps Porporato (Sunbeam).

For the first 100 miles these seven were in a group not spaced from each other by more than a couple of lengths, sometime running side by side and at other time linked out in sheep fashion.



EARL COOPER

Whose Stutz followed that of his team-mate, Anderson, finishing fourth in 5 hours, 46 minutes and 19 seconds, or at 87.11 miles per hour

On the fourth lap Wilcox led by 1-2 second and the others were all bunched; the next lap they were closer; a lap later and the leader was out in front with the others battling for positions and so the duel went on lap after lap for more than 100 miles, first one losing position for tires and then another.

When Anderson got into the lead in the sixth lap for a time he opened a gap which widened to 100 yards; this was opened to half the length of the homestretch. He was making lap after lap in 1:40, a pace of 90 miles an hour. Soon he had 25 seconds lead, the next lap it was 26, then 30, then 35, then 37, then 42. He was in an enviable position alone on the track with the fighting rivals a mile back until tire troubles overcame him.

Little Tire Trouble

Both Resta and De Palma made but two stops each, both for tires, and neither had any mechanical troubles from start to finish. De Palma consumed 3 minutes and 23 seconds as compared with 3 minutes and 19 seconds by Resta. De Palma's first stop at 157 miles was to change the two outside tires and his second stop at 300 miles was to change all four tires and take on supplies. Resta's changes were made at the same times, but Resta changed all four at each stop.

Pit Work Shows Improvement

Anderson lost 7 minutes and 2 seconds at the pit, making eight stops for tires and fuel. He changed the right tires at 85 miles, and then made changes at more or less regular intervals up to the finish. His running mate, Cooper, had better fortune, losing only 5 minutes

Tabulation Showing the Time of the Cars at Several Stages of the Indianapolis 500-Mile Race

Car No.	Car	Driver	Miles: 50	100	200	250	300	400	500	M.P.H.
2	Mercedes	R. DePalma	33:56	1: 7:31.80	2:14:29	2:47:06.64	3:19:32	4:27:17	5:33:55	89.84
3	Peugeot	Resta	33:54	1: 7:30.45	2:15:06	2:47:35	3:20:27	4:27:11	5:37:27	88.91
5	Stutz	Anderson	33:22	1:08:10	2:15:10	2:48:44	3:25:06	4:32:36	5:42:27	87.60
4	Stutz	Cooper	33:59	1:07:37	2:15:46	2:49:30	3:25:03	4:35:47	5:46:19	87.11
15	Duesenberg	O'Donnell	35:30	1:11:36	2:24:06	3:05:33	3:41:11	4:53:50	6:08:13	81.47
8	Peugeot	Burman	34:43	1:09:59	2:22:27	3:03:10	3:38:04	5:01:46	6:13:19	80.36
1	Stutz	Wilcox	33:58	1:09:12	2:20:21	2:57:00	3:33:22	4:49:42	6:14:19	80.11
10	Duesenberg	Alley	35:42	1:11:23	2:21:59	2:59:00	3:35:53	4:58:37	6:15:08	79.33
19	Maxwell	Carlson	35:29	1:10:53	2:22:24	2:59:04	3:40:16	4:59:27	6:19:55	78.96
7	Sunbeam	Von Raalte	34:14	1:02:39	2:21:07	2:55:03	3:41:53	4:51:53	6:35:23	75.79
28	Emden	Haupt	44:05	1:09:00	2:52:42	3:35:21	4:15:45	5:39:37	7:03:30	70.75
14	Sunbeam	Grant	34:52	1:09:38	2:33:40	3:10:14	3:45:19	5:06:38	......	......
21	Maxwell	Orr	35:31	1:10:53	2:30:30	3:07:03	3:43:50	5:02:55	......	......
6	Sunbeam	Porporato	33:56	1:07:36	2:18:26	2:51:28	3:26:17	4:35:56	......	......
18	Sebring	Cooper	35:31	1:29:20	2:58:93	3:42:17	4:26:07	......	......	......
22	Duesenberg	Mulford	36:24	1:17:55	2:42:21	3:20:39	......	......	......	
16	Peugeot	Babcock	35:39	1:11:12	2:23:11	2:58:00	......	......	......	......
9	Kleinert	Klein	38:01	1:37:27	3:58:52	4:43:04	......	......	......	......
23	Maxwell	Rickenbacher	34:00	1:07:38	2:44:36	3:18:20	......	......	......	......
27	Cornelian	Chevrolet	39:25	1:10:53	......	......	......	......	......	......
17	Delage	J. DePalma	36:32	1:12:51	......	......	......	......	......	......
24	Mais	Mais	44:38	......	......	......	......	......	......	......

at the pits, nearly all of the changes being on the right rear and right front tires. Anderson changed a right rear in 30 seconds and others in 32 seconds. Cooper made changes in about the same. The pit work among the leaders was better than in previous races, many of them having practiced changing tires steadily during preliminary spins.

The second group of cars to finish was trailing the leaders by a half hour and was made up of O'Donnell's Duesenberg, Burman's Peugeot, Alley's Duesenberg and Carlson's Maxwell. They shifted positions quite generally during the race, O'Donnell finally landing fifth at 81.47 miles per hour. Burman in the sixth place averaged 80.35, thus making the sixth car to average higher than 80 miles per hour for the entire distance.

EDDIE O'DONNELL

Covering the course in 6 hours, 8 minutes and 13 seconds at the rate of 81.47 miles per hour, his Duesenberg was fifth

Wilcox's Stutz was seventh, Alley's Duesenberg eighth and Carlson's Maxwell ninth. The last car to get in the money was Von Raalte's Sunbeam, which was several laps back, having had hood troubles and tire difficulties.

After the ten getting in the money had finished, the eleventh car, the Emden, the only other running, was given a chance to finish. It was barely 3:30 p. m., when De Palma crossed the line and it was approximately 1 1-2 hours later before the Emden had finished the 500 miles and the race was over.

The performance of the three Sunbeam cars was a little disappointing as only one of them finished. Porporato was looked upon to set the pace if necessary but his car was not fast enough. He led his team-mate Von Raalte by a dozen laps before he went out in lap 165 with a seized piston. Grant in the third Sunbeam was considerably slower, being generally four or five laps behind

BOB BURMAN

Sixth, in his rebuilt Peugeot in 6 hours, 13 minutes and 19 seconds for the 500 miles, an average of 80.36 miles per hour

Von Raalte. Until he went out, Porporato was running three or four laps back of the leader. He was doing laps in 1.40, a speed of 90 miles an hour, but his difficulty was in keeping up this pace. Grant was slower, taking 1.48 to the lap. Grant had trouble first with a broken brake connection which the technical committee insisted on being repaired and later when the mud apron worked loose and he was flagged to repair it. He withdrew with but fifteen laps to go but running 55 miles back of the leader.

The three Maxwell cars suffered troubles, only one finishing, namely, Carlson, who landed in ninth place. At the start Rickenbacher driving the sixteen-valve motor was among the leaders but spark-plug troubles set in and he could not keep the cylinders supplied and the car was finally put out with a broken connecting-rod at 250 miles. Orr, driving another Maxwell, broke a bearing in the rear axle and was out when the race was in its last stages.

Of the other cars that started, the little Cornelian went out with a broken valve at 180 miles. Before going out, the car ran out of gasoline on the back stretch and lost much time. The Kleinart loosened the partition between the gasoline and oil tanks, letting the two mingle and practically lost its standing. It was later taken out for smoking. The Sebring, Delage, Mais, Bugatti, and Purcell were all out early in the race.

Equipment of the Cars

Bosch had 100 per cent. in the ignition line, every one of the twenty-four starters using Bosch magnetos, seventeen starters using the two-spark type and seven the single-spark, those employing the two-spark system being Stutz, Mercedes, Duesenbergs, Maxwells and three others.

In the way of radiator indicators, every car in the race was fitted with a Motometer.

While Silvertown cord tires did not have a 100 per cent. equipment yet they were used on all of the ten cars to finish in the money and on the eleventh car which completed the 500 miles. It was an unqualified victory for them. The winning Mercedes used a Packard carbureter, Bosch plugs and Rudge-Whitworth wire wheels.

Resta used a Zenith carbureter and Rudge wheels. On all three Stutzes the Stromberg carbureter was used and Houk wire wheels. The Master carbureter was used by Burman and three others. The Schebler was used on O'Donnell's Duesenberg.

In the way of lubricating oil, Oilzum was used by practically every car in the race, Ralph De Palma's Mercedes using Monogram, while the three Sunbeams, driven by Porporato, Von Raalte and Grant used castor.

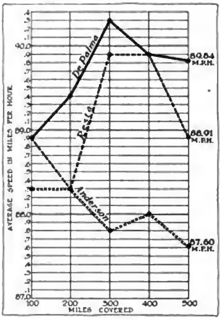
Weighing-in Howard Wilcox's Stutz before the elimination trials. This car finished seventh in the 500-mile race

Overhead Valves Triumph

Life of Spark Plug Important Factor in Race—Fewer Pit Stops and Tire Changes

By A. Ludlow Clayden

AGAIN the overhead valve has vindicated itself and as was suggested in THE AUTOMOBILE last week, a car of this design was first to make its way over the 500-mile course at Indianapolis. Fifteen out of twenty-four entries had their valves in the head and the judgment of the majority has proved to be justified. This is not only because the two foreign cars which finished first and second had engines of this type but because the excellent team performance of the three Stutz cars was direct evidence of the wonderful power of their motors. It would be impossible to say for certain, but it is practically undoubted that the performance of the Stutz is by far the finest ever accomplished by a manufacturer making his debut with a totally new type of engine. It is a better performance than any British team has yet put up with an overhead valve racing car and it has been excelled only by the showing of the Mercedes team in the French Grand Prix, last year. Most remarkable of all, perhaps, is that Wilcox's car with a broken valve spring still contrived to run for hours without losing a great deal of speed and to finish in so good a place. The Stutz showing can only be regarded as the greatest possible encouragement to American manufacturers; it is even more so than would have been a Stutz win without another American car left in the running.



Average speeds of the three leading cars in the 500-mile race at the end of each 100 miles

Stutz Steadiness

The enormous importance of team performances from the viewpoint of showing the quality of design and construction is seldom realized but actually a good team finish may be regarded as proof of a new car, while a win for a new

HOWARD WILCOX

The third of the consistent Stutz team, who finished in seventh place in 6 hours, 14 minutes and 19 seconds, an average of 80.11 miles per hour

type may have a deal of dependence on luck. To all three of the Stutz cars throughout the race only two mechanical mishaps occurred, one being the breaking of a valve spring, already mentioned, and the other the coming loose of an exhaust pipe on the same car. No work whatever was done to either of the three cars save the necessary changing of tires and refilling of gasoline.

From the Stutz motor there is probably little to learn fundamentally; it is merely up-to-date design carried out with good materials and the best of workmanship; it is a splendid testimony of what an American manufacturer can do when he is prepared to give much time and money for the sole purpose of making a fine racing machine. Seeing that this is the first time the sixteen-valve racing motor has been really tried out in this country, the degree of success obtained is entirely remarkable.

100 Inches Difference

Piston displacement of this year's winner was more than 100 cubic inches less than that of the winning Delage of last year which, with its 4.1 by 7-inch motor had a displacement of 380.2 cubic inches. This year, the winning car while traveling at a much higher rate of speed had a piston displacement of only 270.9 cubic inches. The second car in the race in 1914 set to wagging the tongue of motordom with its small displacement of 183 cubic inches but that this was an exceptional performance is shown by the fact that the most consistent performers of this year were grouped very closely around the 270 mark. The winner had a lower displacement by only 3.1 cubic inches than the second car and the Stutzes which finished third and fourth had 296 cubic inches.

The winning two cars, De Palma's Mercedes, and Resta's Peugeot, have met before and the last occasion in France showed that there was little to choose between them. In the 500-mile race if Resta had not had trouble with his steering there is no doubt he could have made a little better time and the race would perhaps have been won in just over, instead of just under, 90 miles per hour.

Slack in Steering Gear

About 150 miles from the finish Resta found a great deal of slack in his steering gear, making it difficult to negotiate the turns as fast as they can be taken normally and examination showed the trouble to be in the worm gear itself. At the finish, there was 4 inches of free movement on the rim of the wheel.

TOM ALLEY

Pilot of the Duesenberg, which covered the five century circuit in 6 hours, 15 minutes and 8 seconds, with an average speed of 79.33 miles an hour

Both De Palma and Resta ran right through the race without lifting the hood and both had only two stops at the pits, taking on tires and gasoline. De Palma took some oil but Resta did not even do this. It seems that De Palma was extremely lucky to be able to finish a winner as something happened two laps from the finish which would have caused trouble speedily. A connecting-rod broke and punched two holes in the crankcase.

Both Cars Show Improvement

As a commentary upon the performance of these two cars the most striking thing is that they both seemed better than they were a year ago. And usually a year old car is not up to its original form. The reason is that just as much care has been taken in preparing these cars as would be given to making new ones and also it is thought that the Packard carbureter on the Mercedes is much better suited to American gasoline than the foreign carbureter found on most of the imported racing cars. It is a fact that the Mercedes throttles down much better than on the old instrument and there is little or no popping in the intake pipe when cutting out to a turn. This is the first important race for quite a long time that has been won by a car with a carbureter containing an air valve. Looking for the lesson from the leading car we find again that it is practically the same as that taught by the Stutz team success, namely, the excellence of a well-tried article prepared with an infinity of pains.

Having started on the foreign cars, we may turn to the adventures of the other Peugeots, of which the small one, in Babcock's hands, went out of business. Babcock had made one stop only for a right rear tire and up to his retirement seemed to be going well.

Burman's Many Mishaps

Burman had a curious experience; while driving, a sudden noise of most alarming character commenced and continued for a time and then vanished. Burman said he thought the whole engine was about to break up and that the

NOEL VON RAALTE

Entered as Norman Graham; this Sunbeam driver finished the race in 6 hours, 35 minutes and 23 seconds, at a speed of 75.79 miles an hour

When and Why 13 Cars Dropped Out

CAR	DRIVER	LAP	REASON FOR ELIMINATION
Cino	Purcell	13	Broken timing gears
Bugatti	Hill	21	Pump gear broken
Mais	Mais	24	Ruled off for leaving course
Cornelian	Chevrolet	77	Valve went through piston
Maxwell	Rickenbacher	104	Broken connecting-rod through crankcase
Kleinart	Klein	112	Disqualified for smoking
Peugeot	Babcock	118	Cracked cylinder
Duesenberg	Mulford	125	Broken connecting-rod
Sebring	Cooper	155	Struck wall, breaking a wheel
Sunbeam	Porporato	165	Piston seized
Maxwell	Orr	169	Broke bearing in rear axle
Sunbeam	Grant	185	Withdrew with loose mud apron
Delage	J. DePalma	142	Loose flywheel

sounds were most likely due to some fault in the lubrication. He suffered two mechanical troubles causing stops. After running nearly the 3 hours, the gear case cover became loose and required to be fixed, but this was far from serious as the job was done in 30 seconds, while the pit attendants changed some tires. After 4 hours' running he had to stop again to change spark plugs and finally the copper pipe which takes oil to the camshafts broke and had to be bound up with a piece of rubber hose. This happened at 4 1-2 hours from the start. Here, failure of the pipe is traceable to workmanship; probably it had not been annealed lately and copper pipes on racing cars which are naturally subject to severe shocks, soon become brittle. In fact, a pipe which is quite soft at the start of a 500-mile race, can and often does become as brittle as glass by the end of the race.

Porporato Seized a Piston

The other foreigners were the Bugatti and the Sunbeams and of these only the two English-owned cars were new enough to hope for a win. The Bugatti was obviously underpowered for a race of this caliber and the same is true of Grant's car, which was a fine machine when new. Porporato, who looked like standing up well among the leaders, suffered the misfortune to freeze a piston after running three-quarters of the distance. This was probably due to a broken piston ring but it will need an internal investigation to make sure. He also suffered a stop to fix his straps holding down the hood and another for the same reason. These cost 3 minutes, 45 seconds altogether which is equivalent to enough to make a two-place difference in the position on the scoring board. His partner, Von Raalte, lost his hood altogether and was stopped so that the referee could instruct him to fetch it and replace it, which cost a lot of time. Previously, he had a 3-minute stop to change two spark plugs. His most serious trouble was very peculiar, however. The platform which carries the magneto on these Sunbeams is apparently bolted securely to the side of the crankcase but is a separate piece. After running just over 5 hours this trouble caused a stop of 16 minutes and the ignition apparatus worked loose again an hour later, taking 19 minutes to fix on this occasion. Altogether, Von Raalte lost nearly an hour at the pits, the magneto trouble being the most serious. It is a remarkable fact that the Sunbeams in Europe, for the last 2 years, have suffered stops for curious little details like this, and it is certainly not due to unpreparedness. It seems much more like dogged bad luck.

Duesenberg Motor Does Well

First there is the Duesenberg team of three and secondly the Sebring and Kleinart with Duesenberg motors and the chassis of all are made up of well-known components. These cars as a team of five or as a team of three did quite well and it is to be noted that their numerous troubles were mostly not connected with the motor. Klein had an almost unique mishap in that his gasoline and oil became mixed by the failure of the partition dividing them. This made it impossible to lubricate the motor in the way intended, namely, by pumping small charges into the crankcase. The result was that the motor was so filled with oil that the smoke became a trouble and the car was ruled out. Klein had some trouble with his pump gland which leaked persistently and caused increasingly frequent stops for water right up to the time of his retirement.

BILLY CARLSON

His Maxwell made an average of 78.96 for the race, taking 6 hours, 19 minutes and 55 seconds to cover the 500 miles

The Sebring had persistent spark plug trouble, losing no less than 42 minutes on this score, while it had another stop to fix the accelerater pedal.

Duesenbergs Stood Up Well

Of the Duesenberg cars, the one driven by Alley suffered no trouble of a mechanical nature beyond a loosened exhaust pipe and finished the race in good shape. O'Donnell stopped only three times and his mechanical adjustments consisted of the replacement of a nut which had jarred off the brake bracket and a quick adjustment of the shock absorber. Mulford's Duesenberg was put out of the race by a stripped gearbox direct drive clutch but he had previously adjusted his steering gear and brakes.

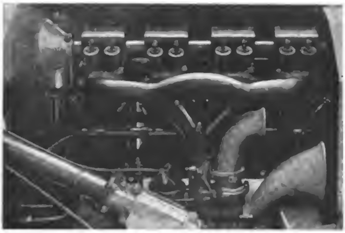
Plugs Caused Maxwell Retirement

Failure of spark plugs to stand up to the demand upon them was the reason for the withdrawal of Rickenbacker's Maxwell and examination of the plugs which gave trouble almost as soon as they were put in, suggested that they were suffering

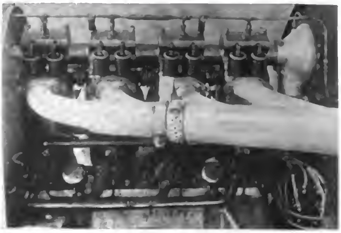
Cars, Drivers, Relief Drivers and Mechanics in the 500-Mile Race

No.	Car	Driver	Rel'f Driver	Mechanic	Rel'f Mechanic
1	Stutz	H. Wilcox	J. Aiken	C. W. Scott	H. H. Jones
2	Mercedes	R. De Palma	C. Bragg	L. Fontain	—
3	Peugeot	D. Resta	—	F. McCarthy	—
4	Stutz	E. Cooper	J. Aiken	R. Dulton	H. H. Jones
5	Stutz	G. Anderson	J. Aiken	T. Rooney	H. H. Jones
6	Sunbeam	J. Porporato	G. Morris	M. Ronco	T. Harrison
7	Sunbeam	N. Von Raalte	G. Morris	E. Copple	T. Harrison
8	Peugeot	R. Burman	R. Knapp	J. Gable	—
9	Kleinart	A. H. Klein	C. L. Rogers	F. B. Leightner	—
10	Duesenberg	T. Alley	W. Chandler	J. Henderson	H. Smith
12	Peugeot	G. C. Babcock	J. Lecain	J. E. Wicker	—
14	Sunbeam	H. Grant	C. A. Limberg	B. Moore	—
15	Duesenberg	E. O'Donnell	B. Keene	P. Henderson	A. H. Johnson
16	Peugeot	G. C. Babcock	—	R. Pallotti	—
17	Delage	J. De Palma	C. Bragg	C. Phillips	E. C. Cheney
18	Sebring	J. Cooper	F. Galvin	L. Pelo	—
19	Maxwell	W. Carlson	—	P. Franzen	S. Lounsberry
21	Maxwell	T. Orr	E. Rickenbacher	R. Stafford	D. C. Latta
22	Duesenberg	R. Mulford	W. Chandler	P. Stevens	A. Johnson
23	Maxwell	R. Rickenbacher	H. Hughes	E. Schraeder	S. Lounsberry
24	Mais	J. A. Mais	F. Clemons	J. Jackes	J. Baker
25	Purcell	C. C. Cox	F. Farber	H. E. McCord	R. Knapp
26	Bugatti	J. R. Hill	—	W. Healy	—
27	Cornelian	L. Chevrolet	J. Boyer	O. Klein	V. Shobe
28	Emden	W. Haupt	—	H. G. Donaldson	L. C. Donaldson

De Palma practicing tire changes on his Mercedes before the race. This practice stood him in good stead in the gruelling speed duel which he won



Intake side of De Palma's Mercedes motor, showing mounting of Packard carbureter, which is said to have been an important factor in his victory



Exhaust side of the Mercedes motor, showing the vertical shaft at the rear for actuating the overhead camshaft, and also one of the two magnetos

from overheating. The most usual sort of failure consisted of a clean break across the insulation just within the steel plug body, which would naturally be the hottest part. It is worthy of comment that this consumption of spark plugs was the principal trouble in England and France last year, but it was overcome before the races in most instances. Better cooling arrangement seems the easy answer and that is none too easy. Somewhat curiously, the car ran well for over a couple of hours without the plug trouble setting in seriously, though there was stop 1 3-4 hours after the start for clutch adjustment. After running 3 1-2 hours the car was taken out on account of its continued plug failure.

Carlson Stopped But Once

Carlson's Maxwell had the distinction of being the only car among the finishers to stop only once. It was also the only Maxwell that escaped trouble, since Orr was put out near the end by breaking the bearings in one of the rear wheels. First, the bearings went and this left the wheel dependent upon the withdrawable drive shaft, so the resulting tangle was utterly hopeless. This is a most unusual sort of failure and really reflects no discredit upon the Maxwell engineering. Orr had one short stop to examine plugs but did not change any. Thus we see that the two valve Maxwells had no ignition trouble, while the one with four valves per cylinder consumed plugs as fast as they were put in. This is proof positive of the higher mean effective pressure and the correspondingly higher temperature obtainable with the four-valve type of motor, and it is to be expected that the way out of the difficulty will be found before the latest Maxwell racer appears again upon a speedway.

Emden Slow but Sure

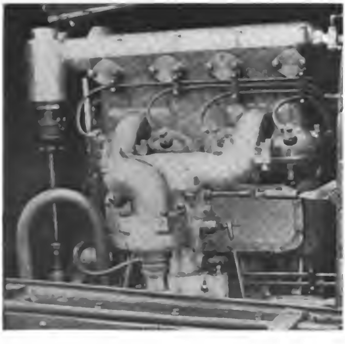
Of the remaining cars, the only one which finished was the Emden, which ran a slow but steady race and came last of all. It had only two stops, one soon after the start to change all four plugs and another at about one-half distance for water, gas and oil.

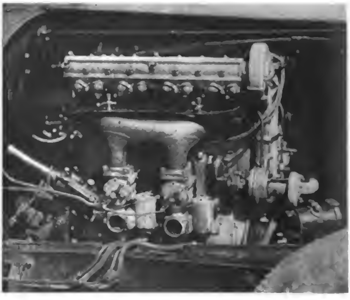
Of the absentees, John DePalma had extremely bad luck and the failure which caused him to retire in the 42nd lap scarcely could be blamed upon his accident in practice. After making a good pace till his first and last stop he found the flywheel running out of true, either due to being loose on the shaft or to the built-up crankshaft having loosened at the flywheel end.

The Purcell stripped the timing gear, which drives the water pump during the 13th lap and the case was obviously hopeless, so this car was the first to give up the contest.

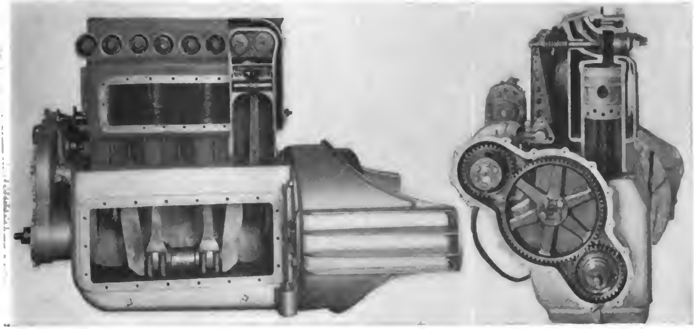
Mais, on the Mais special, was troubled with a flooding carbureter and stopped for this reason after covering only three laps. Pulling up again for the same cause after the 25th lap he overshot the pit and went around the road behind to return to his proper place, thereby earning disqualification.

After making a number of laps ex-





Above—Intake side of Sunbeam four motor. Note two carbureters
Left—Intake side of Maxwell motor, showing overhead camshaft



Side and end semi-sectional views of the Duesenberg motor, showing overhead valve mechanism and other features of construction

tremely slowly the Bugatti failed to put in an appearance, having broken down on some other part of the track, the reason reported being a broken connecting-rod or the same trouble which occurred in practice.

Cornelian Broke a Valve

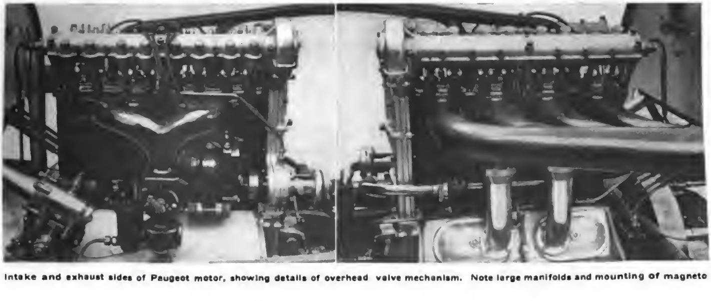
The little Cornelian was one of the most regretted to fall out from a mechanical standpoint because of the remarkable speed shown for so small a motor. The trouble was a broken valve which fell inside the cylinder and did considerable damage. It seemed to be undercooled, as water was taken in three times during the 3 hours that the car ran, but the only mechanical work done consisted of a spark plug change.

Ignition Troubles

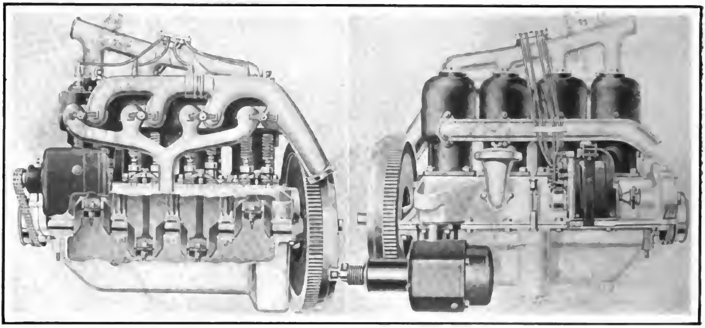
The fastest cars of foreign manufacture had no plug trouble, three of the fastest American machines were almost equally free from it, but the majority of the contestants were sufferers. It was the Mercedes and Peugeot that had no spark plug difficulty during the practice for last year's French Grand Prix, every other car in that race having ignition trouble. The Sunbeams have never been able to overcome the tendency for the plugs to fail and it is only the slower of the American cars that seem fairly free. Even among the slowest, however, there was a good deal of plug changing done. Since Peugeot and Mercedes have found the secret there seems no reason why other people should not do likewise, and the probability is that the secret is simply to prevent the plug getting to more than some certain temperature. A trick which has not yet been tried would be to use plugs of much larger size than the standard pattern, say of double the diameter, for this would give wider insulating area and enable better allowance to be made for expansion. The idea is not new and is the property of a spark plug maker, but it has not yet been tried out. Of course, there is the other attitude possible, namely, that if Peugeot and Mercedes can build motors to take ordinary plugs, then other people should be able to do likewise. But even if this view is accepted, the other scheme should be worthy of experiment.

Mechanical Trouble Means Elimination

Once again the experience of the 500-mile race shows that it is useless to hope to win a race of this sort unless you are safe to go through without touching a spanner or even lifting the hood. The race of a year or 2 hence will have no pit work, bar the changing of tires and, perhaps, the supply of gasoline. Those who have mechanical difficulties, however slight, will retire gracefully at once.



Intake and exhaust sides of Peugeot motor, showing details of overhead valve mechanism. Note large manifolds and mounting of magneto



Left—Cutout view of intake side of Overland model 83 motor, showing five-bearing crankshaft. Right—Exhaust side, with mounting of magneto and Bendix gear for starting. Note oil gauge in plain sight

A New Overland Four—Price Lower

Model 83 Replaces 80 and 81—Bendix Gear for Starting—Cloth Upholstery—Many Detail Refinements

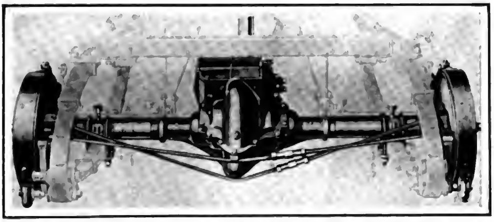
OVERLAND'S largest four-cylinder model for 1916 is revealed as being an attractive model, similar in general appearance to this year's cars, though selling under either of them at $750 as a touring model and $725 as a roadster. It is called model 83, and entirely supersedes models 80 and 81, the fours of the season now closing, which sold for $1,075 and $850, respectively. It is a larger car than model 81, and more refined and a later development than either of them.

The enormous production facilities of the Overland plant are given as the reason for the price drop, for with a contemplated output of 75,000 cars for the coming year, it stands to reason that cost per car can be lowered materially. In fact, at this time a schedule of 400 cars a day is in force, and when the additions now under way are completed and these new parts occupied, a production of 600 a day is figured on.

The model 83 is in line with former Overland construction throughout. It uses the same motor as the $1,075 car of this year, namely the 4 1-8 by 4 1-2 type with cylinders separately cast. It is said to develop 35 horsepower on the block. The wheelbase is 106 inches, the clutch is a cone design, the gearset is incorporated with the rear axle unit, a floating axle is used, steering is on the left, control in the center, drive is through a torsion tube, and uses 33 by 4 tires.

Though in outward appearance the car is almost indistinguishable from model 80, a number of little refining touches have been bestowed. Cloth upholstery, leather bound, is the standard for all cars of this model. This is a radical step to take where such a large output is involved, but Overland makes clear its reasons for adopting such instead of either leather or imitation leather. The difficulty of securing enough good upholstery leather, together with the recent perfecting of waterproof cloth that is durable and easily cleaned are the principal points that led to the use of the latter. There is no doubt that cloth is very comfortable to ride upon, for it is not slippery, clings to the clothes of the passengers and really prevents them from sliding around on the seats.

The cloth is a worsted fabric



Rear axle and gearbox unit of Overland model 83, showing underslung springs and large brakes with a waterproof coating on the under side. It is explained that cleaning is easy. Dust is removed with an ordinary brush, while grease and oil spots are taken off by first wetting with warm water, then rubbing on a little castile or ivory soap and scrubbing with a small brush, and finally rinsing with clean warm water.

Bendix Gear for Starting

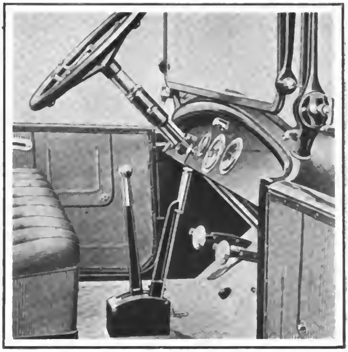
An improvement of note is the fitting of the Bendix form of driving connection between starting motor and flywheel. This was used only on the present six-cylinder Overland, but the Overland engineers like it so well that its adoption on the new four followed. This drive is not new to automobiles, and has been mentioned in these columns, but a brief description of it is merited here. The shifting of the gear is entirely automatic after the current is sent to the electric motor. The device is a weighted pinion on a threaded shaft, the weight serving to carry the pinion into engagement with the flywheel teeth.

Referring to the illustration at the right, page 980, the armature shaft M runs inside of a threaded sleeve A, on which the threaded pinion B can be screwed backwards and forwards. This pinion meshes with the teeth in the rim of the flywheel. A stiff coil spring C attaches at its outer end to the end of the armature shaft at D and its inner end attaches to the outer end of the threaded sleeve at E, which would be entirely free to turn on the armature shaft if it were not for the spring connection. The pinion B is weighted, and is loose enough on the shaft to be moved by the weight until the latter is in its lowest position.

When current is sent to the motor, the armature is revolved at a rapid rate and the weighted pinion is kept from revolving with this shaft by its looseness and by the action of the weight. It therefore, automatically screws forward along the threaded shaft A until it contacts with the flywheel teeth, meshing naturally due to the chamfer on one side of the teeth. When fully meshed, the pinion reaches a stop at the inner end of the screw shaft, and since it cannot screw further, it must now revolve with shaft A. This sudden rigid connection between the two would create a shock if it were not for the cushioning effect of the coil spring. Once the connection between A and B is made, the power from the starter goes through the coiled spring to the threaded sleeve and then through the gear to the flywheel. It is not until the spring is fully coiled that the whole power is transmitted.

Is Automatically Unmeshed

As soon as the engine starts under its own power, the flywheel obviously revolves faster than the armature shaft, and it thus increases the speed of the pinion gear over that of the threaded sleeve on which it is mounted. This serves to back the pinion off the threads, moving it in the reverse direction to its meshing movement but in the same manner, and finally unmeshing the two. This movement is automatic after the engine begins to run faster than the starter.

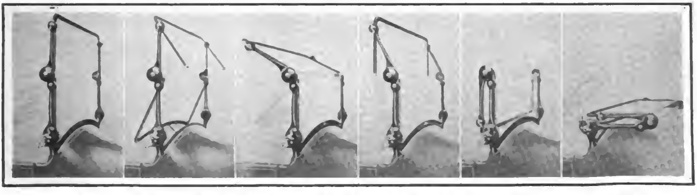


Clutch and brake pedals are adjustable for length, the starter button is located in the toe board and control levers permit easy entrance. Steering wheel is anchored near top to prevent vibration

The device is foolproof because it is impossible to do harm to it by switching on the starter current accidentally after the engine is running. The weighted pinion, being out of balance, is twisted and binds on the screw shaft, revolving with it. This is a clutching effect and is due to the centrifugal force of the unbalanced weight.

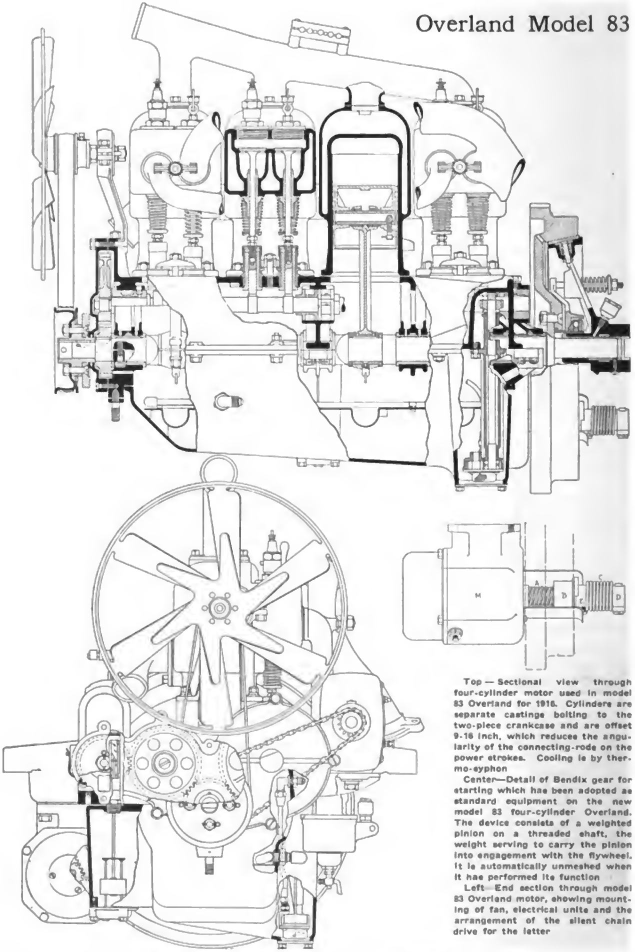
The new model is fitted with a somewhat different type of control box than that used on the model 80, the box performing the same duties as the old, of switching on the lights, carrying the horn button and including the ignition switch, but a special form of key is furnished with two slots in which this will fit. The upper slot is for operating the light switches, and the lower takes care of the ignition. Removal of the key automatically locks the switches. The horn button is on top. On the former box the light switches and the horn were operated by exposed buttons.

While both 1915 fours carried side lights, a noticeable change in the model 83 is the absence of these, the headlamps being provided with a dimming feature for city work. The headlamps are of special design with a quick method of focusing by moving the socket back or forward with a screwdriver. They are made by Auto-Lite and both the door and reflector have a sort of bayonet lock arrangement for hold-



Six of the many positions possible with the new windshield which is standard equipment on the Overland model 83

Overland Model 83



Top — Sectional view through four-cylinder motor used in model 83 Overland for 1916. Cylinders are separate castings bolting to the two-piece crankcase and are offset 9-16 inch, which reduces the angularity of the connecting-rods on the power strokes. Cooling is by thermo-syphon

Center—Detail of Bendix gear for starting which has been adopted as standard equipment on the new model 83 four-cylinder Overland. The device consists of a weighted pinion on a threaded shaft, the weight serving to carry the pinion into engagement with the flywheel. It is automatically unmeshed when it has performed its function

Left—End section through model 83 Overland motor, showing mounting of fan, electrical units and the arrangement of the silent chain drive for the latter ing them in place in the body of the lamp. A quarter turn clears the holding lugs so that either part can be taken out. The socket is entirely independent of the reflector.

Clutch Pedals Now Adjustable

Clutch pedals have been made adjustable for length, a feature that was formerly found only on the six. The pedal arms bolt to the levers proper, and there are several sets of holes so that the relative positions of the two parts may be varied.

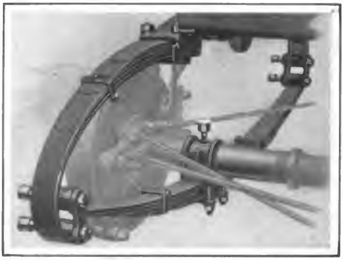
Front fastening of the one-man top is another point worthy of mention, and instead of fastening the front bow to the rigid side supports of the windshield, as is often done with this design of top, metal braces, hinged so as to lie flat when it is folded back, hold the front of the top in position. They attach to the top at about the same point the side supports of the windshield would ordinarily come and are clamped in sockets at the bottom of the windshield. The advantage of this is that the windshield can be hinged to fold at the point where the two glass edges meet and also at the bottom. This does away with immovable side pieces. The shield is practically the same as that used on model 80, and it admits of a wide range of positions for both top and bottom glasses.

Cylinders Offset 9-16 Inch

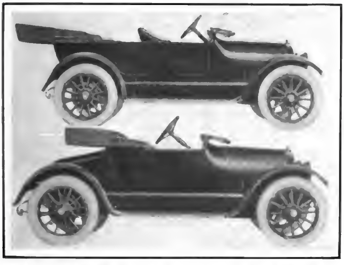
The motor is of the type in which each of the cylinders is a separate casting which bolts to the two-part aluminum crankcase. They are offset 9-16 inch which reduces the angularity of the connecting-rods on the power strokes. The cylinders are L-heads with valves on the left. The exhaust manifold is above the intake in standard fashion, and large passages are given intake and exhaust gases. The water connections are also large, due to the thermo-syphon system.

The five-bearing, carbon steel crankshaft is very rigid and acts as a big factor in reduction of vibration and consequently for smooth running. The three-bearing camshaft has integral cams acting directly upon the tappets. Pistons each carry two rings above the wristpin, and have oil grooves below it to aid in keeping lubricant out of the combustion chambers. Wristpins are hollow and attach in the piston bosses by set screws, the rod ends oscillating on bronze bushings. The standard construction for connecting-rods is adhered to. These are of I-beam drop-forgings.

In the constant-level splash lubrication, the oil is forced through a sight feed on the dash by a gear pump, whence it flows by gravity to the connecting-rod troughs, where it is splashed to the bearing surfaces, the rods having small scoops on their ends. The pump is inside the crankcase instead of having it attached to the outside of the case as heretofore. The location is the same, and the pump design just as it was, but its inclosure helps to clean up the crankcase, and to prevent any waste of oil. Any which now might escape from the pump finds its way back to the reservoir in the bottom of the crankcase. Heretofore, any leakage from the pump was lost. The pump has a strainer as a part of it so that only strained lubricant reaches the bearings. The neat form of revolving sight feed is still fitted with a small vane which rotates when the oil is flowing and it is not difficult to see it even though the glass is fogged.



Overland 83 springs are 47 by 1 3-4 inches. Note the grease cup on swivel seat on axle and those on shackles



Upper—1916 model 83 Overland four-cylinder, five-passenger touring car which sells for $750. Lower—Two-passenger roadster listed at $725

Ignition by High-Tension Magneto

The Auto-Lite lighting and cranking system has the starter unit placed on the right rear side of the crankcase underneath the motor arm, and the generator mounted on the opposite forward side with its drive through silent chain with the crankshaft. Ignition, by a separate high-tension magneto, is entirely independent of the lighting and starting system with the magneto driven through gear and shaft connection with the front gears and carried on the right forward side on an integral crankcase bracket. There is no change whatever in any of the electrical units. The usual equipment of automatic cutouts, circuit breaker and ammeter is provided so that the battery cannot be overcharged, and really gets its current at about the same rate regardless of the car speed.

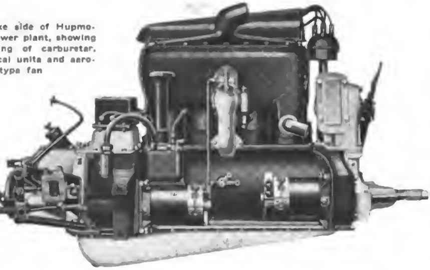
The familiar Overland drive system used includes a cone clutch and back of it the propeller shaft is inclosed within a torsion tube, the flange of which attaches to the front of the rear axle gearbox, which in turn bolts to the differential housing. The clutch, a leather-faced cone, has a brake to stop the shaft spinning when gears are to be changed and has three main springs equally spaced to give a gradual engagement, and eliminate grabbing. These are placed close to the points of contact so as to make a good connection, and they distribute the tension so as to make declutching easy.

The propeller shaft carries a universal joint ahead of where it enters the torsion tube. This member is fitted with a yoke at its front end, the arms of the latter hinging to a cross member of the frame. Radius rods extend diagonally from the ends of the axle tubes to the front of the yoke to aid in preserving axle alignment. The gearset is of the usual three-speed type incorporating nickel-steel gears of stub tooth form. The axle is arranged for axle shaft removal independent of the axle housing, and the differential construction is conventional with four bevel pinions. Roller bearings carry the axle mechanism.

(*Continued on page* 993)

Larger Motor in 1916 Hupmobile

Increased Bore Adds 46 Cubic Inches to Displacement



Intake side of Hupmobile power plant, showing mounting of carburetor, electrical units and aeroplane type fan

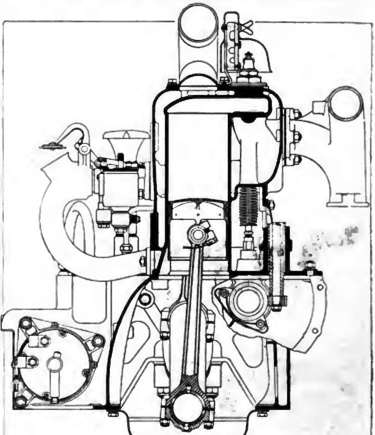
LAST year the Hupmobile was redesigned altogether so, as would be expected, the changes for 1916 are not very great. Certainly the most important is the increase of cylinder bore from 3 3-8 to 3 3-4 which adds 46 cubic inches capacity as the stroke is still 5 1-2 inches; the actual capacity is therefore now 243 cubic inches as against 197 last year. Prices are lower, the five-passenger touring car selling at $1,095 as against $1,200 for 1915.

Another change is in the electrical equipment which is to be Bijur constant current type with two units but otherwise, apart from a few altered dimensions here and there, it is in the body that the characteristics of 1916 must be sought.

Externally the 1916 motor is very like that of 1915 as the extra 3-8 inch on the cylinder bore does not add materially to the over-all dimensions. Cast iron is used for the crankcase to give the maximum of rigidity to the crankshaft bearings, but the cylinders are not integral with the base, as this form of construction is liable to become too massive with fairly large motors with a long stroke. On the road the rigidity is noticeable by absence of vibration up to quite high speeds of revolution, for the Hupmobile motor is capable of high speeds, though it is not primarily a very high-speed engine, being designed rather with the idea of high power production at low and moderate rates of revolution. As an example of the success which has attended the maker's efforts in this direction, the motor pulls smoothly at 5 miles per hour on the top speed of 4 to 1 and accelerates rapidly without pounding. Moderate grades can be taken slowly on high gear and the car will get away easily. Of course the acceleration is more rapid on the second gear, as this gives the large valves and wide gas passages a chance to do their work, meaning that the motor speed rises very quickly and the car speed in proportion, so that up to 25 or 30 miles an hour one can jump away on second almost as quickly as one can depress the throttle pedal.

This rapid acceleration is gained partly by care in reducing the weight of the pistons and further care to balance them against each other.

Quiet operation is insured by the use of chains for the timing drives to camshaft and electric generator and by an unusual system of valve lubrication. The main chain passes around the crankshaft pinion, the camshaft sprocket and also a third pinion which drives the fan and by this latter the tension of the chain is set. From the sectional cut of the motor it can be seen that the fan is mounted on a small spindle which passes through a larger, hollow spindle carrying the sprockets. This large spindle is secured by means of the small studs and nuts shown and also seen in the photograph of the front end of the motor, and it is eccentric in its housing. The flange is slotted at each bolt hole, so that the distance between centers is easy to adjust and to lock. It is from the second pinion on the crankshaft that the generator is driven and the second pinion on the fan spindle can be employed for a magneto drive. In the ordinary way a magneto is not used, but some of the foreign markets still demand it and this is a simple and



Transverse section through Hupmobile motor, showing characteristic air intake on carbureter effective way of providing a drive, should this be required.

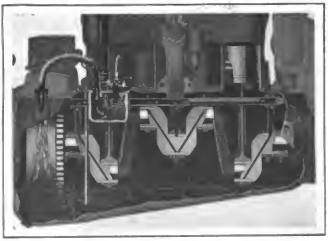
For America the ignition is cared for by an Atwater Kent system driven by skew gear from the front end of the camshaft.

There is a separate adjustment for the generator chain so the whole of the front end motor system is well cared for.

Unique Lubrication System

Probably the Hupmobile is the only car using a drilled crankshaft without an oil pump to force lubricant through it, but though there is no pump a fair oil pressure is obtained. Oil is picked up by the flywheel and flung into a bell mouthed pipe which conducts it to a screening chamber. Thence it flows into a pipe cast in the crankcase, is distributed to the main bearings, and through the holes in the crankshaft to the lower end bearings. Oil also goes to the chains and a separate small lead supplies the valve chamber, the cover thereof being oil tight, and it only returns to the base when it has reached a set level around the tappets. This keeps the valve mechanism in a continuous bath of lubricant which prevents wear and also deadens the small sounds inseparable from a poppet valve system.

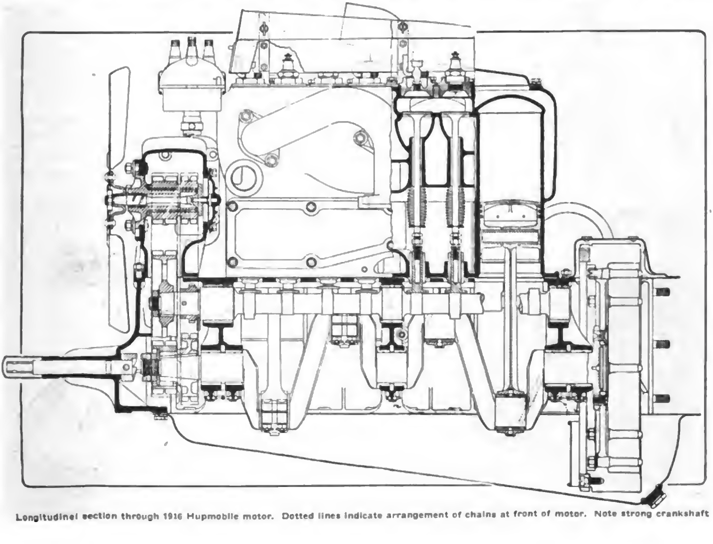
Thermo-syphon cooling is used. The carbureter is a Zenith and is mounted so that air enters through the aluminum pipe shown in the photographs. In this is fitted a valve, controllable from the dashboard so that cold air can be given, direct from the atmosphere, or else air can be drawn in from the opposite side of the motor whence it has to pass between the hot cylinders. All intake passages are cast integral with the cylinders, but the exhaust manifold is separate. It is of unusual design, having the outlet at the center, being, in fact, more like an intake manifold. None the less it gives a very free outflow and enables the muffler pipe to be kept well away from the footboards in the driver's compartment.



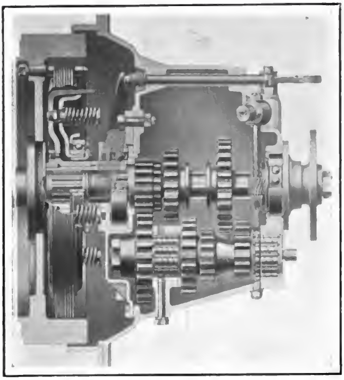
Section through Hupmobile crankcase, showing the general scheme employed in the lubricating system

Gearbox Most Compact

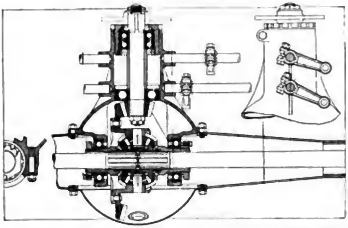
Naturally, owing to the use of the flywheel to pick up oil, the clutch is assured a continuous bath of lubricant, so the steel-to-steel type is used with fifteen plates. It is made up as a transmission assembly and pressure is obtained from a number of small springs instead of one heavy spring. An interesting feature is the arrangement of bearings which can be studied in the sectional view on page 984. Two large ball



Longitudinal section through 1916 Hupmobile motor. Dotted lines indicate arrangement of chains at front of motor. Note strong crankshaft



Section through gearset and clutch, with bearings and cross shaft for speedometer drive



Center of rear axle, showing method of detaching differential and bearing mountings. The thrust of the crown wheel is taken by the bearing on the right of the differential

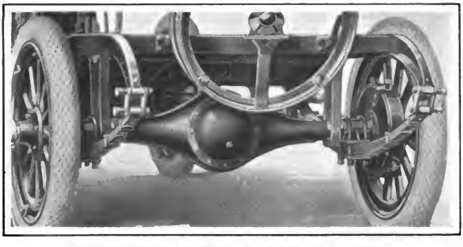
bearings carry the first motion pinion and this is on a hollow shaft containing the plain roller spigot bearings. A large ball bearing is again used at the rear end, and the countershaft is on Hyatt roller bearings. A slight change in design not shown in this illustration, but to be found on the 1916 chassis, is that the center portion of the universal is now an integral part of the gearshaft which does away with the keyed-on flange shown. The gears and their shafts are made in as few pieces as possible so as to save weight and space, the result being a small and light gearset. It may be noticed that there is no gearshifting apparatus on the gearbox itself, which is due to the fact that the lever with the brake lever and all the gearshifting mechanism is mounted on the frame and comes to the final assembly as unit therewith. For connection to the internal gearshifters there are a couple of adjustable links, so the use of a separate lever mounting adds no complication to manufacture. What it most noticeably does do is to bring the levers into a much better position for the driver than is to be found on many other cars with central control. Since great rigidity is not needed for a gearset and the casting is smaller in length, weight is saved by using aluminum for the gearbox instead of cast iron.

Removable Differential

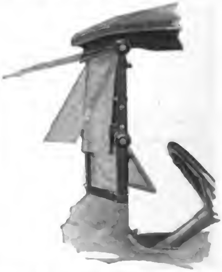
For the rear axle a pressed steel main member is used, with all gearing and bearings mounted in a readily removable center casting. The section at the left shows how easily all the mechanism can be removed and calls for no explanation. A point liable to escape notice is that the thrust of the crown wheel is taken by the double purpose bearing on the *right* side, not by the bearing behind it. This makes the difference that there is then no necessity to hold the outside parts of the bearings which can consequently be just slipped into place. Adjustment for depth of mesh of the bevel gears can be made on the center part of the axle before it is put into the pressed part, and a moment's study will show how greatly this construction simplifies the assembly. Four pinions are used in the differential and the teeth are large, insuring durability. The brakework follows standard lines, the layout being shown in the chassis plan, which also gives a good view of the two-jointed propeller shaft.

Following last year's innovation, the rear springs are underhung beneath the axle, and they take the drive and torque. On the long chassis of 134-inch wheelbase the rear springs are 60-inch and the front 39-inch while on the short chassis of 119-inch wheelbase the front springs are 2 inches shorter and the rear springs 52 inches long.

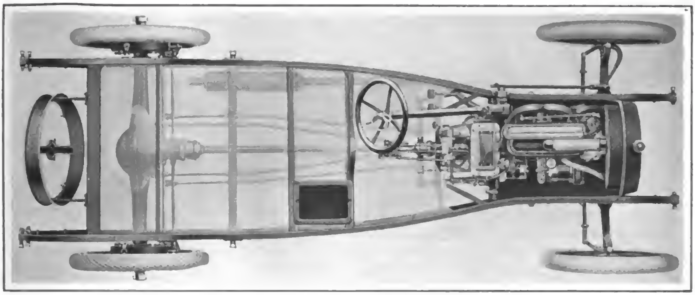
Straight connections and large bearings characterize the steering gear and a special point is the great strength of the swivel arm. It is usual to pierce the swivel pin with a conical



Rear end of 1916 Hupmobile chassis. Note underslung springs



New type windshield on 1916 Hupmobile



Plan view of 1916 Hupmobile chassis, showing tapered frame, layout of brake connections, etc. Note numerous grease cups

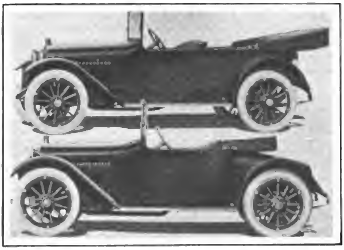
hole and to have a two-branched drop forging to which the tie rod end and the ball joint of the drag link are attached. On the Hupmobile the forging for the linkage is pierced instead of the swivel and it is machined with a central ring that embraces the swivel and is secured by a large nut. This makes the actual drop forging much easier and the resulting parts are stronger than usual.

Standard tires for both chassis are 34 by 4. For limousine or sedan bodies 35 by 4 1-2 are used and the gearing is dropped from 4 to 1 down to 4.25 to 1. Non-skid type tires are always fitted to rear wheels.

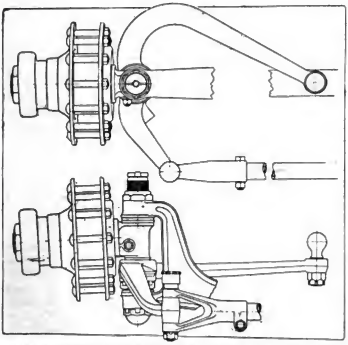
Low Seating Features Body

In the roadster and touring bodies both front and rear seats are placed low, so as to give an easy position for the passengers, and the back of each cushion is much lower than the front so there is a good rake which prevents the passengers from being thrown forward by an exceptional road

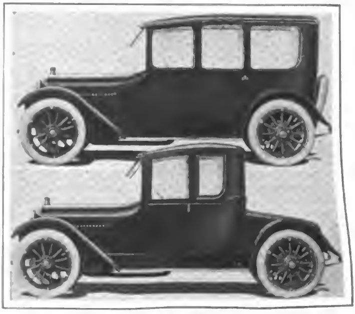
(Continued on page 993)



Upper—Five-passenger automobile touring car which sells for $1,085 with complete equipment. This car was formerly listed $1,200
Lower—Hupmobile 1916 roadster which sells for $1,085



Strong arrangement of steering and tie rod arms on Hupmobile



Above—1916 Hupmobile sedan. Below—The coupé model

The Rostrum

Calculating Compression on Racing Motors

EDITOR THE AUTOMOBILE:—Can you advise me of the method or formula of calculating the volume of the compression space for a high-speed, four valve-in-the head racing motor?

2—Also the valve timing of the Peugeot racing motors.

3—Would like to know the amount of compression usually favored by racing motor designers.

San Francisco, Cal. P. HAWKINS.

—The method of calculating the necessary volume of the compression space for a high-speed motor is the same as that for calculating any other. After the desired compression has been settled upon, it is entirely a matter of making the volume occupied by the gases at the bottom of the intake stroke bear a certain relation to the volume occupied by them at maximum compression or at the top of the compression stroke. Stated in another manner, the relation between piston displacement plus compression volume and compression volume, determines the compression. To put this in the form of a formula, the compression depends upon the relation of $\frac{V + V'}{V'}$; Where V is the piston displacement and V' is the volume of the combustion chamber.

As compressed in the gas engine cylinder, the charge follows neither adiabatic or isothermal laws but falls somewhere between the two according to the amount of heat which is radiated. In other words the expression for pressure is somewhere between $P = P'\left(\frac{V + V'}{V'}\right)^{1.408}$ and $P = P'\left(\frac{V + V'}{V'}\right)$: where P is the compression pressure and P' the initial pressure. For all practical results the compression pressure as estimated on the accompanied curve, Fig. 1 will give accurate results.

2—The valve timing differs on the different Peugeot racers and you do not state to which type you refer.

3—Racing motor designers favor compression which runs very close to the 100-pound mark. A mechanical compression ratio of 5 to 1 is quite frequent. As estimated on published tables covering this point, the compression will vary between 80 and 121 pounds for this amount.

Steeper Cams on Ford Give More Speed

Editor THE AUTOMOBILE:—In the overhauling of a Ford engine, after all parts are made as light as possible, larger manifolds put on, could the valve timing be changed so as to further increase the speed of this engine? In case it can, what timing would you recommend? Also what is the valve lift? Should the compression be changed?

Clay Center, Kans. G. L.

—Probably the only way in which a change in the timing could be effected to provide higher speeds and more power would be to put in a new camshaft with steeper cams. As it is now, the cams which you have are designed for quietness as well as speed. If you wanted to sacrifice the quietness by the use of an extremely flat cam, this could be done and there is no doubt that you could secure more power and speed. At the present time the valve lift is .25-inch and this is ample as it permits of sufficient opening for any gas speeds which you are apt to work with. The compression need not be changed.

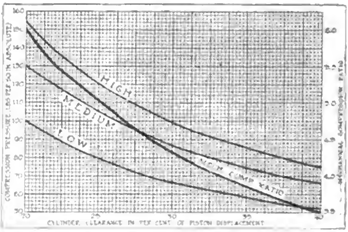


Fig. 1—Curve showing high, low and medium compression for different compression ratios and cylinder clearances

Platinum Points Vary in Composition

Editor THE AUTOMOBILE:—Have the different makes of magnetos different material for breaker points than platinum? If so, what is it?

2—Are there different grades of platinum points?

Thomasboro, Ill. FIEDLER BROS.

—The so-called platinum points for magnetos vary greatly in composition and hardness. Different compositions and percentages of iridium are used in the compositions, the average being somewhere about 15 per cent. iridium or less. In some of the very cheap grades no platinum at all is used, nickel being substituted. These points do not stand up for any length of time.

2—Where platinum is used the only difference in actual grade is in the variation of the percentages of alloying substances used and also in the thickness of the points. In some cases the platinum is very thin.

Preheating Necessary with Present Fuel

Editor THE AUTOMOBILE:—Of two motors exactly alike running with wide open throttles, No. 1 is fed hot mixture through waterjacketed manifold and carbureter, also hot air is used. No. 2 motor is fed mixture through manifold and carbureter which is not waterjacketed, but the carbureter is so much better than that of No. 1 motor that both motors receive equally good mixtures, the only difference being in temperature of the mixture;—the temperature of the cylinders of both motors being kept at a fixed heat by the cooling system.

A says that No. 1 will produce more power—not speed—because its mixture, being already hot, will produce a greater number of heat units when ignited; that is, as much more as the heat of No. 1 mixture exceeds the heat of mixture No. 2 before they were ignited.

B says that it is good to compress the mixture, but to heat it as little as possible while compressing it, so that more expansion will take place after ignition and less of it before. Also he says that No. 2 motor will be more powerful because its mixture not being heated, is not expanded to the extent of No. 1, therefore, more of it will be sucked into No. 2 and that it will have greater expansion, heat and pressure after it is ignited; owing to the fact that it was less expanded before it was ignited. B says to compress the mixture to a high pressure and keep it cool as possible while doing so. A says greater heat and therefore power is secured if the mixture is heated previous to ignition. Can you kindly tell me who is correct in this?

Tampa, Fla. CONSTANT READER.

—The only reason that we preheat fuel is to thoroughly vaporize it. In other words, for a given volume and a given mixture, a greater amount of heat units will be contained in the cooler charge. The reason for this is that the heat expands the charge thereby permitting a smaller number of units of fuel to be contained in a given volume. The fact that some of the heat units which would ordinarily be lost are returned to actual use by preheating the charge is a factor in the situation and does reduce the difference between the two conditions, but it is doubtful if as many heat units would be given up in this manner as would be lost by having a preheated charge. The practical side of the question, however, is one which must be looked upon. With the gasoline that we are now getting it is necessary to use heated air if the best results are to be attained; otherwise, the fuel will not be vaporized, especially during cold weather.

Timing for Two-Cylinder Opposed Motor

Editor THE AUTOMOBILE:—Will you kindly publish in THE AUTOMOBILE information on the following subject: What valve timing should one use on a two-cylinder opposed truck motor with a bore of 4 1-4 and a stroke of 4 1-2?

Chicago, Ill. ART JACOBS.

—Since the valve timing which will give ideal results for any given motor is a variable quantity and depends largely upon such details as manifold design, the only thing which can be done is to give you an approximate timing from which you can vary in one direction or the other until you attain the best results.

If the cams are already made and in the motor, you can only place them so that the valve openings will correspond with those given and allow the closing to take care of itself. A fairly average timing which should give good results is as follows: Intake valve opens 10 degrees after upper dead center, and closes 35 degrees past lower dead center. The exhaust valve opens 40 degrees before lower center and closes 5 degrees past upper center.

Timing on Knight Type Motors

Editor THE AUTOMOBILE:—Does the A. A. A. have charge of all contests in this country and if they do can you inform me where to write to find out the rules governing these contests?

2—Will you give me the complete timing of a Stearns-Knight motor, including the magneto timing?

3—Is the magneto timing on a Knight motor the same as on poppet valve motor? If it is not the same, what is the reason for it?

4—What is the setting of a magneto on racing cars in general?

5—Explain the oiling system on the 1915 small Stearns-Knight motor.

Yonkers, N. Y. W. E. D.

—The A. A. A., or American Automobile Assn., has charge of the automobile contests in this country in the same manner as the A. A. U. or Amateur Athletic Union has charge of the athletic contests. It is the organization which sanctions the races and under whose rules the contests are held. You can get all these rules from the American Automobile Assn., 437 Fifth avenue, New York City, by addressing the contest department.

2—The timing on the Stearns-Knight motors models SK 4 and SK 6 are: inlet valve opens 4 degrees past top center, inlet closes 40 degrees past bottom center, exhaust opens 60 degrees before bottom center and closes at top center. The magneto is set so that full retard occurs on upper dead center.

3—The timing of the Knight cars is very much the same as on poppet-valve cars.

4—In general, the timing for a racing motor is advanced from one to two teeth on the timing gears ahead of touring practice. The exact number of degrees of advance will depend upon the make of magneto and hence no definite rule can be laid down for this, but where it is common touring practice to have the full retard occur on upper center in a racing motor, the full retard position will be advanced one or two teeth on the timing gear.

5—The arrangement of the oiling mechanism is shown in the sectional view of the motor, Fig. 2. The crankcase forms the oil reservoir and this is filled through the breather pipe located at the front end of the motor. An oil pump is located at the front end of the eccentric shaft. The oil in the case passes through a screen into the pump and through a filter screen A through pipes leading to the crankshaft bearing, pumpshaft bearing, chains and thence to the connecting-rod bearings by means of a drilled crankshaft. The oil passing through the crankshaft feeds the connecting-rod bearing and the surplus oil is picked up by the hollow connecting-rod and delivered to the hollow gudgeon pin that is so drilled as to deliver oil to the piston bosses and lubricate this bearing.

The end of the gudgeon pin is plugged by means of a brass expanding patent washer that has a small hole drilled in its center; this hole permits enough oil to pass through it to supply lubrication for the piston. There are also three holes in the lower part of the connecting-rod that allow enough oil to escape to amply lubricate the sleeves. In order to assure the operator that the oiling system is working properly at all times there is a gauge located on the left side of the cowlboard denoting the oil pressure. This gauge should read from 1 to 5 pounds, approximately, when the throttle is closed, and the motor is idling, or under very light load, and should read from 40 to 60 pounds when the throttle is wide open and the car running at normal or high speed. This gauge denotes the pressure of oil on the main bearings and it is essential that the gauge read as described. Its failure to do this is caused generally by a clogged screen and sometimes by a leak in the pipe or connections. A leak on the suction side of the pump will suck air and a bearing is apt to burn out unless this receives attention.

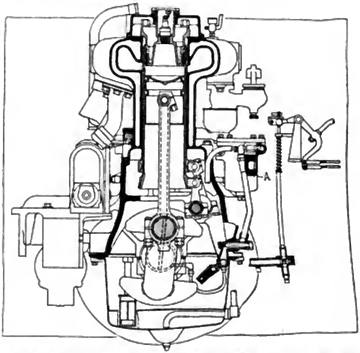


Fig. 2—Sectional view of the Knight engine as made by the Stearns company

The variation in pressure as shown on the gauge is controlled almost entirely by a by-pass on the main oil lead, which is directly connected to the throttle control mechanism. This by-pass consists of a main body and a piston or plunger. A port in this by-pass body registers with a series of holes in its piston when the throttle is closed, or in the idling position, and permits the oil to pass through freely, relieving the pressure on the bearings and eliminating the possibility of smoking.

An adjustment of this by-pass valve is furnished to regulate the pressure in the idling position of the throttle and is operated by a small blade rotating from the center to right or left. This adjustment is locked by means of a clamp bolt. When the throttle is opened the piston or plunger is raised in proportion so that the holes in this plunger cease to register with the port in the body and the blind extension of the plunger seals the port of the by-pass body. This forces all the oil through the bearings and the pressure is then controlled by the speed of the motor. A safety valve is located inside the crankcase on the main oil line and is regulated at the factory for the maximum pressure.

Oil Reservoir Could Not Have Been Filled

Editor THE AUTOMOBILE:—I have recently had the motor of my 30 horsepower Buick car overhauled, new rings put in and a general tightening up. Also had the oiling system looked over. The garage men say they ran the motor and looked for possible leaks; took it out and later delivered it to me and received their money. I took the car out with one gallon of oil in the base—3-4 gallon puts it up to the petcock—smoking well at the exhaust, and had only gone about 10 miles when the motor began to knock. I stopped to make an examination, and found the petcock closed, hard to turn by hand and no signs of a leak. I put in another quart of oil and turned the engine over, but the knock was still there. I phoned the garage and was towed in. The motor was taken down again and the connecting-rod bearings were found to be burned out. The man said that there was but 2 quarts of oil in the base, including the quart of oil which I put in when I stopped, and that the petcock must have been opened and closed again.

What became of the other 3 quarts of oil inside of 10 miles? If there was only 1 quart of oil in the base, would not the bearings get sufficient to prevent burning?

What in your opinion, caused this trouble? The men at the garage say that it was not their fault, while I claim that they have failed to do their work properly. Would greatly appreciate your opinion on this.

Weehawken, N. J. GEO. F. TUTTLE.

—It is not quite certain from your letter which model you refer to but presuming that you mean the model 30 which was built during the year 1913 this model has an oiling system such as illustrated in Fig. 3, and Fig. 4. A plunger pump draws oil from a separate reservoir and forces it through a sight feed on the dash to the center crankshaft bearing. The excess is thrown off from the crank and drains back down the sides of the case into troughs in the lower half of the crankcase. The lower ends of the connecting-rods carry dippers which dip into these troughs and as the oil is splashed up by the dippers, it gradually works its way forward. The pump supplies only sufficient oil to replace that which is lost during operation.

If you merely filled the reservoir without adding any oil directly to the crankcase the connecting-rod bearings would not obtain sufficient lubrication for some time after the motor was started and it would be easily possible to burn out a set of tight new bearings in this manner. Or, if there was insufficient oil in the crankcase and the stroke of the plunger pump had been cut down too much the motor would soon use up this oil in the crankcase and would not receive any from the reservoir.

However, since you state the motor smoked, it was evident that there was sufficient oil in the crankcase. With this amount, certainly should run 10 miles without giving trouble. On the other hand, were any oil put into the reservoir it should be there when the motor stopped if you had only run 10 miles, as you state that no leak was apparent. It would be easily possible for an inexperienced driver to burn out a set of newly-tightened connecting-rod bearings in that distance, but it is impossible to see how he could have gotten rid of 3 quarts of oil in that time. Referring again to the illustrations, you will see that such a thing is impossible with this model motor.

Cannot Use Six Magneto for a Four

Editor THE AUTOMOBILE:—Please tell me whether I can use a six-cylinder Gianoli magneto for a four-cylinder, four-cycle Premier motor and in what way can I use it with the best results?

Kindly give me a wiring diagram for that purpose.

Clarksburg, W. Va. BIRGER MALMQUIST.

—It is not practical to use a six-cylinder magneto for a four-cylinder car.

Improper Gear Mesh Causes Noise

Editor THE AUTOMOBILE:—When I run my 1914 Ford at about 20 or 25 miles per hour, it makes a grinding noise as though there is friction somewhere in the transmission system. Above this speed, or below it, the noise disappears. On taking the rear axle apart I found nothing wrong. Is the trouble in the transmission or in some other part of the car? If so, how can I remedy it?

San Antonio, Tex. FRANK FOSTER.

—Improper meshing of the driveshaft pinion and master gear in all probability is the cause of a noise appearing in the differential when the machine is driven at a speed of 20 or 25 miles an hour. If you will have the driveshaft pinion and master gear replaced the trouble will probably be immediately overcome.

Troubled by a Slipping Disk Clutch

Editor THE AUTOMOBILE:—I have a 1915 Hupmobile, latest model. I have had trouble with slipping of the clutch. Have tried washing it with kerosene but with no results.

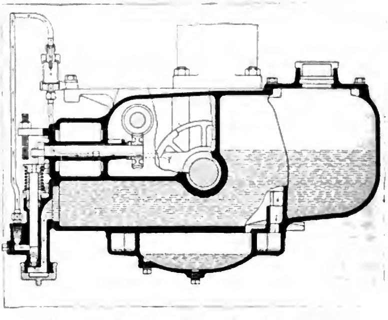


Fig. 3—Transverse section through Buick 30 oil reservoir

Also had the crankcase taken off but see no nuts to take up on like those on the 1913 model. Have tried both kinds of oil but have met with no success. The instruction book states that there are no adjustments.

Ambler, Pa. L. E. DRAKE.

—The causes of a slipping clutch on a 1915 Hupmobile are exactly the same as those which would cause any mutiple disk clutch to slip and there is no particular weak point in the design of this clutch which can be picked out as the cause of the trouble. Probably the clutch is being held disengaged by the sticking of the pedal shaft in its bearing, or other members of the operating mechanism are sticking due to lack of lubrication, thus not allowing the clutch to become fully engaged when the pressure is removed from the clutch pedal. If the mechanism is found to be in good shape, the next cause would be insufficient pressure exerted on the plates. This might be caused by weak clutch springs, or springs that have taken a permanent set after a few thousand miles of service.

Automobile manufacturers can test springs for their tension and while great care is exercised in the strength of the steel wire which goes into them and the heat treatment of the same, nevertheless occasionally springs will pass by inspection, no matter how rigid, that have not been carefully heat treated and after some little service they will make a permanent set and fail to exert sufficient pressure on the plate to transmit the power.

The third, and most likely cause in the Hupmobile, is dirty and gummed plates due to neglecting to change the lubricating oil in the motor.

Needs License to Be a Chauffeur

Editor THE AUTOMOBILE:—If I own and operate my own car for hire, and have my state license, do I have to get a chauffeur's license?

Neoga, Ill. A. READER.

—Your license to be a chauffeur is entirely independent from the registration of the car. In order to be licensed to carry on the business of a chauffeur, you will have to pay a separate fee and have a regular chauffeur's license which includes a distinguishing number or mark which is assigned to you. To secure the license, you must pass an examination held at a point which is named by the secretary of state and when your application is sent in it is accompanied by the fee and your photograph in accordance with the regulations printed on the blank. The aim of this law is to have every chauffeur in the state registered upon the books of the state authorities and upon those of the county clerk in the county of which the applicant is a resident. You will be provided with a badge after you have secured your license which must be worn in a conspicuous place at all times when you are driving a vehicle for hire.

Savage Car Not Manufactured

Editor THE AUTOMOBILE:—Could you tell us where the Savage car is made?

Oshkosh, Wis. IMPERIAL MOTOR CAR CO.

—The Savage car is not manufactured. The originators of the company were not long ago arrested for conspiracy to defraud through the mails and although they were not convicted, the idea of manufacturing the car has been abandoned.

Wants Information on W. E. Laboratories

Editor THE AUTOMOBILE:—The Western Electrical Laboratories, Des Moines, Ia., during January of this year sent out a circular letter announcing that they were making blueprints of every Delco system since 1912 to 1915 types that the Delco people were putting out. I wrote them in regard to this and the letters were returned marked unclaimed. They failed to put their street address on their letter. Can any reader of THE AUTOMOBILE give any information about them?

Coalinga, Cal. F. K. HEINZEN.

—THE AUTOMOBILE has no record of the Western Electrical Laboratories of Des Moines, but probably some of our readers in that territory are acquainted with this organization and will give information concerning it.

Mulford's Lozier Was a Four-Cylinder

Editor THE AUTOMOBILE:—Will you kindly advise me whether or not the Lozier car driven by Ralph Mulford in the 1911 Indianapolis race was a four- or a six-cylinder car?

2—Is there an agency in this country for the Hispano-Suiza car?

Cleveland, O. R. MERRIAN.

—The Lozier driven by Ralph Mulford in the 1911 Indianapolis race was a four-cylinder car, although the race was won by a Marmon six.

2—There is no agency in this country for the Hispano-Suiza car.

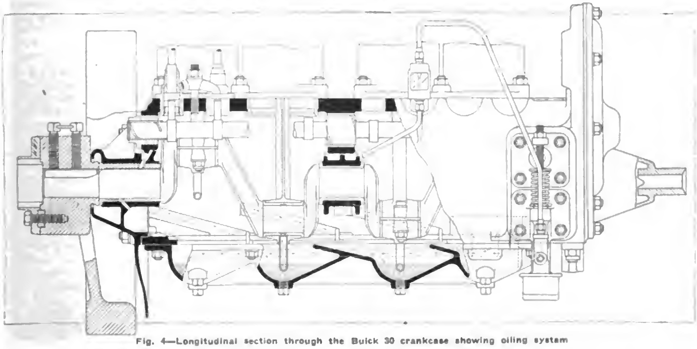


Fig. 4—Longitudinal section through the Buick 30 crankcase showing oiling system

Ungenerous Spring Capacity, Useless Spring Movements and Horizontal Rigidity Chief Faults to Be Remedied

(The Improvement of Spring Systems—XIV)

By M. C. K.

WITH the advent of the "silly season," during which the magnetism of theory seems neutralized by the attractions of outdoors, and with the stirring events of the world tending likewise to distract the mind from the tame technical upbuilding of comfort, safety and economy for motor vehicle users, there will be a pause in this series of articles after the present issue, the thread to be picked up later, D.V., as soon as the writer shall have gathered a set of graphic records of the effects of road shocks to illustrate his conclusions, especially those points which mere theorizing leaves in doubt on account of the complication of spring action with the action of more or less elastic tires whose physical properties are indeterminate or unknown. These points, as some readers are aware, relate mainly to the question what the exact movements and shock forces of vehicle bodies and running-gears must be and are under a number of different and representative road and vehicle conditions when a spring suspension of suitable flexibility and working capacity is supplemented with a device, such as the "bob check" briefly described in articles XI and XII, which returns the spring elements to their equilibrium after each shock with a minimum of delay—the delay, or moderation of the checking action, being subject to regulation through adjustment of the device. It is known that these movements and shocks are frequently disagreeable and destructive with only the average spring suspension to tone them down and that the unsystematic search for improvement through scattered individual efforts is leading to a costly and wasteful diversification in construction which must sooner or later be stopped, under the compulsion of competition, while at present the burden of finding a suitable solution of the difficulties for each vehicle rests very largely on its owner, the manufacturer supplying only a plain leaf spring suspension.

Two Compromise Methods

The method which has been developed in practice to meet this situation has in the past few years passed from one stage to another. At first, the aim was usually to make springs flexible enough and to help them sustain shocks by means of shock dampers or absorbers of different sort and value, none of them load-sustaining. For the higher-priced cars this still remains the rule, and the most ambitious makers provide springs so large that, in conjunction with bumpers and rebound straps, the equipment meets most requirements, excepting overload capacity. But the general industrial tendency has during the last 2-3 years turned toward supplying the market with a great variety of so-called shock absorbers which are in reality auxiliary coil springs and whose main function is that of supplying the flexibility which the original spring equipment is lacking. As compared with the first method there is a saving both in the cost of the springs and in that of the devices, and the development is logical enough, so far as it goes, for cars not intended to be driven at high speed or on rough roads, that is, for a modicum of comfort and safety. The mobility or rapid oscillation of an unfettered coil spring is also looked upon as desirable, to enable the car to glide over the small inequalities of good roads without vibration or wavy motion of the car body, but no data have been brought out to uphold very decidedly this contention, which amounts to a claim that the action of a short and stiff leaf spring plus an auxiliary coil spring is superior to that of a leaf spring of equivalent flexibility. In some instances the coil springs are in fact made to operate with considerable friction to slow up their oscillations.

What is "Good Enough"?

(The writer is told, occasionally, that nobody suffers intensely for lack of spring improvements and that the whole development will take care of itself very nicely; "all people have to do is to drive with care and moderation, and they can then get along with what they have without any further innovations and without being told that something more perfect is possible, much less having it pointed out to them with fervor." The answer is, perhaps, that an improvement should in fact have economical force to fit itself into a development without destroying acceptable existing values, being adopted first where it proves itself most needed or desired—as the motor vehicle itself has done—and that there is an abundant opening for an improved spring system in the thousands of pleasure cars and commercial vehicles which are built on new designs every year, designs in which room can be made for improvement with economy for the maker as well as for the prospective users of the vehicles.)

Limited Virtues

The useful coil spring stroke is rarely more than 1½ inch and cannot be longer when the coil is applied at one end of a half-elliptic. This range makes ¾ inch for the axle, and if the leaf spring is twice as stiff, hereto comes a simultaneous leaf spring compression of ¾ inch, making the total range for which additional flexibility is gained 1½ inch, or the same as the coil spring stroke alone. For cross springs the device is more effective, giving the benefit of its full stroke plus that of the leaf spring. Correctly mounted (under forced tension equal to minimum load) the coil spring reduces the rebound, and not a few of them are so mounted, but for overloads they increase the rebound. In all cases practical difficulties have to be overcome to make the attachments strong enough and wear-enduring as well as rigid laterally, and, as the load must be carried on the auxiliary springs, these must be wound very openly and they must be very accurately calculated, made and heat-treated in order to have a predetermined range of action after being compressed by the static load. Their possible range scarcely renders it practicable to have the auxiliary springs useful for carrying the normal full load as well as the empty vehicle with the desirable flexibility, except in vehicles whose load is only a small percentage of the vehicle weight. The application to commercial vehicles is therefore limited, and in the application to pleasure cars the drawback remains that the other end of the leaf spring action—that relating to overloads and severe shocks—is not affected by them, so that the leaf springs, to take care of these extremes, must still be made relatively long and heavy with a considerable range of stroke of their own or else must be supplemented by overload springs, while the need of real shock absorber or spring damper action also remains nearly the same as if the auxiliary springs were not employed.

Compromise and Multiplicity

Auxiliary coil springs, after some wear has taken place, usually result in a certain lateral looseness in the suspension against which special precautions must be adopted, and in those cases a spring damper of such construction as to neutralize the looseness is found preferable over other dampers which do not possess that feature. The choice of a damper is also affected by the leaf spring dimensions, as these may be selected with main reference to comfort in ordinary travel on ordinary roads or with main reference to safety at high speed and on wretched roads. On the whole, so long as compromises are the rule and can be made in one or another direction, the development runs irresistibly toward a great multiplicity of forms and manufacture in spring devices, and the perplexed owner, to whom the final decision in his own case is left, with a few adjustments thrown into the bargain for him to attend to, arrives eventually at the conclusion that, pending the coming of better things which the car manufacturer will provide of his own accord, he can get along without any spring accessories if he drives carefully and uses oversize tires, under-inflated, paying the bills as cheerfully as he may.

An Overworked Advantage

With regard to his commercial vehicles whose suspension is far more imperfect—on account of large load variations, unmitigated horizontal shocks and the greater emphasis on economy in their construction, especially in their spring dimensions and quality—he consoles himself with the fact that these badly sprung vehicles, despite the vibrations and the rough jolts which they deal to drivers and loads and to their own structures, pay handsomely for themselves, all repair bills included, through one factor alone, which is the extension of business zone and business volume made possible by them, and which could not be accomplished by any other means at common disposal or representing a comparable investment. Perhaps he also observes that it is only in those lines of business in which a long radius for the transportation work serves decidedly to extend business volume that the economy or profit in using motor vehicles is undisputed, but in this observation he is less interested than the members of the motor vehicle industry, and these are slowly beginning to realize that the upkeep expense, which is the only thing that limits the sale of commercial motor vehicles, is decided in greater degree by the quality of the spring suspension than by that of the roads. A bad road jolts sense into the driver, but a bad spring suspension shakes it out of him.

What Improvements Pay Best?

The "volume of business" has carried the motor truck business over many pitfalls, and now a war in which economy is not scrutinized is an additional lucky factor for the moment, but eventually the economical question is one of motor truck against motor truck or against horses for the short haul as well as for the long one, for the rough one as well as for that over smooth and hard roads, and, then, the economical shortcoming which it will pay best to remedy is the one which is most universal and yet least recognized and the remedying of which will appeal most directly—through the senses and through the repair bills—to the drivers and owners. It happens that the spring system is also the feature in construction of which the faults can most readily be pointed out and that these very definite faults can be removed without any other difficulty than the mental one of parting with a few accustomed notions and without increased cost of vehicle production. From certain communications from readers, however, it is learned that the lines of reasoning followed in previous articles is looked upon, here and there, as being theoretical and therefore inconclusive—more so than vague generalizations at the fringe of the subject—yet it is generally admitted that it should be possible and practicable to improve present results and reduce upkeep cost. With a view to these opinions some general and informal remarks may be in order, to summarize in a fashion the reasoning previously presented.

Handicapped Accessory Designers

If a system of construction has faults, or features which plainly counteract its purpose, the rational way to improvement is to remove these faults first and strive for further refinements afterwards. This can perhaps be taken for granted. The first natural question is therefore: "What is the fault of the present spring system?" The general answer is: "It is a stingy system. It does not give enough. It is a system for horse vehicles. The users cannot improve it radically by means of accessories, because there is not enough spring in it to begin with, for the work motor vehicles must do." Accessory devices are handicapped by having to supply the missing spring capacity, in some form of friction, as well as providing the regulation of movements. This combination of purposes does not work out for all cases. It would be a miracle if it did, as the shocks and the movements do not come at the same time and some movement is necessary.

Generous with One Hand Only

Anent the stint. In the matter of power, the user needs 3 or 4 horsepowers for his average work, and the automobile industry gives him 20 to 40, so that he may climb hills at any speed he wants and may have ample chances for pulling his truck load out of the mire. A single-cylinder motor would do the work, but the industry gives him 4, 6, 8 and 12 cylinders. Where material strength is involved he generally gets an ample factor of safety. He does not like vibration or noise; the industry gives him a vehicle as silent as a cat in daytime and one on which a pencil can stand upright while the motor is running. In all things he gets the good measure appropriate for the generous part which motor vehicles are to take in the scheme of the world. Only the spring suspension is stinted, being best fit for standing still with, but for the air tires; witness the thumping and rumbling of any ordinary motor truck, loaded or unloaded, on asphalt. The system is calculated for static loads, yet meant for a vehicle whose shock loads are the important ones. It has to have bumpers to prevent collapse, if it is made for comfort. It has a 4-inch stroke though one of 8 or 9 inches is wanted two or three times a week, if it is made mainly for protection. It has to have flexibility added at one end and reinforcements at the other, if the compromise is made in favor of the middle range. It is intrinsically fit for its average work only, with scarcely a smidge to spare for emergencies. The devices added to it, usually by the vehicle owner, to enable it to withstand these very normal emergencies, may save the integrity of the spring but they do not make it perform additional spring service; that is, they absorb some shock forces but not so dependably as could be done if the spring were built for the emergency, nor so rapidly as to get it ready for a fresh shock the next moment.

With an abundance of spring to start with it would still be advisable to use an auxiliary device for regulation and limiting of movements, but there would be enough spring left for the fresh shock even if the spring were not fully restored to its best position when it occurred.

These difficulties are too complicated for vehicle users to cope with.

First Thing to Do

If this view is correct, essentially, the first thing to do is to provide more spring, and, as a spring of great flexibility is slow and wasteful of movement for severe shocks, while one rigid enough for the latter is inefficient for light shocks, the additional spring capacity should be attuned to meet both conditions. It should economize movement and time by being arranged to take light shocks easily and sharp ones stoutly; it should have progressive resistance to flexion.

Useless Movements

The next thing to do is to remove the most conspicuously irrational feature from the ordinary spring, which is its continued oscillation after each of its working movements. These reciprocations of springs and of vehicle bodies have been associated with spring work and spring duty so long that the great lay mentality, whose hesitations thicken the flow of thought in everybody, shrinks from any radical interference with them, and ascribes mystic virtues to them. Yet it is well known that a perfectly good spring cuts down its series of oscillations to a single stroke when it has no static load to keep it moving. It is also plain that the force required for stopping the spring from wasting its working-time on useless bobbing cannot be greater than, or as great as, that of the shock which produced the first compression, and that it should be possible to get it back from the compression to equilibrium in the same short time it took to compress it (which was the time it took the vehicle to pass over the road obstacle) without experiencing more shock from this action than from the shock itself, or quite as much. And it is known that with a spring of suitable flexibility the shocks that are felt disagreeably are not those sustained when an obstacle is struck with the spring in equilibrium (the first obstacle after a smooth stretch of road) but those which follow and are received by a spring already compressed through continuance of oscillation or already in a motion that prevents it from offering a gradually increasing resistance to the fresh impact. It is a clear inference that best all-around results must be obtained by shocklessly and rapidly stopping the rebound of a spring at the point of its static equilibrium, provided the spring in itself has a full-fledged capacity for absorbing any shock received by it in this position.

The same result is arrived at by considering the movements of the vehicle body rather than the shock forces. These movements are exemplified in the great upward thrust given to the vehicle body when the running-gear strikes an edge separating one road level from another 4 to 5 inches higher. As the wheels cannot get further downward than the new level permits, the spring rebound takes effect upwardly, as everybody knows, and the inertia of the body carries the spring extension, beyond the equilibrium, to an extreme. But the self-contained checking device which prevents body and axle from separating beyond this limit, unless very slowly, while retarding the rebound from its start as much as practicable for the class of vehicle in question, changes the sudden thrust to a gradual rise, as desired.

Preparedness for Shock

Under all conceivable road conditions the absolute stopping of oscillations, by sufficient resistance applied during the spring's return from compression to the position of static equilibrium, supplies the rational condition of preparedness for all eventualities of the road. While it does not necessarily reduce every shock to its minimum of shock effect or suddenness, it strikes the best average in this respect, and this is the point of importance where it is the extremes that must be avoided. The softness of the cushioning, on the other hand, must be provided by having great capacity and range—carrying-power as well as flexibility, or what in previous articles has been designated as "dynamic flexibility"—in the combination of leaf spring and air spring.

The Best Leaf Springs Alone Will Do

If it were not desirable to provide a suspension able to take care of large load variations, as can best be done by means of a system giving decreasing flexibility for increasing loads and shocks, the necessary capacity and range could in most cases be supplied through leaf springs alone, without getting to unwieldy dimensions and too-slow action, by taking up the almost discarded full-elliptic (which moreover could be made progressive by a suitable modern development of the old scheme of a Cupid's-bow curvature) or by double half-elliptics with many broad and thin leaves. A step in this direction is taken, for example, by the large Express companies, who find it the best plan to shoulder the expense of having broad and rather thin-leaved half-elliptics made of high-priced alloy steels—giving increased safe flexion for a given length—but dare not go far enough in flexibility for two reasons; one being that the vehicles do not allow the range of action for utilizing such increased flexibility and the other that they have not so far succeeded in finding the proper and durable device absolutely necessary for regulating large oscillations.

Considerations of the same nature account for the fact that it is customary to accept a more restricted range of spring action for heavy than for light vehicles, although everybody of course admits that there is the same need of range of movement for gradually absorbing a shock in both classes of vehicles.

Properties of Air Springs under Control

While the manner of applying a combination of a leaf spring with an air spring, to provide a radical and economical remedy for the difficulties mentioned, may be subject to a thousand variations, the principle of utilizing this combination is clear and widely understood. The volume of air used, its tension and the mechanical arrangement by which a sliding scale of axle lifts produces a different sliding scale of compressions of the air—and therefore different resistances—are the factors which can be manipulated to give desirable results. Here, as in the case of unaided leaf springs of unusually large working-capacity, the difficulties which have been experienced in the past have depended mainly upon failure to realize the need of a suitable checking action for the rebound and for regulating the rapidity of oscillation, while appropriate and dependable means for obviating leakage of the air have also been missing. The system of maintaining the air pressure by a constant pumping action, as done with the Westinghouse system of air springs for vehicles, has now been proved adequate for overcoming this practical objection, and the diaphragm system—as it is termed in other lines—for operating a liquid piston against air imprisoned in a completely impervious metallic container, as outlined in these articles before, is so close a parallel to methods used for vacuum pumps and in other industrial applications that no question of its soundness can arise, but only that of fitting an air spring of this nature into a vehicle frame in an acceptable manner. The road to fundamental improvement is thus clear. It requires only to be traveled.

Possibilities for Racing Cars

To go still farther in the arrangements and undertake, for example, to utilize each road shock for propulsion, as conceivably may be done, would be to go beyond the fundamentals and into special refinements. The combination of a leaf spring and an air spring supplies, however, a possibility in this direction—which might be useful for racing cars—as pressure on the air spring could be applied propulsively, if desired.

Horizontal Shock Absorption and Vibration

But, aside from (1) stinted working-capacity and (2) continued oscillation, there is a third fundamental shortcoming in ordinary springing to be remedied. This is (3) rigidity to the horizontal component of shock forces. The spring system should be arranged to work in the required direction. In this respect cantilever springs and the proposed "rocker" springs furnish a partial solution; at least an improvement. In combination with air tires it is probably sufficient for all present practical purposes in connection with pleasure cars. And for heavy vehicles with relatively unelastic tires the "composite wheel," affording a yielding movement in its own plane, yet not affecting the axle, is strongly suggested—so much more as it obviates most of the operative troubles connected with traction on difficult road surfaces, with starting of heavy loads and with clutches and differentials—while the development of a nonvibrating fibrous material for the central disks of such wheels, as well as for other truck wheels, represents one of the attractive additional possibilities; on which enterprising manufacturers are already working, seconded by a host of inventive experimenters with plastic materials. A more remote practical chance of the same general nature lies in the devising of a tire material giving a minimum of flexion under static load, yet more yielding to shocks and less bounding than solid rubber (so as to confine shocks to the running-gear if the spring suspension is right); having in fact just enough resiliency to recover its shape slowly after a flexion.

The two materials last mentioned are frankly the products only of industrial dreamland, as yet, so far as their use in the automobile industry is concerned, but the rest of the required improvements are plainly within reach, and their conception is based, not primarily on abstruse theorizing or figuring, but simply on the self-evident desirability of removing those three main shortcomings in present-day springing which all can observe. The theoretical considerations which have been brought out in the preceding articles have served mostly to bring under the reader's mental debate the whole complexity of factors which should influence reasoning and construction.

Sponge Rubber with Nitrogen Under Tension for Filling Tires

SHORTAGE of rubber has interrupted German experiments to determine the durability of a new substitute for air in tires. The substance is called *Schaum-Kautschuk*, which would correspond to foam rubber or sponge rubber, and is produced by placing raw rubber in a steel container and heating it. At an intermediate temperature, when the rubber is soft and sticky, nitrogen gas is pressed into the form under a tension of 400 atmospheres, under which pressure a large percentage of it is dissolved in the rubber. The heating goes on until the rubber with the nitrogen is vulcanized—and the vulcanization is the feature that promises durability for the finished product—whereafter the pressure is partially released and the nitrogen returns to its free state as a gas which is capsuled in millions of minute blisters in the rubber, the pressure remaining 8 to 10 atmospheres. In this form the substance is pressed directly into tire casings. Its heat conductivity is very small and the specific gravity varies from 0.1 to 0.4 (the large variation indicating a remaining imperfection in the process), and the original amount of rubber is swelled to five times its volume.—From *Automobil-Rundschau*, April, 1915.

A New Overland Four—Price Lower

(Continued from page 981)

Brakes are operated in drums of 2 1-4-inch face width, and the expanding emergency set acts upon the inner side of the drum with a diameter of 13 inches, with the service contracting set having a working diameter of 13 3-8 inches.

Rear springs are three-quarter elliptic and hung under the axle. They are 47 inches long with a width of 1 3-4 inches.

A demonstration run in the new Overland revealed to THE AUTOMOBILE representative that the car is a highly-developed example of low-priced machines. The roomy roadster model was used, the seats being low and of the proper angle to fit the back. In driving the car, the convenience of the accelerator pedal is specially noticeable in that it extends forward between the clutch and brake pedals, and does not require any stretching to reach it. Several tests of the ability of the starter to take care of itself under extreme conditions were made, and it was very evident that no harm could come to it through attempting to throw its gear into mesh when the engine was running. The cloth upholstery is very comfortable especially when going at a good speed and does prevent slipping. The motor handles the car in excellent shape and has ample pulling power in rough going.

Larger Motor in 1916 Hupmobile

(Continued from page 985)

shock. Little things which make for completeness are the provision of leather backing to the front seats—thus lining the whole tonneau with leather—and the supply of a soft tonneau carpet. On the six-passenger touring car, and in the limousine, there are folding seats of a rather larger size than is customary on cars of medium price. The top is a mohair one-person type and has Collins curtains that are easy to put up from inside.

New Pattern of Windshield

The new style of windshield in which the upper glass overlaps the lower is a feature of the Hupmobile equipment and makes for great comfort in wet weather, since it gives a well-protected driving view when slightly raised. Also in hot weather, it can be raised just a little to admit a strong ventilating draft without withdrawing the protection to the eyes.

The standard color of the 1916 Hupmobiles is a fairly dark shade of blue which goes very well with the black running gear and mudguards, and with the cinnabar red wheels. Prices for the coming season are: Five-passenger touring car, $1,085; seven-passenger touring car, $1,225; all-year touring car, $1,185; roadster, $1,085; limousine, $2,365; sedan; $1,365; and coupé, $1,165.

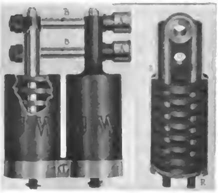
ACCESSORIES

New J. M. Shock Absorber

An improved type of shock absorber has been brought out by the J. M. company under the model number of Z-2. It is of unique construction in that all the wear is taken upon a single bushing of Non-Gran bronze and since this can be replaced at a very slight cost should it wear out the shock absorber is given an unlimited life with an upkeep expense of practically nothing. Since the shock absorber is guaranteed for 2 years against wear or defect, even these bushings will be replaced by the manufacturer.

The shock absorber is a plunger and spring design as shown in the accompanying illustration. The plunger is formed by a hairpin-shaped bolt with a spring retainer on the end, the spring surrounding the plunger and bearing against a shoulder on the housing at the upper end. Thus the spring operates between the movable housing and the stationary plunger spring retainer. The exact operation will be made clear from the accompanying illustrations. Referring to the transverse section the spring is held between the shoulder D and the spring retainer R surrounding the hairpin-shaped plunger P. The bolt from the spring passes through the hole O through the housing and through the Non-Gran bronze bushing B. Thus it will be seen that all the wear is taken up on this bronze bushing.

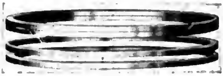
Ample provision is made for lubricating the shock absorbers by the grease cups A and the oil holes B. The price of the shock absorbers is $30 per set.—The J. M. Shock Absorber Co., Inc., Philadelphia, Pa.



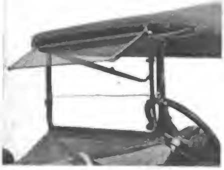
Exterior and part sectional view of the new J. M. shock absorber. All the wear is taken on a single bushing of Non-Gran bronze

Wright Piston Rings

With the idea of getting away from the possibility of leakage through the slot or break in the one-piece type of eccentric piston ring, the Wright ring, as designed, consists of two eccentric rings, one being superimposed upon the other. The ring is so made that when placed in its groove in the piston, the two slots, which are cut in opposite directions, are permanently separated by about 90 degrees. The eccentric shape of the ring is planned to insure even pressure all the way around its fitting face. Close-grained gray iron accurately sized and surfaced to fit is the material used. The use of these rings is claimed to increase motor efficiency, reduce gasoline and oil consumption and to decrease carbon deposits and the necessity for valve grinding. The rings are manufactured by W. W. Wainwright & Son, Connersville, Ind. The standard width of the rings is 1-4 inch and the standard thickness 3-16 inch. Prices vary from 65 cents each for rings under 3 inches diameter to $1.25 each for those under 5 1-2 inches diameter.—The V. A. Longaker Co., sole distributor, Indianapolis, Ind.



Wright piston ring which consists of two eccentric rings, one being superimposed upon the other in such a way that the two slots are kept 90 degrees apart



Smith Road-View shield visor designed to keep rain, snow and sleet off the windshield. It fastens to the front bow of the top

Shield for Wet Weather

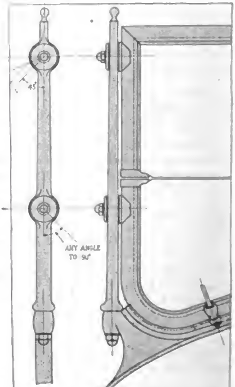
The Road-View shield visor is an appliance made to keep rain, snow or sleet off windshields. It consists of a metallic frame holding within it a plate glass. This frame is attached to the front bow of any automobile top by two friction joints, making positive automatic action. In putting the top down, the visor folds up against the inside of top and thus both visor and top fold back together.

The Road-View shield visor stock sizes are 8 1-2 by 39 inches and 8 1-2 by 41 inches, the former costing $5 and the larger one $5.50. Other sizes will however be made to order.—Joseph N. Smith Co., Detroit, Mich.

Vanguard Windshields

The Vanguard Mfg. Co., which devotes its plant solely to the production of windshields, makes its specialty in a variety of sizes and styles to meet the demands of nearly any car. All of them are constructed of steel with black enamel finish. In many styles either coach glass or plate glass is obtainable, the former being considerably cheaper. It is thinner, and not so durable.

Straight shields and zig-zag types for older cars are supplied but the newest type is the rain-vision, ventilating construction, the form of which is shown in the sketch. This has straight side supports to which the two panes of glass are pivoted to swing inward or outward as desired. The side supports are fitted with attachments at the top for holding the one-man form of top. This particular form shown is used on Paige-Detroit cars and the side members are forgings. The pivots are arranged to hold the glass at any angle up to 90 degrees, or horizontally. There is no metal strip where the edges of the two pieces of glass come together, but small



Detail of Vanguard rain-vision ventilating windshield. The pivots will hold the glass at any angle up to 90 degrees, or horizontally

Upper—R. & H. platinum rivets. Lower—Screws made of the same material

metal clamps screwing into the side portions of the frame of the glass serve to hold it firmly in position in the frame, which may really be called a three-quarter frame. Various methods of attachment to the cowl are possible, that shown being by bringing the end of the side support through a receiving hole in the body support and threading the side member for a nut.

The latest product of the Vanguard factory is the Ford De Luxe windshield and cowl. A form of two panel straight shield with straight side supports similar to that described above is fitted to a steel cowl, the whole thing being made to attach to the top edge of the Ford body. It attaches to the dash and body of the car at identically the same points and using the same bolts as are required with the regular windshield coming as standard equipment with a Ford. This makes its mounting very easy. These cowls are made in two sizes to fit either the 1912-13 Fords or the 1914 and 1915 cars. In either size the assembly is sold for $20.

Other shields range in price from $12.50 to $25 depending upon the style and kind of glass.—Vanguard Mfg. Co., Detroit, Mich.

R. & H. Platinum

With the disturbances abroad, inquiry is often made as to what will be the effect on our supply of platinum. This metal which is so vital in securing the best results for use at the contact points of spark coils, magnetos and other electrical apparatus is so necessary that the maintenance of a steady supply is of prime importance. With this in view, the R. & H. Platinum Works, one of the largest concerns devoted to the manufacture of platinum tip screws and rivets, has increased its plant and the facilities for the manufacture of these products. The plant is located at Perth Amboy, N. J., and here the product refined from South American ore is manufactured.

The art of manufacturing the platinum and iridio-platinum tipped screws and rivets has advanced so rapidly that where thousands of dollars were previously wasted by the necessity of having a platinum shank on the platinum tip in order to make a connection to the screw or rivet, now by electric welding a connection can be made which allows every particle of the platinum to play its part as a contact point and not as a fastening device. These iridio-platinum compositions are made to any specifications and can be furnished to any degree of hardness. Where the shanked tip is desired, instead of using the platinum for this purpose, nickel can be employed for the shank while the tip itself is of any desired composition of iridium and platinum. The accompanying illustrations show the iridio-platinum rivets with nickel shanks and iridio-platinum tipped screws and rivets in which the alloy is welded.

Self-Lubricating Springs

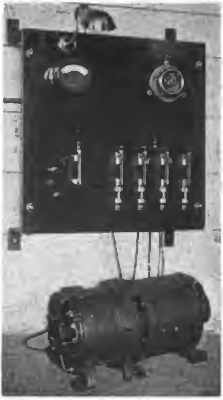
A design of automobile spring which is styled a self-lubricating type has as a feature the cup-like depression D stamped in either end of every leaf of the spring. These cups are filled with a heavy, non-fluid lubricant having the property of long life. The lubricant is spread over the entire friction area by the action of the spring in service, it is said. A natural slight concavity of the spring leaves themselves provides an easy channel for the lubrication of all parts. The maker gives a two-year guarantee against defective material or workmanship from the date of making.—Detroit Steel Products Co., Detroit, Mich.

Lincoln Battery Charger

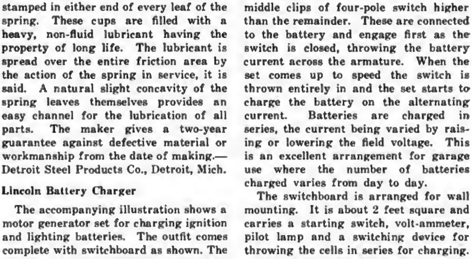
The accompanying illustration shows a motor generator set for charging ignition and lighting batteries. The outfit comes complete with switchboard as shown. The set consists of a single-phase motor with a shunt-wound generator, the motor starting up from the direct current end, current being taken from the battery which is to be charged, the generator acting as a shunt motor. This method of starting is accomplished by having two middle clips of four-pole switch higher than the remainder. These are connected to the battery and engage first as the switch is closed, throwing the battery current across the armature. When the set comes up to speed the switch is thrown entirely in and the set starts to charge the battery on the alternating current. Batteries are charged in series, the current being varied by raising or lowering the field voltage. This is an excellent arrangement for garage use where the number of batteries charged varies from day to day.

The switchboard is arranged for wall mounting. It is about 2 feet square and carries a starting switch, volt-ammeter, pilot lamp and a switching device for throwing the cells in series for charging.

The outfit is made in two sizes, the smaller for charging one to eight cells, the larger having a capacity up to fifteen. The motor generator set uses two ball-bearings.—Lincoln Electric Co., Cleveland, O.



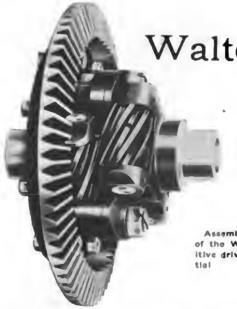
Lincoln battery charging outfit which comes in two sizes. It consists of a motor generator and switchboard



Self-lubricating spring made by the Detroit Steel Products Co. The cup-like depressions D are filled with heavy lubricant which lasts a long time. This is spread over the leaf surface by the action of the spring

Walter Differential Uses Irreversible Worm

Equal Drive to Both Wheels—22.5-Degree Lead Angle Employed



Assembled view of the Walter positive drive differential

A NEW type of worm differential which is of exceedingly simple design, and which has the meritorious feature of driving both wheels, regardless of the traction condition of either has been put on the market under the name of the Walter positive drive differential. The differential consists of two pairs of spiral gears mounted in a two-part housing as shown in the accompanying illustration. The two pairs of spiral gears mesh together and also mesh with worms mounted in the housing and on the driveshaft. The housing is in halves which are alike except for the flange for the bevel gear. The two bolts which hold the housing together set one ahead of the other in order to bring the spiral gear pairs into direct mesh.

22.5-Degree Lead Angle

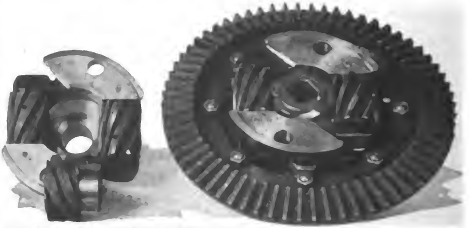
The worm can be given any desired pitch within the limits of good practice, but in the standard design they will have a 22.5 degree lead angle as this has been found to be the best in practice. The construction is not limited, however, to any special spiral angle.

With this construction, the operation will be as follows: The driving resistances of the wheel tend to rotate the spiral gears on their pins in opposite directions. When one wheel has a greater resistance the inequality of force cannot drive the other wheel faster as the spiral gear cannot drive the worm on account of the relationship of the pitch angle to one another. The result is that both wheels are positively driven. When turning, the outside wheel rolls faster and so permits the inside wheel to turn correspondingly slower, giving a compensating differential action.

Worm gearing has been chosen because it provides strength, while at the same time giving a smooth and pliant action. The flexibility of the worm gearing is very effective in diminishing the shocks transmitted through the differential mechanism.

Five Advantages

Five advantages are claimed for this type of differential. These may be briefly summarized as follows: 1—The car will not stall if a single wheel alone has traction. 2—The motor power is used more effectively as both wheels are steadily driven. 3—Skidding is eliminated in many cases due to the steady driving of both wheels. 4—More even pulling is secured on a rough road for the same reason. 5—The wear and strain on tires due to an accelerated or spinning wheel recovering the road is eliminated, a notable advantage for economy.



View of crown gear, differential assembly and arrangement of Walter positive drive device

Different from 45-Degree and Ratchet Types

As will be noted from the foregoing description, this differential is different in construction and principle from the 45-degree type and the ratchet differentials which have an over-running action. The widest difference between the 45-degree and this is that it is a positive drive in the first place, and secondly, it is irreversible whereas it is the nature of 45-degree gears to be perfectly reversible. The distinction between the Walter differential and the ratchet differential is two-fold as far as operation is concerned. In the first place, it has not an over-running action, and, secondly, instead of driving the wheel of most resistance, the two wheels are given equal power.

Tire Fabric Must Stand Test

Following is an account of a fabric test in the factory of the Goodyear Tire & Rubber Co., Akron, O., which turned out 1,500,000 automobile tires last year:

First, the threads per inch are counted, the width is measured, the column bow measured (which shows how near the warp and filling threads are at right angles to each other), the selvage noted to see if it is slack enough, broken threads, weak threads, holes and oil spots are watched for, and the uniformity of weaving is criticized. Then the total length and weight of the fabric is checked up with the invoice, and the ounces per square yard are figured from the company's own measurements. Before the rolls are passed on into the factory, the strength, gauge, twist, crimp and per cent. of moisture are ascertained.

Pieces of fabric are returned to us from the bias cutters and are tested all over again to see how they have been affected in the calenders. The resulting records form a library upon which our specifications are based.

The AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, June 3, 1915 No. 22

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Ave., Phone Harrison 7707
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - - - - - - - - - - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico -One Year, $3.00
Canada -One Year, 5.00
Foreign Countries -One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

Modernize the High-Priced Car

AT the 1915 shows it was obvious that while the design on moderate-priced cars was changing rapidly, the expensive machines remained very much the same as they had been for several years past. It seems likely that the coming of the eight and twelve is going to bring about great changes in the factories which have so far specialized on cars costing from $3,500 upwards. The effect of this may be much greater than might at first be imagined, because the high-priced car has, during the last several years, taken a less and less important place. No longer do we look to the erstwhile leaders of design for innovations, and the firms that began by imitating are now in the front from the design viewpoint.

Perhaps the high-priced car needs a little modernizing if it is to continue to be worth its price and even if there is no commercial compulsion the high-class manufacturers with their experienced staffs and smaller outputs are in an ideal position for the production of very up-to-date chassis. To date the expensive car has been a more imposing vehicle than the cheaper types, but often the performance has not always established its superiority of design. If it is modernized to the point where it once again takes the lead as a performer on the road it seems likely that many a man will feel it worth while to put out an extra $1,000 or more who would otherwise have refrained from doing so.

If this comes to pass, as looks extremely probable, it will be a great thing for the American automobile industry, for it will encourage foreign business in markets so far hardly touched and thus will hasten the ultimate complete supremacy of the American automobile.

300-Cubic-Inch Results

THE 300-cubic-inch motor has made good in the 500-mile race by raising the speed average from 82.47 to 89.84 miles per hour, a performance which the most optimistic did not anticipate and which was partly due to the brick track being cool after nearly a week of continuous rains, and further due to the lack of sunshine which cut all of the glare that is present when the sun is shining out of the drivers' eyes, thus giving ideal conditions, and such as may not be present again for several years. They were conditions not present at any previous 500-mile race.

Perhaps the most amazing feature of the race was the regularity of the pace set by the different leaders, a pace which at no time was less than 89 miles per hour and never higher than 91 miles. Although leaders shifted very frequently until the 350 mark was reached still the average per hour hung in the same place. In other words, the 300-inch motor as developed by at least three different makers is capable of an amazing speed, and all three makers are deserving of credit for getting such wonderful results. Stutz, as the American representative, deserves all credit to build three new cars and have all finish in the money which is a performance rarely, if ever, equaled in this country or abroad. New motors are always expected to fail in the first big race, but this race has proven otherwise in the Stutz case, only one of the three suffering mechanical troubles, but not of such moment as to put it beyond the money class.

Lubrication a Factor

A few problems yet confront many of the makers of the high-speed 300-inch motor. First in this category comes the question of lubrication, nearly one-third of the cars eliminated going out with lubrication troubles in which a piston seized, or a connecting-rod broke due to a bearing burning out. This problem of the high-speed motor will soon be solved. The small high-speed motor is now in this country and a season or so will elapse before it is finally mastered. In fact, all of the lubrication troubles of the race were not on the American cars, some of the foreigners failing in this respect.

Triumph for Cord Tires

The race has been a signal advance for cord tires, as every one of the ten to finish in the money used Silvertown cords, and the eleventh car which covered the 500 miles but just outside of the money was also fitted with them. These tires gave a better account of themselves than a year ago, particularly in that there were few, if any, cases of treads flying off, and in the whole race there were only two cars that came to the pits without tires on, or had entirely thrown them off.

Buick Will Make Sixes Only

Two Chassis Comprise 1916 Line—44,553 Cars Built for 1915 Season

DETROIT, MICH., June 2—*Special Telegram*—Sixes only will be made by the Buick Motor Co., Flint, Mich., for 1916. It is a radical departure from the policy of this company, which has been building fours ever since it started in business 14 years ago. Two chassis will be made, one having a wheelbase of 115 inches, the other with a wheelbase of 130 inches. On the smaller cars the motor will be 3 1-2 inches by 5, while on the larger cars it will be 3 3-4 by 5. Motors will all be block cast and with the valves in the head.

There will be two entirely new body models, a sedan and a coupé. Bodies will be greatly improved in design and finish. All cars will have cantilever rear springs and semi-elliptic front springs and the windshield will be of a new design. Genuine black leather will be used for upholstery.

The four small cars consist of model 44 roadster, listing at $950; model 45 five-passenger touring car, $985; model 46 three-passenger coupé, $1,350; and model 47 sedan; a closed car for city purposes, $1,875.

The two big sixes are model 54 roadster at $1,450 and model 50 five- or seven-passenger touring at $1,485, which is $165 less than the 1915 model. Wooden wheels, with demountable rims and 32- by 4-inch tires on the small cars and 36 by 4 1-2 on the big cars, will be used.

During the 1915 season just ended the Buick company built and sold 44,553 cars. For next year an output of at least 60,000 is scheduled.

New Six-Cylinder Boat-Body Mitchell for 1916

CHICAGO, ILL., June 2—*Special Telegram*—The Mitchell-Lewis Motor Co., Racine, Wis., is out with a new six-cylinder model for 1916 selling at $1,250 as a roadster or five-passenger and at $1,285 as a seven-passenger. This model shows advancement over the 1915 designs, body design and in chassis units as well. It has a block motor as against pair-cast for 1915, dimensions being 3 1-2 by 5 inches. Wheelbase is 125 inches and rear suspension is by cantilevers. Tires are 34 by 4 with non-skids in rear.

The new body is fashioned after boat designs having an uninterrupted line from the windshield base to the radiator filler neck. There is a tumble-in effect and a large bell-shaped back.

In its new block motor the company has produced a decidedly neat and accessible unit. A removable cylinder head is employed. The carbureter, fed from a Stewart vacuum tank is mounted high on the right side, bolts to the casting and feeds through cored passages. A hot-air pipe is attached vertically to the exhaust pipe on the opposite side. Ignition is by a battery type system with the distributer mounted on the left and driven from the timing gear housing. Starting and lighting is by the single-unit system, the drive from the motor being through a cone clutch and hollow propeller shaft to a floating axle.

Reo To Increase Production—No Changes in Cars

LANSING, MICH., June 1—While it has been rumored that the Reo Motor Car Co. is soon to announce its new models for 1916, officials of the company make the statement that the company has not had any intention of bringing out a new model for next year. In fact, the plans are said to be to continue the 1915 models, but to increase the 1916 production from 50 to 75 per cent. The demand for the 1915 cars has been such that the scheduled output for the season will show to have been over 2,000 cars under the orders received.

Fiat Brings Out Riviera Model as Four and Six

POUGHKEEPSIE, N. Y., May 29—A new model, known as the Riviera, has been brought out by the Fiat Co. and mounted on its four- and six-cylinder type 55 and 56 chassis. One of the special features of the new type of body is its simplified lines which have resulted in a weight reduction which is stated by the makers to be 600 pounds below other bodies of a similar type. It is a combination five- and seven-passenger design and sells, completely equipped, for $4,850 on the four- and $5,350 on the six-cylinder chassis.

The cylinder dimensions for the Riviera model on the four-cylinder chassis are 5.125 by 6.75 inches. The motor is featured by having the intake and exhaust manifolds cast integrally with the cylinder, a hollow chrome nickel steel crankshaft and many features of design which follow European practice. The entire chassis is designed and built in the Fiat shops. The wheelbase on this chassis is 128 inches.

The type 56, six cylinder car has a wheelbase of 135 inches and a bore and stroke of 4.4 by 5.9 inches. Otherwise all the specifications are the same as the Riviera four-cylinder model force feed oiling, Fiat double-jet carbureter, irreversible worm and gear steering, multiple steel disk clutch, etc.

Speedway Assn. of America Planned

To Correlate Various Activities of Different Speedway Movements—Prizes $264,000

INDIANAPOLIS, IND., May 29—Preliminary steps in the organization of the Speedway Assn. of America were taken here today by representatives of the seven speedways that will hold meets this year. This new association has in mind the correlation of the various activities of the different speedway movements in order to avoid conflict of dates for races, and to better the general welfare of speedway racing and perhaps promote the building of special racing cars for this speedway circuit. C. W. Sedwick of the Indianapolis speedway was today elected temporary president and F. E. Edwards of the Chicago speedway temporary secretary. A meeting for final organization and the election of officers will be held in Chicago June 17, two days prior to the opening of the new 2-mile board speedway in that city.

At today's meeting many plans as to the scope of the speedway association were discussed, and it is possible to see the time when such a central speedway organization may have its own corps of officials to handle the different meets, thereby greatly simplifying the task of staging the various meets. At present it is necessary to perfect an organization at each speedway for a single meet a year, and by organization this work could be vastly simplified. The same applies to the securing of entries, foreign ones in particular.

The seven speedways represented today were: Indianapolis, Chicago, New York, Sioux City, Omaha, Tacoma and Minneapolis. These seven have all scheduled one meet for this season and a total of $264,000 is offered as cash prizes for these meets, as follows:

Sheepshead Bay Speedway Corp., New York	$50,000
Indianapolis Motor Speedway, Indianapolis	50,000
Speedway Park Assn., Chicago	54,000
Twin City Motor Speedway, Minneapolis	50,000
Sioux City (Iowa) Speedway Assn., Sioux City	15,000
Auto Speedway Co., Omaha, Neb.	15,000
Tacoma Speedway Assn., Tacoma, Wash.	30,000
Total	$264,000

These seven speedways have a total track mileage of 13.75 as follows:

Speedway	Surface	Miles
Sheepshead Bay	board	2
Indianapolis	brick	2.5
Chicago	board	2
Minneapolis	cement	2
Sioux City	dirt	2
Omaha	board	1.25
Tacoma	board	2
Total		13.75

With one meet on each of these seven

speedways for this season there will be a total of 3,150 miles of racing. Sheepshead Bay, Indianapolis, Chicago and Minneapolis are scheduling 500-mile events. Sioux City and Omaha are each 300-mile events and Tacoma has three races on 2 days giving a total mileage of 550. There is a probability that Chicago will have a second meet this fall.

Goan Heads Varnish Co.

DETROIT, MICH., May 26—O. S. Goan, of New York, was today elected president of Berry Bros., one of the biggest varnish manufacturing concerns in the United States. Mr. Goan succeeds Frank W. Blair, of the Union Trust Co., Detroit, who will devote all of his time to the latter concern.

Maxwell Report May Show Earnings of $3,000,000

NEW YORK CITY, May 31—The fiscal year of the Maxwell Motor Co., Detroit, Mich., will end July 31, and indications are that net profits will run close to $3,000,000 after liberal charges for depreciation, compared with $1,505,467 in the preceding year.. In other words, the company will earn its first preferred dividend about four times over.

The preferred stock of Maxwell Motors is selling around 84, carrying dividends of 1¾ per cent. and an extra payment of ¾ and 1 per cent. on account of back dividends. The books will close on June 10 and the dividend will be payable July 1. After the payment of the 2½ per cent. there will still be an accumulation of $15 a share on the first preferred.

Wellington Mutual Production Manager

JACKSON, MICH., May 31—J. W. Wellington, formerly treasurer of the United States Motors Co. has been appointed production manager of the Mutual Motors Co. of this city. Fred Buchler has been made factory superintendent, having formerly occupied this post with the Imperial company of this city.

Springer Back from Europe

YOUNGSTOWN, O., May 31—Frank V. Springer, who has been in Europe representing the Republic Rubber Co. for several months, has returned and will be connected with the home office of the company. Mr. Springer when abroad was investigating general rubber conditions in the British Isles and on the continent.

To Classify Studebaker Directors?

NEW YORK CITY, June 2—On July 7 stockholders of the Studebaker Corp. will meet to vote on a proposal to classify the company's directors into five groups, one of which will be elected annually.

Erskine To Head Studebaker

J. M. Studebaker Retires—Fish Succeeds Him as Chairman of Board of Directors

SOUTH BEND, IND., May 29—J. M. Studebaker, Sr., last of the Studebaker brothers, who founded the corporation which now bears their name, is about to retire as chairman of the board of directors and will become the honorary president of the concern. This is the announcement by Frederick S. Fish, president of the corporation, who succeeds to the office of chairman of the board of directors. A. R. Erskine, first vice-president, will be made president and the post which he now holds will be abolished. In speaking further in regard to the matter Mr. Fish said: "The present organization of this corporation is the best it has ever had in its history, which is proved by the successes which have attended its administration. The object of the changes is to perpetuate for the longest time possible a continuation of this happy condition. This necessitates a change in the charter which it is expected will be effected on July 7 at a specially called stockholders' meeting for that purpose. About 3 weeks ago the matter was brought before the board of directors and after a full discussion, they concurred in the plan, all of which, in every detail and essential, is of my own initiation and suggestion, with the exception that I made a confidant of J. M. Studebaker." Mr. Studebaker was for many years president of the Studebaker Bros. Mfg. Co., succeeding to that position upon the death of his older brother, Clem Studebaker. He remained president until the reorganization of the concern as the Studebaker Corp., when he was named chairman of the board of directors.

Paul Smith Is Chalmers Sales Manager

DETROIT, MICH., May 29—Paul Smith, well known in trade circles, becomes sales manager of the Chalmers Motor Co. June 1. Percy Owen, who has held this position for some years, advances to the newly-created office of general sales manager. In his new capacity Mr. Owen will pay special attention to foreign sales, while Mr. Smith is to have direct charge of salesmen under Mr. Owen.

In conjunction with this change another important step has been taken by the Chalmers company. Hereafter the service department will be discontinued as a separate unit but will become part of the sales department and will be under the direct supervision of Mr. Owen.

Undoubtedly Mr. Smith is one of the best known and best liked men in the entire automobile industry. His broad experience in the field, together with his large acquaintance with dealers throughout the world, will complete a sales organization that has made new automobile history during the past few months. Mr. Smith won his spurs through his early connection with the Studebaker Corp., during which time he succeeded in establishing selling connections in practically every city in the world. Later he became manager of the Lozier Motor Co. and more recently resigned to accept the presidency of the R. S. Corp., with headquarters on the Pacific Coast.

Macauley on Packard Board of Directors

DETROIT, MICH., June 1—Alvan Macauley, vice-president and general manager of the Packard Motor Car Co., has been elected to the board of directors. Mr. Macauley succeeds J. W. Packard of Warren, O., inventor of the first car of that name. While Mr. Packard retains his financial interest in the company, he retires from the directorate to devote more time to other pursuits.

It is said that in the production of the Twin Six, recently announced, the resources of the Packard company are to be utilized on a scale never before approached by that concern. Cash on hand in the treasury is said to total over $6,000,000, so there will be no lack of finances for carrying out plans for a largely increased production under the most advanced methods.

Stalnaker Pathfinder Vice-Pres.

INDIANAPOLIS, IND., June 1—*Special Telegram*—W. E. Stalnaker, who for 6 years has represented the Premier in Chicago, and who since the first of the year has retained the Pathfinder line, was today elected vice-president of the Pathfinder Co., this city, and will have charge of the sales. His Chicago business will still be continued and represents the Pathfinder.

Insurance Fund for Race Drivers

NEW YORK CITY, May 31—Ray Harroun, Maxwell chief engineer, has made the suggestion that some definite plan should be put into effect that will provide for the care of race drivers and riding mechanics, injured in the regularly sanctioned events of the season. He suggests that a direct path to such an end would be the establishment of a national insurance fund comprised of 1 per cent. of the gross receipts of the various meetings, this fund to be administered by a commission, representing the drivers, etc., as well as the entrants in the various meetings.

S. A. E. Summer Papers and Their Authors Announced—Cover Wide Field

Standards Committee Program Calls for Reports from 11 Divisions—Physical Properties of S. A. E. Steels One of the High Spots—Opportunities for Social Enjoyment

NEW YORK CITY, June 1—Announcements have been made covering the entire program for the summer meeting of the Society of Automobile Engineers. As THE AUTOMOBILE reported last week, the professional sessions are very complete, covering a wide field of subjects and giving a varied nature to the program which makes it one which will appeal to a large percentage of the Society membership. Reservations for the summer meeting are coming in at a rapid rate and the session, which will last from June 14 to 17, promises to be a busy one and at the same time, one which will afford time for the social enjoyment of the members and their families.

The itinerary of the trip, which was published in THE AUTOMOBILE last week, includes a steamship tour starting from Detroit on Monday, June 14 at 2 p. m. on the specially chartered steamship *Noronic*. The entire 4 days will be spent upon the vessel which during the trip will include such points as Midland, Parry Sound, Point au Baril, back to Parry Sound and then Detroit with a side trip on Tuesday afternoon on a smaller steamer through the Thirty Thousand Islands of Georgian Bay. Entertainments will be furnished by the sections on Monday, Tuesday and Wednesday evenings. The vessel is due at Detroit Thursday at 5 p. m.

Important Standards Work

Important work along the lines of standardization is expected at the meeting, as the reports of eleven divisions are counted upon. The divisions which will report include the ball and roller bearings, carbureter fittings, chain, electrical equipment, electric vehicle, international standards, iron and steel, miscellaneous, research, springs, truck standards.

The ball and roller bearings division will report a stock list of taper roller bearings and a stock list of thrust bearings.

The carbureter fitting division is working upon dimensions of flanges for 1-2 and 5-8 and for 2 1-2, 3 and 3 1-2-inch carbureters. It is also working upon standard dimensions for the outlet on the exhaust manifold for carbureter hot-air supply.

The chain division is examining the possibility of securing interchangeability of different makes of silent chains.

The electric equipment division is examining bulb bases, sockets and connector plugs and also methods of limiting headlight illumination.

Electric vehicle division topics include speed and mileage ratings, motor voltage, standardized motor name plates and number of cells in battery equipment.

International standards of solid tires are being considered by the newly created international division.

Probably of the greatest importance is the work of the iron and steel division, which expects to make announcements on the curves and tables of the physical properties of carbon steels which has engaged their attention during the past year. It is also considering the lower limit of vanadium in the chrome-vanadium steels, additional specifications on nickel-chromium steel and definite specifications of steel castings.

Many miscellaneous features are being discussed by the miscellaneous division including dimensions on small parts such as belts and pulleys, hose and hose clamps, speedometer driveshaft ends, thread tolerance, license pads, etc.

Tap drill sizes are occupying the attention of the research division, while the spring division is engaged upon a nomenclature of cantilever springs, the test of parallelism of eyes and master leaf of leaf springs, modification of eye and bolt tolerance for leaf springs and other dimensions covering the offset center bolts, nuts, width, concavity, etc.

The truck standards division is to make a report on industrial trucks and also on the advisability of a 34-inch truck wheel diameter. The full program of the professional session is given on this page. Copies of the paper to be presented at the meeting will be mailed to the members in separate pamphlet form early this month, and efforts are being made to have the members contribute written discussions on these papers when possible, having one copy from which to read and one to hand the stenographer at the time in order to insure the orderly arrangement of the material in the record. The meetings committee suggests that those who will contribute written discussions should forward their names before the meeting.

To Arrange for Visiting Members

During Monday morning, June 14, the society committees will have headquarters at the Hotel Statler in Detroit where all arrangements have been made for taking care of the out-of-town members participating in the trip. The Detroit local committee is also making preparations to receive the members arriving Monday morning.

Reservations for the trip are being made through E. A. Holton, general passenger agent of the Northern Navigation Co., Sarnia, Ont. For the complete trip on the *Noronic* and *Waubic* the fare is $26 per person, berths and meals included. Both in a professional way and from a social standpoint, the trip promises to be one of great profit. The professional program follows:

June 11-17
PROGRAM
Monday, June 14, 3 P. M.
Business Session
President's Address
Treasurer's Report.
Report of Membership Committee.
Election of Nominating Committee Members.
New Business
Professional Session
Automobile Clutches—W. F. Herst
A Formula for the Comparison of Automobile Performance—C. T. Myers.
A Scientific Method of Testing Electric Vehicles—T. H. Schoepf.
Monday, 8 P. M.
Professional Session
Farm Tractors and Their Motors—Philip S. Rose.
Road Tractors—Frank H. Trego.
Increasing Truck Efficiency with Trailers—A. R. Miller
Automobile Lubrication—C. W. Stratford.
Tuesday, June 15 10 A. M.
Professional Session
Size and Inflation of Pneumatic Tires—P. W. Litchfield.
Spiral Bevel Gears for Automobile Drives—A. L. Stewart.
Pressed Steel Wheels for Pleasure Cars—Orrel A. Parker.
Spring Design—C. H. Gleason.
Tuesday, June 15, 8 P. M.
Standards Committee Meeting.
Wednesday, June 16, 8 P. M.
Professional Session
Aeroplane Engines—Neil MacCoull.
A Type of Truck for Military Use—Jerry W. DeCou.
Aluminum Alloy Pistons—Eugene Gruenewald.
Motor Fire Apparatus—Joseph A. Anglada

Thursday, June 17, 10 A. M.
Reports of Divisions of the Standards Committee
Report of Carbureter Fittings Division—J. J. Aull, Chairman.
Report of Electrical Equipment Division—A. L. Riker, Chairman
Report of Electric Vehicle Division—A. J. Slade, Chairman.
Report of Iron and Steel Division—K. W. Zimmerschied, Chairman
Report of Miscellaneous Division—J. G. Utz, Chairman.
Report of Springs Division—C. W. McKinley, Chairman
STATEMENTS OF PROGRESS
Ball and Roller Bearings Division—F. G. Hughes, Chairman.
Chain Division—F. L. Morse, Chairman.
International Standards Division—A. L. Clayden, Chairman.
Research Division—D. L. Gallup, Chairman.
Truck Standards Division—Wm. P. Kennedy, Chairman

Deutsch Now Sales Engineer

DETROIT, MICH., June 2—*Special Telegram*—S. Deutsch, formerly chief engineer of the Detroit Electric Appliance Co. has opened offices in the Chamber of Commerce Bldg. as sales engineer. He is a direct factory selling agent for the Liggett Spring & Axle Co., Monongahela, Pa., manufacturer of springs and axles; F. Bissell & Co., Toledo, O., electrical devices; Blackburn Specialty Co., Cleveland, O., maker of the Yale lock ignition switches; the Stewart Mfg. Co., Chicago, Ill.; die moulded castings and steel reinforced die cast motor bearings.

Motors Needed for Chili Buses

Opportunity for American Manufacturers Who Act Promptly Through U. E. Bureau

NEW YORK CITY, June 1—Motor buses are practically unknown in Chili. Owing to the low buildings, the cities stretch over a great part of the land. The streets in the cities of Santiago and Valparaiso are very well paved.

A large company is about to start a bus service in Santiago. The buses will be built in Chili, but the motors will have to be ordered here or in Europe. Owing to the war in Europe, they will not be able to supply these, and here is a chance for the American machines.

Owing to the fact that only the motors will be bought in foreign countries, they will be imported free of custom house duties, as all machine parts do not pay duties. Fully equipped cars or buses now pay 5 per cent. of their declared value.

There has been considerable trouble with the trolley car service in Chili, especially in the big cities mentioned, on account of the companies having increased their passage money to double the previous amount.

In the cities mentioned, there are large distances to be covered, as runs of 5 to 7 miles are not unusual.

Another place where buses could be introduced for summer work is Viña del Mar, the summer resort of Chili. Lines running to the race course and beach could bring considerable business, as at present the means of transportation are an absolute failure in every sense.

As stated above, the street pavements are very good, all asphalt, and very well kept. In Viña del Mar, there are milk wagons transformed into motor buses, which do a large business.

Any inquiry about this will be gladly attended to by THE AUTOMOBILE through the United Export Bureau which was announced last week and which has a well-trained staff of South American employees and is therefore in a position to render every assistance in this line.

New Basis for Taxation in Ohio

CLEVELAND, O., May 28—A new basis for the listing of automobiles for taxation in Cuyahoga county has been announced by C. P. Salen and J. B. Ruhl, deputy tax commissioners of Cleveland. The new basis is:

Cars entirely new, return at 100 per cent. of list price; cars of 1915 model put in use prior to April 5, 1915, and since January 1, 1915, at 90 per cent. of list.

Cars of 1915 model put in use prior to January 1, 1915, and since February 1, 1914, at 80 per cent. of list price; cars of the model of 1914, at 50 per cent. of list price; cars of the model of 1913, at 40 per cent. of list price.

Cars of the model of 1912, at 30 per cent. of list price; cars of the model of 1911, at 20 per cent. of list price; cars of the model of 1910 and prior thereto at 10 per cent. of list price.

Lanier Joins Norwalk Tire

NEW YORK CITY, May 28—J. F. Lanier, in charge of the sale of Diamond tires in the Southwest, with headquarters at St. Louis, has severed his connection with the B. F. Goodrich Co., to join the Norwalk Tire & Rubber Co., Norwalk, Conn.

At various times Lanier has been in charge of the sale of Diamond tires in Kansas City, St. Louis, Buffalo, and New Jersey. In his new connection he will have entire charge of the sale of Norwalk tires for the central part of the country.

Schwalbach Joins Grossman

NEW YORK CITY, May 31—Alex Schwalbach, who recently resigned as advertising manager of the J. S. Bretz Co., and its successor, the Bearings Co. of America, will remain in Brooklyn, N. Y., to become advertising manager of the Emil Grossman Mfg. Co., manufacturer of accessories.

Elston Sells Pumpelly Interest

INDIANAPOLIS, IND., June 1—Sidney W. Elston, secretary and treasurer of Pumpelly Battery Co., this city, has sold his interest and severed connection with same. Mr. Elston will take a vacation of some months after which he expects to again engage in some branch of the industry with which he has been identified since the early years—the days of electrics and steamers.

Giants vs. Tigers on Overland Day

TOLEDO, O., May 30—Overland Day, June 21, when the New York Giants and the Detroit Tigers journey to this city to give 11,000 employees of the Willys-Overland Co. their annual baseball festival, will have considerable more than local interest for the sporting world. At his personal expense John N. Willys, president of the company, will bring the two teams together for the first time in baseball history.

Get London Agency for Scripps-Booth

LONDON, ENGLAND, May 27—Peters & Sons have taken the agency in this city for the Scripps-Booth export trade. They have contracted for 5,000 cars.

New 4-Cylinder Car at $980

New York and Akron Interests Behind Co.—First of 5,000 Cars in Sept.

NEW YORK CITY, May 28—New York and Akron interests are behind a plan to manufacture a four-cylinder five-passenger touring car and roadster chassis to sell with complete equipment at $980 to $990. A feature of this car will be the careful attention to the blending of the lines of the body, cowl, hood, and radiator, while several novel ideas are included; among these are the novel form of radiator cap which will sweep upward like the lines at the bow of a boat, thus carrying out the straight lines which characterize the entire top of the V-shaped radiator, the hood and the body. A spare wire wheel is carried in the rear of the body while rear fenders are dispensed with, the wheels being carried under the body slightly at the side so that these are unnecessary. The touring car is a five-passenger with divided front seats and the roadster carries three in clover-leaf fashion.

Car Will Be Low

The whole car will have a very low appearance due to the front axle being dropped. The doors instead of being vertical are raked slightly to harmonize with the general design. The radiator will have a tall, narrow appearance when viewed from the front and no dash lights will be employed.

The block motor will be 3 3-4 by 5.5 giving an S. A. E. rating of 22.5 horsepower. The water is circulated positively by a pump and the customary fan is also used. The lubricating system is a circulating splash. Ignition is by magneto and electric lighting and starting are furnished. The crankshaft has three bearings. Drive is through a cone clutch and three-speed selective gearset, which are in a unit with the motor to an inclosed driveshaft and a helical bevel drive in connection with a semi-floating rear axle. Wire wheels are used on Q. D. demountable rims. The front fenders are crowned and follow the contour of the wheels. The springs are semi-elliptic in the front and overslung cantilever in the rear, taking the drive. Thirty-four by 4 tires are used and the equipment is complete.

It is expected that the first cars will be completed early in September. The company plans to do a large export business and its officials state that they have already received orders for 3,000 cars whereas the first lot to be manufactured will number but 5,000. No name for the car has as yet been decided upon.

Briscoe Adds Eight for 1916

Argo to Be Made Only as Four—New Plants for Both Concerns

JACKSON, MICH., May 28—A new plant for the Briscoe Motor Co., also one for the Argo Motor Co., will be started shortly. Concerning the 1916 plans of both concerns, it has not yet been finally decided as far as the Briscoe is concerned, except that an eight cylinder car will be marketed. The Argo is to be made only as a four, selling at $435 for the touring car and $385 for the runabout. From 10,000 to 20,000 are to be made, all told.

Two farms, the Murphy and the Horning, have been purchased to that effect by Benjamin Briscoe, president of the two companies. Upon the Murphy farm which covers 55 acres of ground there will be erected the Briscoe factory. The main building will be two stories high, 250 by 300 feet. There will also be an office building, testing buildings, a laboratory, a power plant. Near the factory will be a half-mile testing track.

It is claimed that the new plant will be so constructed as to enable an annual production of 50,000 Briscoe cars.

Details for the new Argo plant are not yet definitely settled. It will, however, be a much larger plant than the one now being occupied by that concern.

In addition to the manufacturing buildings, it is the intention of Mr. Briscoe to also erect a boys' trade school and a central clubhouse, for the use of all city people. The school is to make the teaching of automobile construction one of its features.

Improved Body in New Marmon Chassis Changes Small

INDIANAPOLIS, IND., May 30—The Nordyke & Marmon Co. has had a sample of its 1916 six on view at the factory during the past week. In specification the new car is almost precisely the same as the present type but the body is a little wider and more pains are taken to insure the high-class character of the finish. Several little alterations, such as a new way of fitting the back curtain of the top make for increased neatness and better appearance.

On the chassis the principal change is the introduction of an oil-pressure release valve in connection with the throttle, so that the motor gets more oil as the carbureter is opened. Bosch starting and lighting is retained but changed in that the pinion of the starting motor is mounted on splines on the armature spindle instead of being keyed rigidly, this assisting an easy slip into mesh with the flywheel ring gear. In addition to the seven-passenger touring car there will be a few bodies of the three-seated, clover-leaf pattern. The company announces that, despite all rumors to the contrary, it has no intention of producing a twelve-cylinder car.

Two New Davis Sixes for 1916—Four Continued

RICHMOND, IND., May 29—The Davis Motor Car Co., this city, will bring out three models for 1916, a four-cylinder continued from 1915 with improvements and two new sixes, one listing at $1,250 and the other at $1,495. The four was called model 38 last season and now is listed at $1,165 instead of $1,235. The larger of the new sixes has a 125-inch wheelbase and comes in seven-passenger form only. Its motor is a Continental, 3 1-2 by 5, the clutch a cone and the gearset a three-speed. It is fitted with Westinghouse cranking, lighting and ignition. Tires are 34 by 4 1-2.

The small six has a 120-inch wheelbase and is fitted with a five-passenger body. The motor, also a Continental, is 3 1-4 by 4 1-2 and the other chassis units the same in design as those of the large six.

All Davis cars for 1916 have a new type of body with separated front seats, that for the driver being mounted on a sliding base and that for the front seat passenger being of the revolving type, so the occupant may turn around and face the tonneau passengers.

Haynes Announces Two Sixes for 1916

KOKOMO, IND., May 27—Preliminary announcements have been made regarding the new Haynes for 1916, which will consist of two sixes with three different body styles. The wheelbases are respectively 121 and 127 inches, and the cars are known as models 34 and 35. The same high speed design motor is used in the new models. Features are the self-lubricating spring, spiral bevel drive, adjustable front seats and disappearing auxiliary seats in the seven-passenger model.

A three-passenger roadster is mounted on the smaller car, or model 34, the center seat is dropped back in an aisleway left between the two forward seats, thus providing an unusual amount of carrying space. Other improvements are larger bodies, deeper upholstery, and the equipment includes a Waltham clock, a Boyce motometer, a trouble lamp, an automatic circuit breaker, to take the place of fuses, a Spartan horn and non-skid tires on the rear.

Madison Runabout on Display

Original Ideas in Body—Chassis Is Assembled of High Class Units

INDIANAPOLIS, IND., May 30—The first of the Madison cars to be made by the newly organized Madison Motors Co., Anderson, Ind., has been on exhibition here at the Severin hotel. This is a six with an attractive type of roadster body, known as Dolly Madison. The company is scheduling a production of 600 sixes with the roadster and touring body styles and will begin deliveries almost immediately. It is intended to introduce a small four-cylinder later in the year and this is to be turned out in much larger quantities. The company's slogan is that its car contains well-known components such as Rutenber motor, Detroit Gear & Mfg. Co. transmission and clutch, American Gear & Mfg. Co. axle, etc., and that these parts are assembled into a well-appearing whole.

The motor, a high-speed type 3 by 5 inches, uses a Stewart-Warner vacuum feed, and starting and lighting are cared for by a Remy two-unit system, which cares for the ignition, the distributer and contact breaker being magneto pattern. For the clutch a dry-disk design is employed with thirteen plates of alternate steel and asbestos fabric. The Hotchkiss drive is used, the rear springs being no less than 56 inches long and underhung. Actually, the springs are of three-quarter type with the quarter spring almost half the length of the main spring, this giving very easy riding. The steel used for the springs is said to be the best silico-manganese. Wheelbase is 120 inches and the tire equipment consists of 34 by 4-inch Goodrich, non-skid in the rear.

Both the touring car and the roadster are to sell for $1,375 but the latter has a set of five Houk wire wheels as standard equipment, while the touring car has wood wheels.

The Dolly Madison car is an extremely smart roadster and is exceptionally comfortable as it is supplied with a high door on either side. This makes a clean line with the hood besides protecting the passengers. There is a very large gasoline tank and the spare wheel is carried at the rear on a hub type of carrier to which it attaches precisely as on an axle.

The Madison company gave a luncheon to the press on Friday evening at which the new model was christened by Barney Oldfield.

Designs Four-Wheel-Drive Automobile

ST. LOUIS, MO., May 28—What is said to be the first four-wheel-drive automobile was launched here this week by the Neustadt Auto and Supply Co., its maker. The car was built for H. M. Boyd of Fort Myers, Fla., who after exhibiting the machine here a few days departed for Indianapolis and Detroit to urge the adoption of his design.

Boyd has taken out patents on the various features of his invention. A 1909 Apperson car was used as the basis of his present machine. Among the experiments demonstrated by Boyd here was that of placing the front wheels of his machine against a high curb and then forcing the car to climb the curb by the traction of the front wheels.

Paige Uncovers New Light Six at $1,095

DETROIT, MICH., May 27—The Paige-Detroit Motor Car Co. is bringing out a light six-cylinder model, known as the Six-36, to sell at $1,095 and to be the running mate of the model 46, the larger six-cylinder machine which was placed upon the market last January.

The new model is an exact reproduction of the larger six, so far as outward lines is concerned. It preserves the streamline type of body with the sloping cowl and hood and the pointed radiator, as first brought out by Paige in the Six-46.

The new model has a 3 by 5, block-cast engine, and conforms to approved conventional design for a light machine of this type. It is claimed that the car weighs 2,600 pounds.

Full details and photographs of the new Six-36 will appear in a later issue.

Chevrolet to Reduce Prices for 1916

NEW YORK CITY, June 1—The Chevrolet Motor Co., has announced for 1916 a continuation of the Baby Grand and Royal Mail touring and roadster cars. A material price reduction, however, has been made, the Baby Grand five-passenger car which formerly sold for $985 being now $750, the Royal Mail, formerly $860, is now $720 and the 4-90 selling at $490 is continued at the same price, with electric lighting and starting, $60 extra. This is a five-passenger touring car.

Continental Newest Truck

CHICAGO, ILL., May 29—The Continental Motor Truck Co., 343 South Dearborn street, Chicago, has placed four truck models upon the market. The Continental concern is a new one, made up of Chicago business men. The trucks will be manufactured in Detroit.

Former Federal Truck Head Dies

CHICAGO, ILL., June 1—E. R. Lightcap, formerly president of the Packard Motor Car Co. of Chicago, and the Federal Motor Truck Co., Detroit, Mich., died yesterday of pneumonia in Chicago.

Southern Automobile Sales Better

Farmers a Large Purchasing Power—Good Field for Trucks for Transporting Cotton

DETROIT, MICH., May 27—Lewis L. Halle, manager Abraham Brothers Motor Car Co., Paige and Chalmers dealers in Montgomery, Ala., was a Detroit visitor last week. Mr. Halle reports conditions in the South as considerably improved in the last 60 days, due to the price of cotton reaching 9 to 9 1-2 cents per pound, a figure at which the farmers could afford to start selling. Immediately cotton sales were made the purchase of automobiles started and has been increasing favorably since. Mr. Halle estimates that perhaps more than one-half of the cotton is still unsold. The result of this is that for this season not one-half the crop will be planted. To make up for this the farmers are raising spring wheat, corn and oats and going in more for cattle raising. This introduction of mixed farming should do much to avert similar conditions which took place during the past year. There is talk of starting a packing industry in Montgomery with the sole thought of interesting the farmers in the breeding of hogs.

At present many of the Montgomery dealers sell more than 60 per cent. of their cars outside of the city, these going to farmers who own from 500 to 1,000 acres. Montgomery, a city of 60,000, is situated in a county that has 600 miles of fine gravel road which makes it favorable for farmers using cars.

Up to the present time few trucks have been sold in Montgomery. There is a good possible truck field with the farming trade, trucks being used to transport the cotton to market.

One condition which has helped the sales of cars recently is that the French and English governments have purchased 5,000 horses and mules, these largely coming from the farmers. This has enabled the farmer to finance himself for a few months.

At this writing the Montgomery dealers have not formed a dealers' organization but they have been acting in concert in many movements to their own advantage.

Wadsworth to Manufacture Bodies

DETROIT, MICH., May 28—F. E. Wadsworth, who is secretary and treasurer of the Detroit Motor Car Supply Co., the Detroit Engine Works and the Michigan Steel Boat Co. has purchased a tract of land 300 by 1,200 feet, between Jefferson avenue and Kercheval, and will start the erection of an automobile body plant. The latter will be four stories high, 240 by 260 feet.

It is expected that 500 to 800 men will be employed.

The name of the new company which is to be incorporated has not yet been decided. It is, however, stated that its officers will not be those of the concerns with which Mr. Wadsworth is now connected. In fact, this new business will be run entirely independent from the other companies.

It might be mentioned that very recently Mr. Wadsworth declined an order for several million dollars worth of war material intended for the British government.

Oakland Officials in Session

PONTIAC, MICH., May 27—Oakland Motor Co.'s branch managers, special representatives and officers and officials of the company met today at the first day of the annual 3-day convention.

The 1916 models, the sales policy, the sales campaign, the general situation in the land, and many other matters touching upon the industry in general and the Oakland business in particular will be discussed.

Those present today were: C. W. Nash, president of the General Motors Co., also vice-president and general manager of the Oakland Motor Co.; Fred W. Warner, general sales manager of the Oakland company; C. B. Voorheis, assistant sales manager; J. H. McDearmon, assistant sales manager; the following branch managers: W. B. Tracy, Detroit, Mich.; E. J. Kilbone, Chicago, Ill.; B. W. Losey, Minneapolis, Minn.; L. B. Saunders, Boston, Mass.; K. R. Roberts, San Francisco, Cal.; L. S. Shoup, Indianapolis, Ind.; J. T. Simons, San Antonio, Tex.; A. P. Ten Brook, Kansas City; J. E. Johnson, Philadelphia, Pa.; also the following special representatives: Fred. C. Wood, W. P. Upham, C. L. Zutavern, H. C. Maley, Chicago, director of advertising, and H. H. Thatcher, manager Michigan sales.

Benson Attends Studebaker Convention at Portland

PORTLAND, ORE., May 27.—First Vice-President E. R. Benson, of the Studebaker Corp., Detroit, was the guest of honor at the convention of Studebaker dealers and distributors of this district. Mr. Benson spoke to the force of about 100 which comprised the gathering, expressed his satisfaction at what had been done this season, spoke about the 1916 Studebaker cars and the selling campaign. It was shown that sales in this district have been far ahead of those of 1914, and the future looks even brighter.

More War Truck Orders

Large Contracts Reported for Jeffery, White, Peerless and Morton Cos.

NEW YORK CITY, June 1—Large war orders have been received by several of the truck manufacturers. The Thomas B. Jeffery Co., Kenosha, Wis., received an order of 1,250 trucks from the French Government. These have practically all been delivered and consist of 200 Jeffery Quads, 1,000 ¾-tonners, and fifty 1½-tonners.

Hitherto most of the trucks had gone to Russia. The Canadian contingents, the Belgian army and the British expeditionary force also have a number of Quad trucks in service at the front, amounting to over 100.

The Jeffery factory is working night and day on three 8-hour shifts and has been for several weeks past. At present the company is shipping to several South-American countries and most of the big European countries, Siberia, Manitoba and Australia. An order for trucks was recently received from the dealer at Copenhagen, Denmark.

The White Co. has received an order for 300 tank trucks for the Russian army, to be used as tenders for the active vehicles at the front and for the transportation of gasoline to the bases. The order will amount to about $1,000,000. The trucks each have a capacity of 1,200 gallons of gasoline and 300 gallons of oil. It is said that the White company recently filled a similar order for the French.

It is reported in Cleveland, unofficially, that the Peerless company has recently received war orders to a total value of $6,000,000.

In the early part of May the Morton Truck & Tractor Co., Harrisburg, Pa., acquired facilities to begin work on tractors, trucks, and armored cars to the value of $1,200,000 for the Russian and British Governments. Arrangements were consummated with the Harrisburg Mfg. & Boiler Co. for manufacturing space.

The Gramm Motor Truck Co. has closed contracts with the British Government for trucks valued at $2,000,000. A representative of the British Government is said to be supervising the construction at the company's plant in Lima, O.

Russia Buys American Cars

NEW YORK CITY, May 31—W. V. Logan, of the Goodyear Tire & Rubber Co., who recently returned from Russia, states the Russian Government is fast introducing the American automobile and has been a heavy buyer since the war started. When the war started there were only 12,500 motor vehicles in Russia. The government purchased between $15,000,000 and $20,000,000 worth of new machines while Mr. Logan was in that country.

Few Market Changes

NEW YORK CITY, May 31—Few changes occurred in this week's market quotations. Most of these were in the metals markets which were featured by the advance of $5 per ton of lead. This metal showed a gradual rise from Thursday on, closing on Monday at $4.75 per 100 pounds. Aluminum this week was stronger at 25 cents a pound, a gain of 2 cents. Electrolytic copper fluctuated throughout the week and closed at 18 1-2 cents without any change. Open-hearth steel went up 50 cents a ton. Tin rose 25 cents per 100 pounds.

Up-river Para rose 1 cent. Trading was dull and the offerings were light. The petroleum market remains steady; linseed oil is quiet.

Sparton Horn on 1916 Packard

NEW YORK CITY, May 31—The Packard Motor Car Co., Detroit, Mich., has adopted the Sparton signal as regular equipment on its 1916 cars.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Week's Changes
Aluminum	.23	.23	.24	.25	.25	+ .02
Antimony	.35	.34	.35	.34	.34	— .01
Beams & Channels, 100 lbs.	1.31	1.31	1.31	1.31	1.31	......
Bessemer Steel, ton	19.00	19.00	19.00	19.00	19.00	......
Copper, Elec., lb	.18½	.18	.18	.18½	.18½	......
Copper, Lake, lb	.18¼	.18½	.18½	.18½	.18¼	......
Cottonseed Oil, bbl.	6.20	6.20	6.20	6.33	6.30	+ .10
Cyanide Potash, lb.	.24	.24	.24	.24	.24	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl	.12	.12	.12	.12	.12	......
Lard Oil, prime	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	4.30	4.30	4.40	4.50	4.75	+ .45
Linseed Oil	.67	.67	.67	.67	.67	......
Open-Hearth Steel, ton	19.00	19.00	19.00	19.00	19.50	+ .50
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, refined	.82	.82	.85	.85	.85	+ .03
Rubber, Fine Up River, Para	.60	.60	.61	.61	.61	+ .01
Silk, raw Ital.	..	..	3.90	..	..	......
Silk, raw, Japan	..	..	3.45	..	..	......
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	......
Tin, 100 lb	37.75	37.25	37.25	37.75	38.00	+ .25
Tire Scrap	.05	.05	.05	.05	.05	......

War Halts Trade in Italy

Plants Busy on Army Orders for Cars, Motor Trucks and Tractors

PARIS, May 13—According to a correspondent who has just returned from a tour of inspection of the automobile factories of Italy, the private automobile trade of that country is at a standstill. During the early stages of the war the Italian factories supplied a considerable amount of automobile material to Germany, the Fiat company in particular furnishing 1,500 trucks. This business has now been stopped, for the works have been given important orders for the Italian army. Fiat is particularly busy on six-cylinder aviation motors declared to be an exact copy of the Mercedes aviation engine. France has made arrangements to supply Italy with an immense number of aeroplanes. Isotta-Fraschini is building automobiles and light trucks for the war department. The former Italian Darracq factory is working on gasoline tractors for the haulage of heavy guns across country.

Federal Truck Capital Increased to $500,000

DETROIT, MICH., May 27—Five years ago in June, the Federal Motor Truck Co., was started with a capital stock of $100,000. This was doubled about 2 years ago. Now the company has increased it from $200,000 to $500,000.

The business of the Federal company has been increasing very rapidly lately and it has been found necessary to enlarge the plant, to add new machinery and to increase the working force, to take care of the rush of orders, promptly. For the present, the expansion will consist in adding one story to the main plant, which means an addition 300 by 60 feet.

There has never been such a rush at the plant, officials say. Business has been coming from all parts of the country and there is no sign of any letting up. Secretary and sales director, J. F. Bowman recently returned from an extended trip through New England, and reports the truck business to be the best it ever was. From other sections in the country Federal distributors report a similar condition.

Ten to twelve trucks are made daily at the present time, but this production will be increased 50 per cent. when the additions to the plant are completed.

Independent Motors Increases Capital $60,000

PORT HURON, MICH., May 28—The Independent Motors Co., formerly the Cass

Motor Truck Co., has increased its capital stock from $60,000 to $120,000. One-half of the increased capital is preferred stock, which has been subscribed by a number of well-known Detroit capitalists.

The Independent company is building the Independent 1,000 and 1,500-pound worm-drive trucks and the Cass 1 1-2-ton truck. The company is planning increased production facilities.

The officers of the company are: A. W. Frantz, president; B. L. Howes, vice-president; W. B. Ford, treasurer; M. H. Rupe, secretary. Messrs. Frantz, Howes, Ford, J. J. Haynes and W. D. Smith form the board of directors.

To Expand Operation of New Rittman Gasoline Process

WASHINGTON, D. C., May 31—Secretary Lane announced today that excellent progress was being made in the development of the gasoline and benzol processes designed by Dr. W. F. Rittman of the Bureau of Mines to increase the output of gasoline by refiners and to make possible the production from crude petroleum of toluol and benzol, which are the bases for dyes.

The gasoline process is now ready for large scale industrial application. The benzol process is being developed in co-operation with the Aetna Chemical Co. of New York, which company has entered into an agreement whereby all patentable equipment, processes and ideas available will be turned over to the department to be dedicated to the public.

The department stands ready to enter into similar agreements with other companies.

Security Prices Higher

Market, However, Dull—International Uncertainties a Restraining Factor

NEW YORK CITY, May 31—The stock market is dull and waiting, pending further developments in the controversy between the United States and the German government. Still, the market continues to exhibit a good tone. The volume of trading in the stock market on Saturday was small and the dealings seemed to be devoid of significance. Automobile securities were a little higher this week, there being few declines.

Most of the tire issues went up. Goodyear common rose 15 points; Kelly-Springfield common and first preferred, 3 and 1 1-2 points; Swinehart 1-2 point; and U. S. Rubber common and preferred, 1 and 3-4 points, respectively.

Automobile stock prices in general showed a higher tendency. International Motor common and preferred rose 2 and 4 points, respectively; Maxwell common, first preferred, and second preferred, rose 3 1-2, 4 and 3 points, respectively; Studebaker common and preferred went up 2 and 1 1-2 points; and Willys-Overland common and preferred showed a gain of 3 1-2 and 7-8 points.

Dividends Declared

CLEVELAND, O., May 28—The Peerless Motor Car Co. has declared a regular quarterly dividend of 1 3-4 per cent. on the preferred stock, and 3 1-2 per cent. additional on account of accumulated dividends. Both dividends are payable July 1 to stock of record June 20. The dividends had been suspended April, 1914.

The declaration of the total 5 1-4 per cent. on the preferred places the stock on its regular 7 per cent. basis, and makes up two of the four dividends which were unpaid.

DETROIT, MICH., May 31—The Packard Motor Car. Co. has declared the regular quarterly dividend of 1¾ per cent. upon the preferred stock, payable June 15 to stockholders of record upon the close of business the first day of June, 1915.

NEW YORK CITY, May 31—The Rubber Goods Mfg. Co. has declared the regular quarterly dividend of 1¾ per cent. on the preferred, and a dividend of 1 per cent. on the common stock, payable June 15, to stock of record of June 8.

EAST PALESTINE, O., May 29—The McGraw Tire & Rubber Co., East Palestine; 5 per cent. semi-annual dividend on common stock, payable June 1.

Remy Preferred Stock All Redeemed

ANDERSON, IND., May 31—The Remy Electric Co., Anderson, Ind., has filed notice that all of its preferred stock has been redeemed.

Wilcox-McKim Files Petition

DETROIT, MICH., May 31—The Wilcox McKim Co., Saginaw, Mich., automobile parts manufacturer, filed a voluntary petition in bankruptcy giving its liabilities as $16,000 and its assets as $24,000. A reorganization is planned.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co.	220	..	300	..	..
Ajax-Grieb Rubber Co. pfd.	99	..	101	..	..
Aluminum Castings pfd.	98	100	98	100	..
J. I. Case pfd.	85	87	..	..	..
Chalmers Motor Co. com.	101	..	89	91	—1
Chalmers Motor Co. pfd.	92	..	95	97	..
Electric Storage Battery Co.	52	53	..	..	..
Firestone Tire & Rubber Co. com.	306	310	475	480	..
Firestone Tire & Rubber Co. pfd.	106	109	110	112½	..
General Motors Co. com.	93½	94	135	136½	..
General Motors Co. pfd.	93½	94	98	100	+1
B. F. Goodrich Co. com.	25	26	43	45	—1
B. F. Goodrich Co. pfd.	88	89½	101¼	102	— ½
Goodyear Tire & Rubber Co. com.	170	176	240	..	+15
Goodyear Tire & Rubber Co. pfd.	98½	100	105	106	..
Gray & Davis, Inc., pfd.	95	102½	..	..	..
International Motor Co. com.	..	5	14	15	+2
International Motor Co. com.	3	10	34	38	+4
Kelly-Springfield Tire Co. com.	..	..	82½	85	+1½
Kelly-Springfield Tire Co. 1st pfd.	..	..	82½	85	+1½
Kelly-Springfield Tire Co. 2d pfd.	..	..	115	135	..
Maxwell Motor Co. com.	14½	15	42½	44	+3½
Maxwell Motor Co. 1st pfd.	45	46	86	87½	+4
Maxwell Motor Co. 2d pfd.	19	19¾	37	38¾	+3
Miller Rubber Co. com.	..	..	180	185	..
Miller Rubber Co. pfd.	..	..	104	105	..
New Departure Mfg. Co. com.	123	125	136	141	..
New Departure Mfg. Co. pfd.	105	107	106	..	..
Packard Motor Co. com.	103	..	..	104½	..
Packard Motor Car Co. pfd.	98½	100½	..	100½	..
Peerless Motor Car Co. com.	18	25	..	..	..
Peerless Motor Car Co. pfd.	..	62½	..	..	..
Portage Rubber Co. com.	..	40	35	38	..
Portage Rubber Co. pfd.	..	90	85	88	..
*Reo Motor Truck Co.	9¾	10¼	14⅜	15⅜	— ⅜
*Reo Motor Car Co.	27	28½	32¾	33½	— ⅛
Splitdorf Electric Co. pfd.	40	50	..	..	..
Stewart-Warner Speed. Corp. com.	47½	48½	64	67	..
Stewart-Warner Speed. Corp. pfd.	97	99	103	105	+1
Studebaker Corporation com.	34	35	67	69	+2
Studebaker Corporation pfd.	88½	90	97½	99½	+1½
Swinehart Tire & Rubber Co.	65	75	80	90	..
Texas Co.	144½	145½	123½	125	+ ½
U. S. Rubber Co. com.	58⅛	58¼	62	64	+1
U. S. Rubber Co. 1st pfd.	102⅝	55⅛	62	64	+ ¾
Vacuum Oil Co.	224	226	200	205	+5
White Co. pfd.	107	110	103	108	..
Willys-Overland Co. com.	78	80	114½	116½	+3½
Willys-Overland Co. pfd.	95	95½	100	103	+ ⅞

*Par value $10; all others $100 par value

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
ACTIVE STOCKS					
Chalmers Motor Co. com.	101	107	88	91	—1
Chalmers Motor Co. pfd.	93½	..	94	97	..
Continental Motor Co. com.	..	180	175	185	..
Continental Motor Co. pfd.	..	75	84	86	— ½
General Motors Co. com.	92½	94	135	140	—1½
General Motors Co. pfd.	93	94	98	99	—2
Maxwell Motor Co. com.	14⅛	15½	41½	43½	+1½
Maxwell Motor Co. 1st pfd.	45	46½	85½	87¼	+2¼
Maxwell Motor Co. 2d pfd.	19	20	36½	38½	+1¼
Packard Motor Car Co. com.	103	..	102	104	..
Packard Motor Car Co. pfd.	98½	100½	99	..	..
*Reo Motor Car Co.	18	18¾	32¾	33¾	..
*Reo Motor Truck Co.	9⅛	9⅞	14¼	15⅜	..
Studebaker Corporation com.	..	..	66	68	+ ½
Studebaker Corporation pfd.	..	..	..	99	..
INACTIVE STOCKS					
*Atlas Drop Forge Co.	..	21	..	26	..
Ford Motor Co. of Canada	..	550	950	1000	+50
Kelsey Wheel Co.	..	193	200	..	..
W. K. Prudden Co.	..	20½	19½	21	..
Regal Motor Car Co. pfd.	..	30	..	25	..
BONDS					
General Motors, notes, 6s, 1915	101	102	..	..	..
Packard Motor Co., 5s, 1916	95	98½	98¼	..	..

S. G. V. Plant Sold for $55,600

Probably Will Not Be Continued—Lozier Plattsburg Real Estate Sold

READING, PA., May 29—The automobile plant of the S. G. V. Co., Reading, was sold at the receiver's sale on May 27 to F. L. Metzler, of Newark, N. J., a member of the New Jersey Machinery Exchange, for $55,600. The sale was conducted by R. E. Graham of Philadelphia, the receiver.

Negotiations are now pending with two or three bidders for the good will and the service department of the company. It is doubtful if it will be continued as a running concern at Reading.

Sell Lozier Plattsburg Plant

PLATTSBURG, N. Y., May 28—A syndicate of Plattsburg business men has purchased the real estate formerly owned by the Lozier Motor Co., in this city. About 75 per cent. of the plant has been sold in lots, bringing in about $200,000. Some time ago three buildings, included in the Lozier plant here, were sold to S. S. Kempner. Charles Shongood, who acted as the auctioneer, states that the rest of the plant will probably be sold in 2 or 3 weeks.

$170,000 Bid for Detroit Body Assets Confirmed

DETROIT, MICH., May 27—The sale of the assets, except the receivable accounts, of the bankrupt Detroit Body Co., to the Fisher Body Co., has been confirmed by the United States district court. The latter company bid $170,000 for the property. It is stated that this money will be sufficient to meet the claims of the preferred creditors, while from the accounts receivable it is anticipated enough will be collected to pay claims of the general creditors. The Security Trust Co. is receiver for the bankrupt concern.

Savidge Steering Device Makes Record

INDIANAPOLIS, IND., May 29—Contracts for 75,000 Savidge devices in about 8 months is the record of the Savidge Steering Device Co. of Indianapolis. This company was organized in September of last year to manufacture a steering device for Ford cars.

Rumely Co. to Be Reorganized

LAPORTE, IND., May 28—It is confirmed that there will be a reorganization of the M. Rumely Co., Laporte, now in the hands of Receiver Finley P. Mount. The note-holders' committee, of which John W. Patten is chairman, has deemed it the best for the protection of the noteholders, after investigation, to reorganize the concern, provided a plan consistent with their interests can be formulated. In order that the committee may have the authority to represent the noteholders in carrying on the necessary negotiations, the holders of notes have been asked to deposit them with the United States Mortgage & Trust Co., New York City, or its agents, which will issue certificates of deposit. Just what the plan of the reorganization will be can not be told at this time, it will probably take many conferences of those interested before a plan can be arranged.

The company's business continues to increase. The total number of men employed in the company's shops has passed the 1,000 mark. Of these 584 are employed in the shops at Laporte, a gain for the week of twenty-eight men. The others are distributed among the plants at Battle Creek, Richmond, Stillwater and Toronto.

Champion Extends Time Limit of Profit-Sharing Plan

TOLEDO, O., May 31—In order that the dealers who have not as yet signed the profit-sharing agreement of the Champion Spark Plug Co., this city, may have further time to take advantage of that opportunity, the time limit for their acceptance has been advanced from June 1 to July 1, 1915.

It is recalled that when the first announcement was made to the trade, attention was called to the dealer that all he had to do was to fill out the blank which had been mailed to him, or which he could procure through his jobber's salesmen. At the end of the year the company would send the dealer a check representing his pro rata share of the profits which he had earned, and which would be based upon the number of Champion plugs he had purchased during the year.

$2,000,000 Co. to Manufacture Dual Gear

JACKSON, MISS., May 30—The Orr Modern Motor Car Co., capitalized at $2,000,000, has been organized at Yazoo City to manufacture a dual gear, multi-speed, gear-driving mechanism for automobiles. The officers are G. A. Wilson, president, and C. D. Orr, the inventor, secretary.

The basic principle of the invention is the worm drive. Power is applied directly to the rear wheels in a straight line, doing away with all but one universal joint and many small parts. In fact, it is said to eliminate two-thirds of the parts now used in transmitting power, to deliver 10 per cent. additional power, and to eliminate noise and jerking, while reducing the cost of maintenance to a minimum.

Springfield Plants on Overtime

Truck, Machine and Tire Factories Rushed — Winton Changes Name

SPRINGFIELD, O., May 28—Two local factories are working overtime to get out the orders on hand for machines and supplies. They are the Robbins and Myers Co., and the Victor Rubber Co. Another one, which is starting in again on a big contract, which will necessitate the employment of a large force, is the Kelly-Springfield Motor Truck Co.

When C. F. McGilvray, president of the Robbins and Myers Co. was asked how his plant was running, he stated that it was running 4 hours overtime in most departments. It is employing about 1,400, which is a larger force than it had last year.

Out at the Victor Rubber works day and night forces are being employed to meet the demands of the trade. Recently the company began the manufacture of pneumatic tires. As a result it has been forced to enlarge its works. The contractors are at work now erecting a large two-story addition, 200 feet long. About half of it is finished.

The Kelly-Springfield Motor Truck Co. is busy with another large order to be filled at once. This one has just been received. More employees will be added to handle it.

Now the Winton Co.

CLEVELAND, O., May 29—Papers have been filed with the secretary of state changing the name of the Winton Motor Car Co., Cleveland, to the Winton Co. No change in the capitalization was made.

Cadillac Ships 2,506 Eights in May

DETROIT, MICH., May 31—During the twenty-six working days of May the Cadillac Motor Car Co. shipped 2,506 eights, or 181 more cars than in April. The total number of cars shipped to date is 10,788. Of this number 288 have been delivered thus far to Detroiters.

DETROIT, MICH., May 29—A new three-story office building will be erected by the Cadillac Motor Car Co.

Buying Moreland Truck Parts in East

LOS ANGELES, CAL., May 26—Watt Moreland, general manager of the Moreland Distillate Motor Truck Co. of this city is in the East purchasing ten carloads of motor truck parts for the Los Angeles factory. Moreland's first day at the Timken plant in Detroit resulted in five carloads of axles and David Brown worms being shipped West. The Continental Motor Mfg. Co., was also visited and a large supply of truck motors ordered. A large supply of transmissions was purchased from the Brown-Lipe factory at Syracuse. Milwaukee and Lafayette are to be called upon for supplies for the Los Angeles truck factory. Large shipments of pressed steel frames and Ross steering gears will complete the Moreland order.

American Piston Ring Closes Large Contracts

NEWARK, N. J., May 27—The American Piston Ring Co., this city, has closed contracts for the 1916 equipment of the Chalmers Motor Co.; Pierce-Arrow Motor Car Co.; Winton Motor Car Co.; Lozier Motor Co.; F. B. Stearns Co.; L. P. C. Motor Co.; International Motor Co.; Fiat Co., and the Sterling Motor Co.

The American Piston Ring Co. has removed the entire plant to its new factory building at South Eleventh street, this city, which triples its production capacity. Orders on hand will not only keep the plant going at full capacity for 10 hours during the day but also 10 hours three nights per week.

Ten Broeck Tyre Co. Working Night and Day—Equipment Doubled

LOUISVILLE, KY., May 27—During the last 2 months the Ten Broeck Tyre Co., has doubled its equipment and is working a big force both night and day. The company now employs about 500 men.

About 300 tires a day is the present output of the factory. The general revival of trade is being reflected in the business of the local tire factory, which finds its output more than double that of last year, according to an official.

H. L. Lewman, president of the concern, states that the factory is well supplied with crude rubber and expects to increase the present output within a short time.

Austin to Build New Plant

GRAND RAPIDS, MICH., May 29—It became known that Walter S. Austin, president of the Austin Automobile Co., has decided to build a new plant, probably on South Division avenue. Details are withheld for the present.

$100,000 Plant for Maxwell in Dayton

DAYTON, O., May 29—The Maxwell Motor Co. plant in this city will be enlarged through an addition, to be 160 by 100 feet in size, at an expenditure of about $100,000.

Chalmers Four-Story Addition

DETROIT, MICH., May 29—A four-story addition, 60 by 90 feet, will be erected by the Chalmers Motor Co., to increase the capacity of the machine shops.

Ford Reduces Prices on Parts

Reductions Range From 10 to 25 %—Stearns Business Gains 50 %

DETROIT, MICH., June 1—*Special Telegram*—The Ford Motor Co. has announced a reduction on most of its parts ranging from 10 to 25 per cent. A few parts, however, which it was found cost more to manufacture now than heretofore, were increased in price. For instance, the front axle assembly now costs $24 instead of $22. On the other hand, the rear axle assembly, which formerly listed at $60, now costs $55. Radiators have been reduced from $20 to $15, and fenders from $3 to $2.50.

Stearns Shows 50% Increase

CLEVELAND, O., May 28—The F. B. Stearns Co., this city, increased its business during the first week of May 50 per cent. over the corresponding week in 1914. During March and April of this year there was an increase of 25 per cent. over the same months in 1914.

Portage Takes Over Barberton Plant—To Build New Factory

CANTON, O., May 28—A deal has been closed whereby the Portage Rubber Co. has taken over the plant of the American Strawboard Co. in Barberton, O., for the purpose of converting it into a rubber plant. A new plant will be erected on the site and the old plant will be used as a reclaiming plant. The Portage Rubber Co. was organized in 1911. The principal product of the company is automobile tires and tubes, although other rubber articles are manufactured.

Houpt Takes Hudson Agency

NEW YORK CITY, June 1—The Hudson Motor Car Co. of New York today took over the distribution of the Hudson cars in the Metropolitan District, formerly handled by the A. Elliott Ranney Co. H. S. Houpt is president of the company.

The service station for the cars will be continued at 64th street and Broadway. The local salesroom at that address will be removed to the Circle Building, Broadway and Columbus Circle. The Brooklyn salesroom for Hudson cars, at 1184 Bedford avenue, under the name of the A. Elliott Ranney Co., will be continued as the Brooklyn salesroom of the local company.

$600,000 Oil Refinery for Gainesville

GAINESVILLE, TEX., April 30—An oil refinery to cost approximately $600,000 is to be erected here by the Producers' Refining Co., which is now being organized. The stock of the new company is held principally by F. H. Thwing, of Kansas City, Mo.; H. M. Ebans, of Pasadena, Cal.; Thomas H. Smith, of Denver, Col., and George A. Todd, of Ponca City, Okla. These men and their associates have contracted with a number of oil producers of the Healdton, Okla., field to purchase a minimum of 6,000 barrels of oil per day for a period of 5 years. The producers who are parties to this contract have taken stock in the new company and will pay for it in oil.

To Enlarge Bailey Gearless Differential Production

SYRACUSE, N. Y., May 28—The New Process Gear Corp., this city, has entered into a contract with the Gearless Differential Co. of Detroit, to manufacture the Bailey gearless differential for the trade.

The present policy of going after replacement business on cars already in service, will be continued.

Oakland Daily Output to 45 Cars and Still Growing

PONTIAC, MICH., May 28—The output of the Oakland Motor Co., which has been of an average of thirty-five cars a day, will be increased to forty-five a day beginning next week. This will be increased steadily through the increase of the working force until the output reaches 100 cars a day.

Cornelian Plant Working to Capacity

ALLEGAN, MICH., May 27—With a force of 248 men the Blood Bros. Machine Co., which make the Cornelian cars, is now working to its full capacity. The men are working 24 hours a day, there being three shifts. A schedule has been laid out for a minimum output of twenty-five cars a week, but this will gradually be increased. The first two demonstrators were shipped to dealers last week.

King Drive-Away Day June 10

DETROIT, MICH., May 28—The King Motor Car Co. has arranged for the first drive-away of eight-cylinder cars. This is to take place June 10, and purchasers of King cars from New York, Pennsylvania, Virginia, West Virginia, Ohio, Indiana, Michigan and Ontario have advised the company that they will be there to take delivery of their cars.

Autocar Sales Increase 40 Per Cent

ARDMORE, PA., May 31—Sales of Autocars have increased 40 per cent. during the past 5 months, according to a statement of the Autocar Co., this city. This increase has come from all branches throughout the United States and is made up entirely of domestic sales.

$50,000 in Prizes for Sheepshead

Track Will Be Completed September 1, When Entries Close—Flying Start

New York City, May 27—The opening of the new 2-mile Sheepshead Bay speedway, New York City, will without doubt take place on Saturday, October 2, with a race for which twelve cash prizes totaling $50,000 will be offered, New York City thus opening with a motor racing classic the equal of any yet staged in the country. President Carl G. Fisher, who is also president of the Indianapolis speedway gave his sanction to this program which differs but little from the Indianapolis one. Instead of ten prizes given at Indianapolis there will be twelve with $20,000 to the winner, $10,000 to second, $6,000 to third, $3,000 to fourth and $2,500 to fifth. The last seven prizes are, $1,600; $1,400; $1,300; $1,200; $1,100; $1,000; and $900.

The exact hour of starting is not yet known, but the start will be a flying one as used at Indianapolis, and President Fisher has agreed to pace the front row of starters. Eliminating speed trials will undoubtedly be held on the Saturday afternoon previous to the race and the following Monday. In addition to eliminating speed trials there may be a special event such as a pursuit race or other attractions.

Entries Close Sept. 1

Entries will close September 1, the fee being $200 per car which is returned if car starts. Owing to the use of a board track it will be necessary for all cars to carry approved mud aprons so that grease cannot leak onto the boards. The usual changing of steering spindles and parts prior to the race will be insisted upon, but the changing of the axle proper will not be required.

Rush Work Night and Day

Work is at present being pushed night and day on the erection of the speedway and it will be finished in ample time for the meet.

Detroit Electric Starts on 1,500 Mile Run

Detroit, Mich., May 28—A practical demonstration of what the electric vehicle can do has been arranged by the Anderson Electric Car Co., on a scale never before attempted with an electrically driven automobile.

Beginning June 1 a stock model 52 Detroit electric brougham, seating five passengers, with Detroit lead batteries, Houk wire wheels and Goodrich Silvertown cord tires, will start a series of twenty daily runs to places of interest around Detroit. The daily mileage will be at least 75 miles, so all told 1,500 miles to be run between June 1 and 23.

The Anderson company wants to demonstrate by this series of runs that the electric car is a practical family vehicle, of easy operation and that it can stand severe road driving, just as the gasoline car.

A committee of three Detroit newspaper men will act as supervisors of the runs, and Secretary Charles A. Hughes, of the Detroit Athletic Club, will send the car away daily from the club house and check it upon its return. The day's run must be made on one battery charge.

In addition to the driver and a representative of the Anderson company, there will be room for three more passengers in the car. The company has extended an invitation to any one interested to take part in one or several trips. In fact the manufacturers are desirous that prospective purchasers take part in the runs as they believe the demonstration will be the very best argument in favor of the electric's practicability.

Although the twenty runs will be made to cities and towns it has been arranged to have basket luncheon by the roadside as often as the weather will permit this.

Stutz Stars at Newark Track

Newark, N. J., May 31—Joe Dickinson, in a Stutz, carried off the honors in today's automobile races on the 1-2-mile track at Olympic Park, held by the Matty Matthews Auto Racing Assn., Inc., by taking four out of the six events. The attendance was 5,000. The results of the races follow:

One-Mile Time Trials (free for all)—Won by Dickinson, Stutz; Frazer, Correja, second, Duryea, Ford Special, third; time, 1:12 1-5.

Two-Mile Special Invitation (Class E)—Final heat won by Dickinson, Stutz; Watson, Mercer, second; Frazer, Correja, third; time, 2:39 4-5.

Five-Mile Non-Stock (Class E)—Won by Watson, Mercer, Frazer, Correja, second; Vail, Otto, third; time, 6:36 3-5.

Two-Mile Non-Stock (Class D)—Final heat won by Dickinson, Stutz; Lambert, Stutz, second; Watson, Mercer, third; time, 2:41 1-5.

Five-Mile Handicap, Non-Stock (Class E)—Won by Lambert, Stutz; Vail, Otto, second; Murchil, National, third; time, 6:51 3-5.

Special Professional Australian Pursuit Race (Class E)—Won by Dickinson, Stutz; Frazer, Correja, second; Vail, Otto, third, distance, 4 3-4 miles.

Galesburg Entries to Date Number Five

Galesburg, Ill., May 28—Five entries are in for the 100-mile race by automobiles on the Galesburg Fair Assn. grounds on June 9, and many more are looked for. Those already registered include the following: Tom Alley, driving a Dusenberg; Ed. O'Donnell, a Dusenberg; S. Ostewid, an Apperson Special; Jack Dody, a Crown Special; and Andy Burt, a Stutz. It is expected that two Maxwells will be entered.

100 M. P. H. on Tacoma Speedway

Track Finished May 24—Boarding Cost $55,000—16 Entries—$10,500 in Prizes

Indianapolis, Ind., May 29—Manager G. D. Dunn of the Tacoma Speedway Assn., Tacoma, Wash., who is here attending the speedway races, says that the boarding of the 2-mile Tacoma speedway was completed May 24, and that already one car has lapped it at an unofficial speed of over 100 miles per hour. This speedway is located on a 230-acre tract 6 miles from the heart of the city and was used last year with a gravel surface. In boarding, the 2 by 4 material has been laid directly on the gravel, without intervening sleepers, the 2 by 4's lying in the direction of travel and placed 5 inches apart with the intervening spaces filled with gravel and the entire top covered with a layer of liquid asphalt 1-8 inch thick. The boarding cost $55,000.

The track is 50 feet wide and banked at the turns so that the outer edge is 18 feet high, the banking all being gravel. The homestretch is 60 feet wide to care for the pits at the starting line.

This track is not a perfect oval being longer on one side than the other, the straightaway on the homestretch measuring 2,700 feet and that on the backstretch 1,800 feet. On one end is a straight of 700 feet and 800 feet on the opposite end. The grandstand accommodate 9,500. Twenty-seven cars can be started according to A.A.A. rules and to date sixteen entries are in.

The total of $10,500 in prizes is divided up among three races covering 2 days as follows: 100-mile race, $1,500; 200-miles, $3,500; and 250-mile race $5,500.

One Set of Goodyear Tires on Transcontinental Stutz

New York City, May 31—The transcontinental Stutz Bearcat which recently broke the coast to coast record by covering the 3,728.4 miles between San Diego, Cal., and this city in 11 days, 7 hours and 15 minutes, completed the trip on a single set of Goodyear tires, the same air being in the front pair at the finish of the run. Other features of equipment were mentioned in The Automobile for May 20.

Demonstrates Advantages of Use of Sub-Casings in Tires

Los Angeles, Cal., May 29—For the purpose of demonstrating the advantages derived from tires that are equipped with sub-casings, the Western Auto Sub-Casing Co., of this city is conducting a novel test.

The company installed a machine which duplicates the duties imposed on tires in usual running. The machine consists of a high speed rasp wheel to give friction; and a wheel with inflated tire applied to the rasp with pressure on the tire. This pressure is equivalent to the weight of the car and places approximately the same weight on the tire as when it is on the road.

The machine demonstrated that the tire equipped with a sub-casing did not blow out as soon as the one not reinforced.

Saxon Averages 37 M.P.G. for 4,665 Miles

DETROIT, MICH., May 27.—The 30-days' reliability and consumption test which was started April 26 by a four-cylinder stock Saxon roadster ended today. The little car was kept actually 32 consecutive days on the road and covered in that time 4,665 miles or an average of 145.8 miles a day.

The total expense for gasoline and oil was $25.07 or an average of $0.0053 per mile. The expense consisted of $13.97 for 127 gallons of gasoline and $11.10 for 63 quarts of lubricant. This consumption represents an average of 37 miles per gallon of gasoline and 74 miles to the quart of oil.

During more than half of the time the test was under way, it rained and the roads were at times in very bad condition. The car followed two routes on every alternating day, being checked by city officials out of Detroit and by officials of the Wolverine Automobile Club daily in this city.

Sioux City Getting Ready

SIOUX CITY, IA., May 27—Improvements are being made on the 2-mile speedway here for its coming meet July 3, by increasing the banking on the turns 2 feet and using 20,000 additional gallons of oil as compared with last year. A new bleachers' grandstand to accommodate 1,800 has been erected on the back stretch. The track surface of this speedway is 70 feet wide with the exception of the homestretch which is considerably wider.

To Nationalize Traffic Rules

CINCINNATI, O., May 31—Formation of plans for the adoption of national traffic rules was advocated at the annual meeting of the International Assn. of Police Chiefs which was held in Cincinnati, O., last week. C. E. Healy, chief of Chicago, declared that the pedestrian was hardest to control, but that he has partially solved the problem in his city by securing the co-operation of business men. He advocated safety zones for pedestrians. The importance of automobiles in police work was also discussed at length.

Two Shows for Columbus

First, Aug. 30 to Sept. 3—Second, Jan. 29 to Feb. 5—Jitney Developments

COLUMBUS, O., March 28—In order to put the business of operating automobile shows in the Buckeye Capital on a business basis, the Columbus Automobile Show Co. has been incorporated with a capital of $1,200 for the purpose of giving all kinds of automobile and accessory displays. The stockholders of the corporation consist of twelve of the well-known dealers of the city, each of whom will hold one share of the stock. The company will be operated for profit, similar to other commercial incorporations and if any profit is made it will go into the pockets of the stockholders, who are the exhibitors.

It is planned to give two automobile shows during the coming 8 months. The first, which will be known as the autumn show will be held in the South Machinery Hall at the Ohio State Fair and will be held August 30 to September 3 inclusive, the same dates as the state fair. All displays of automobiles, motor trucks or accessories must be in that building, which has been leased by the show company from the Ohio Agricultural Commission.

The second annual automobile show will be held in the Memorial Hall, January 29 to February 5 inclusive and will be similar to previous shows. Displays of passenger cars, commercial vehicles and accessories will be made.

Neutral in New Jersey Jitney War

TRENTON, N. J., May 28—The State Motor Vehicle Department issued a proclamation of neutrality today in the war between trolley companies and jitney operators.

The proclamation was the outcome of a complaint brought before Commissioner Dill by the Trenton and Mercer County Traction Corp. against G. P. Gibson, who had driven a jitney past a standing trolley car. The defendant was discharged.

Louisville Jitney Bond Clause Void

LOUISVILLE, KY., May 29—Circuit Judge Samuel B. Kirby today declared void the clause in the jitney bus ordinance relating to bonds required of owners and operators and granted a temporary injunction prohibiting the City of Louisville from enforcing the measure. The temporary order was granted on the application of seventy-three jitney bus operators, and will be continued in effect until the action can be tried out on its merits.

The court does not hold that the bond of $5,000 required by the ordinance is excessive, but says that the section held invalid provides for something more than a bond of $5,000, and that in inserting this extra provision the General Council exceeded its authority.

Cannot Regulate Jitneys in Massachusetts

BOSTON, MASS., May 31—Tht attempt of the street railway magnates to curb the jitney bus business in Massachusetts got a jolt here when Attorney-General Atwill at the request of the legislature sent down an opinion that the proposed law to govern them was unconstitutional. This was such a surprise that there is some doubt now whether there will be any legislation at all this year governing the buses. And even if there is some law passed there is a possibility of confusion because one section of the motor law now states specifically that no city or town shall pass ordinances restricting motor vehicles. At present any such regulations as restrict the vehicles are illegal, but no one has discovered it, or made any attempt to modify the matters.

3-Cent Jitney Offered for N. Y.

NEW YORK CITY, June 1—Three bids for the new bus routes in Manhattan were received by the franchise committee of the Board of Estimate today and opened by Acting Mayor McAneny. The Fifth Avenue Co. wants a 10-cent fare, the Motor Bus Co., both 5- and 10-cent fares, and Messrs. Brunner and Ridley, of 405 Pearl street, representing a concern not yet organized, a 3-cent fare for each of three zones.

The Motor Bus Co. promises to have 100 buses going within 6 months. The Brunner-Ridley representatives state that operation would begin within 4 months with buses of 3 tons capacity, either propelled by electricity or gasoline, or both.

Supreme Court Upholds Validity of Florida Automobile Tax

ATLANTA, GA., May 29—Florida may now be added to the list of states whose laws for the taxing of automobiles have been upheld by the highest tribunal in the land. In Florida, the state statutes fix a license tax of $3 on each car. Automobile owners, after paying that, contended they should not be required to pay a further tax, in some places being subjected to separate city and county taxes as well, and went to the courts, but the supreme court has ruled against the plaintiffs.

The Week in the Industry

Brown Joins Los Angeles Pierce—J. S. Brown, who has been connected with the automobile industry in Southern California for several years, has joined the forces of the W. E. Bush organization, Southern California distributor for the Pierce-Arrow line in Los Angeles, Cal. Brown will devote his time to the management of the used-car department, which is located adjoining the main Bush salesroom on South Grand avenue.

New Man in Los Angeles Apperson—M. H. Green has been appointed retail sales manager of the Los Angeles Apperson branch. Green was for 6 years manager of the Cadillac and 3 years sales manager of the Hudson agency in Los Angeles. F. M. Headlee, former manager of the Chalmers agency in Los Angeles, has assumed the duties of wholesale manager of the Apperson branch, which covers the entire territory of Southern California and Arizona.

Garage

Goodyear's New Booklet. — A new booklet on "Goodyear Fortified Tires" has been issued to the trade by The Goodyear Tire & Rubber Co., Akron, O. It is primarily a booklet discussing big car requirements, and is intended to illustrate the progress Goodyear has made in the car field in the past few years, by dwelling on the two types of tires that exemplify its work.

Motor Men in New Roles

Symons Saginaw Fisk Mgr.—The Fisk Rubber Co., Chicopee Falls, Mass., has opened a branch in Saginaw, Mich., at 812 Genesee avenue, in charge of H. E. Symons.

Titus Joins Owen Magnetic—E. S. Partridge, sales manager of the Owen Magnetic Co., New York City, has added Fred J. Titus to the staff. Titus was recently with the Simplex company.

Eitzen Savage Tire Mgr.—H. H. Eitzen has been appointed manager of the San Diego, Cal., branch of the Savage Tire Co. He was with the Goodrich company for several years, and previous to that time was engaged in the tire business in Idaho.

Wolfe Transferred to Dallas — M. C. Wolfe, former salesmanager for the Kissel-Kar Co., has been made manager for the company at Dallas, Tex. He succeeds B. M. Lindsey, who resigned only a few days ago to become vice-president and general manager of the M. & S. Sales Co.

Pearson Makes Change—George Pearson, Jr., formerly of the Pearson Motor Car Co., San Francisco agent for the Maxwell cars, has disposed of his interests in the company to the R. & S. Corp. and has taken the Northern California agency for the Saxon Motor Car Co. of Detroit.

Westman in Accessory Business — E. E. Westman, who for the past 5 years has been connected with the Cole Motor Car Co. and Premier Motor Mfg. Co. in the capacity of purchasing agent, has severed his connection with the latter company to embark in the wholesale accessories business on his own account under the name of Standard Bearings & Parts Co. with headquarters in Indianapolis.

Johnson Goes to Seattle—Mel Johnson, who for some years past has been manager of the Howard Automobile Co., Buick distributor, branch at Portland, Ore., has resigned to give all his time and attention to the Seattle Buick agency, in which he secured an interest some 2 years ago. He will be succeeded by G. H. McCutcheon, who is at present manager of the Howard branch in Oakland. C. M. Reese, McCutcheon's assistant, will take charge of the Oakland branch.

Dealer

Recent Visitors to Studebaker Plant—Recent visitors to the plant of the Studebaker Corp., Detroit, Mich., were W. S. Williams, branch manager of the Studebaker agency in Dallas, Tex.; J. Wollaeger, of the Wollaeger Auto Sales Co., Milwaukee, Wis., and A. H. Pearsall, branch manager of the Studebaker Corp., Chicago, Ill., and L. Markle, president of L. Markle & Co., Chicago, Ill.

The Automobile Calendar

June 3	New York City, 11th Annual Automobile Outing for Orphans; Orphans' Auto. Day Assn. of N. Y.
June 3	New York City, N. A. C. C. Annual Meeting.
June 7-11	San Francisco, Cal., National Electric Light Assn.
June 9	Galesburg, Ill., 100-Mile Race, Galesburg District Fair Assn.
June 11-12	Effingham, Ill., Hillclimb and Fuel Economy Test. Salt Creek Hill, Effingham Automobile Club.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14	San Antonio, Texas, Jitney Convention.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 15-17	Chambersburg, Pa., Run to Atlantic City.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Utica, N. Y., Hill Climb, Automobile Club of Utica.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
July 5	Visalia, Cal., Road Race, Tulare Co. Auto. Assn.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Races.
Sept	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 8-11	Hamline, Minn., 2-Day Meet at State Fair Grounds between Minneapolis and St. Paul, State Fair.
Sept. 13	Oakland, Cal., Pan-American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct	St. Louis, Mo., Show, Forest Park Highlands, St. Louis Automobile Manufacturers and Dealers' Assn.
Oct. 1	Minneapolis, Minn., Track Race, Twin City Motor Speedway Co.
Oct. 1-2	Trenton, N. J., Track Races, Inter-State Fair.
Oct. 2	New York City, Sheepshead Bay Motor Speedway Track Meet.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show, Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.
March	Boston, Mass., Truck Show, Mechanics Bldg.

Polack Tire in Detroit—The Polack Tyre Co., New York City, has opened a Detroit store at 605 Woodward avenue.

Moves into New Quarters—The Springfield Buick Co. has moved into its new salesrooms and service station at 650 Main street, Springfield, Mass.

A Carload of "Velvets"—The John W. Blackledge Mfg. Co., Chicago, has shipped a carload of shock absorbers to E. A. Patterson, distributor for Kansas.

Chicago Battery Office Moved—General Lead Batteries Co., Newark, N. J., announces the removal of its Chicago office to 219 East Twenty-fourth street.

Wheeler & Schebler Branch Moved—Wheeler & Schebler have moved their Chicago branch to 2021 Michigan avenue with larger and better accommodations.

Vining Has Moved—R. W. Vining, who handles the Paterson car in the New England territory, with headquarters in Boston, Mass., has moved from 320 Newbury street to 16 Columbus avenue, in the Motor Mart.

New Horseshoe Tire Dealer—The Racine Auto Tire Sales Co., Indianapolis, Ind., has opened a salesroom at 60 West New York street, and will act as state distributor for the Horseshoe tires, which are made by the Racine Auto Tire Co.

New Detroit Supply Cos.—The Auto Supply Store, Detroit, Mich., has opened for business at 680 Woodward avenue, with a complete line of accessories and supplies. The Detroit Distributing Co. has opened quarters at 799 Woodward avenue.

Baltimore's New Public Garage—Frank Baumeister has completed a public garage, up to date in every particular, at 13 South Bethel street, Baltimore, Md. Obstructing pillars are eliminated and the place has been fitted with many labor-saving devices.

Chevrolet at New Haven—The Chevrolet Motor Co. has opened a branch at 226-228 George street, New Haven, Conn., and J. H. Whalley, for the past 4 years with the Hartford Buick Co., has been appointed manager, with Edward Burns in charge of sales.

Goodyear Closes N. Y. Retail Store—The Goodyear Tire & Rubber Co. has discontinued its Broadway retail store in New York City. It has opened a service station at 207 West 50th street. Business will continue under the direction of P. W. Smith, present branch manager.

Takes on Miller Tire—The Knight Garage, Inc., at 249-263 George street, Manchester, N. H., has just taken the Miller tire agency as another of its accessories. The garage is being rebuilt and it will handle the Stewart-Warner speedometer service when the work is finished.

Leavitt's New Bldg. Completed—The four-story building erected by J. W. Leavitt & Co., Seattle, Wash., Pacific Coast distributor of Overland cars, was completed this week. It provides a total floor-space of 36,000 square feet and is one of the largest and best equipped automobile establishments on the Pacific Coast.

Start Their Own Firm—Edward N. Tarbell, for the past 7 years manager of the Post & Lester Co.'s Springfield, Mass., branch, and B. Waters, manager of the Albany and Worcester branches of the company, have formed the Tarbell-Waters Co., at Springfield, Mass., and opened an accessory store at 275 Bridge street, carrying a large line.

New Oklahoma City Co.—The Oklahoma Tire Construction Co. is a new establishment in Oklahoma City, Okla., having opened up at 202 West Second street to reconstruct tires. Another new concern is the Oklahoma Rubber Co. that has opened at 623 North Broadway. This company will make a specialty of quick tire repair service to all motorists in trouble around the city.

Will Operate Own Repair Dept.—C. E. Cain & Son, operating a garage at Waupaca, Wis., and leasing the repair shop to outside parties, has decided to establish its own repair department and also an accessory and supply store. Tom Halverson, former occupant, has arranged for space with the A. M. Hanson Garage Co. and will operate not only a shop but a selling agency and supply department.

Seattle Co. Moves—Rothweiler & Co., Seattle, Wash., distributor of Cole automobiles in the Puget Sound country and sub-agents for the Ford in Seattle, has moved into its new two-story brick building at Denny Way and Broadway.

Jones Auto Lock in Tacoma—Ben Wold, secretary of the Griffith Motor Car Co., distributor of Dodge cars in Tacoma, Wash., has taken the agency for the Jones Auto Lock.

Invading Milwaukee's Residential Section—One of the oldest and finest residences in Milwaukee, at the northwest corner of Grand avenue and Eleventh street, is being razed to make way for a business block, the first tenant to be the Auto Mart, now located at 225 West Water street, with a Ford branch at 809 Grand avenue. The Auto Mart has taken a 5-year lease on the building to be erected for completion July 1.

Buys Big Service Bldg.—The J. C. Tucker Co. has bought from the General Fire Extinguisher Co. two large buildings near its present service station on Exchange street, Providence, R. I., so that it will have more room to care for owners of Chase and Vim vehicles, for which it has the agency. The present service station it occupies is claimed to be the largest in the State. When the new buildings are remodeled the main offices now at Narragansett Pier will be moved to Providence.

New St. Paul Agencies—F. Joswich, of the Joswich Manufacturing Co., St. Paul, Minn., has opened the local agency for Chandler cars at 382 Cedar street. H. F. Hine has leased a building at Main avenue and 6th street for the local agency for Federal tires. The Hyatt Roller Bearing Co. of Detroit has established a Northwestern agency at 1400 Hennepin avenue, covering Minnesota, the Dakotas, Montana and Iowa. N. S. Swan, of Boston, in charge. The Heinze Electric Co., Lowell, Mass., has opened a Northwestern branch at 33 11th street S.

New Detroit Service Co. Formed—In conjunction with the Gordon Auto Sales Co., Detroit, Mich., which handles the Chandler, Dort and Ohio, there has been formed the Detroit Motor Service Co., which will take care of the service department of the Gordon company. Headquarters are at 1000 Woodward avenue. Those in charge W. W. Case, former manager of the service department of the Anderson Electric Car Co., H. W. Shay, former foreman in the same department, and E. H. Monasmith, former assistant electrical engineer of that firm.

Chandler's Washington Headquarters in Seattle—Hereafter the Chandler car will be represented in Seattle, Wash., by the Northern Motor Car Co., 909 East Pike street. This company has had the distribution of these cars in Western Washington for some time, but heretofore has maintained its quarters in Tacoma. Its headquarters and service station will hereafter be in Seattle, although it will continue to maintain its branch in Tacoma, where in addition to the Chandler it is distributor for the Maxwell. A branch is also maintained in Olympia and Chehalis, Wash.

Minneapolis Dealers Erect New Homes—The Walter S. Milnor Co. is erecting at Harmon place and 12th street, Minneapolis, Minn., a two-story brick automobile building, 98 by 157 feet, to cost $75,000, to be ready August 1. The corner section, 38 by 157 feet, will be occupied by the Western Motor Supply Co., and the remainder for the shop and garage of the building company. The garage will accommodate fifty cars and twelve in the shop. The Parker Garage at 10th street and Mary place is having a second story. The change called for engineering skill, as the roof had to be raised seven feet, and it is 125 by 168 feet in dimensions. The garage is in constant use. The work will be done July 1. E. W. Decker will erect at Harmon place and 15th street a $50,000 building for the Twin City Motor Co. It will be two stories.

(*Continued on page* 1012)

Automobile Agencies Recently Established

PASSENGER VEHICLES

Pennsylvania

Bellefonte	Oldsmobile	Palace Garage
Biglerville	Saxon	S. G. Bigham
Chambersburg	Saxon	National Auto Co.
Donora	Chandler	R. M. Ridgely
Harrisburg	Pilot	C. H. Mank
Lebanon	Monarch	I. F. Urich
Oil City	Saxon	Garvey & Malerich
Pittsburgh	Premier	Pittsburgh Meteor Co.
Reading	Saxon	Reading Optical Co.
Sewickley	Chandler	Auto Service Co.
Spring Mills	Saxon	L. C. Lee
Wilkes Barre	Premier	J. S. Niver

Rhode Island

Providence	Premier	J. O'Donnel
Providence	Scripps-Booth	A. J. Howard

South Dakota

Brookings	Studebaker	F. C. Fryer
Canton	Studebaker	Sundrold & Kolsrud
Yankton	Oldsmobile	E. F. Nyberg

Tennessee

Lexington	Studebaker	Brown Bros.
Memphis	Premier	Premier Sales Co.
Newport	Chandler	J. R. Seehorn
Rogersville	Saxon	Kenner & Co.

Texas

Abilene	Chandler	A. E. Cullum
Austin	Oldsmobile	W. T. Wroe & Sons
Austin	Premier	Ewell Nalle
Caldwell	Chandler	J. F. Cobb
Cuero	Oldsmobile	E. S. Hall
Galveston	Chandler	Taylor Motor Co.
McKinney	Studebaker	R. L. Crockett
Memphis	Saxon	W. Wilson

Utah

Gunnison	Oldsmobile	J. W. Edwards
Orderville	Oldsmobile	H. Chamberlain
Salt Lake City	Beardsley Electric	R. F. Baurer
Tooele	Oldsmobile	J. H. Tate

Virginia

Bristol	Oldsmobile	Bristol Hardware Corp.
Martinsville	Chandler	T. G. Burch
Marion	Chandler	Marion Auto Co.
Portsmouth	Moline	Portsmouth Mch. Wks.
Pulaski	Chandler	P. C. Massey
Wytheville	Chandler	Pierce & Company

Washington

Aberdeen	Pilot	J. H. Pittenger
Olympia	Chandler	V. E. Myers
Olympia	Chandler	A. N. Dazy
Tacoma	Beardsley Electric	M. F. Lindsay

West Virginia

Huntington	Saxon	H. F. Shank
Huntington	Stearns	W. N. Rarden
Parkersburg	Premier	J. J. Crotty

Wisconsin

Algoma	Argo	Haney, Gasper White Co.
Berlin	Oldsmobile	Johnson Fortnum Mch. Wks.
Brillion	Studebaker	R. A. Schultz
Brodhead	Briscoe	H. E. Everson
Delavan	Franklin	W. H. Stewart
Dodgeville	Reo	G. Elvod
Eau Claire	Chandler	Storley Auto Co.
Ft. Atkinson	Chevrolet	Vance & Roos
Ft. Atkinson	Briscoe	North Side Garage
Ft. Atkinson	Metz	North Side Garage
Galesville	Oldsmobile	A. J. Olson
Forestville	Case	A. Jennerjohn
Galesville	Overland	A. J. Olson
Gillette	Buick	Gillette Machine Co.
Grand Rapids	Moline	C. L. Duncan
Grafton	Oldsmobile	Clausing & Kranz
Green Bay	Grant	West Side Garage
Greenwood	Maxwell	Arlis & Buker
Kewaunee	Dodge	Dvorak & Gaynor
Ladysmith	Ford	Ryall's Garage
Lake Geneva	Ford	Lowty Brothers
Marshfield	Cadillac	Lang & Sherman
Marshfield	Grant	H. Wegner
Milwaukee	Baker	L. & H. Auto Sales Co.
Milwaukee	Crow Elkhart	J. Tellier Auto Co.
Milwaukee	King	Lauson Salentine Co.
Monticello	Chevrolet	Freitag & Benkert
New Richmond	Buick	F. A. Henry
New Richmond	Chevrolet	Lynch Brothers
New Richmond	Cornelian	R. L. Miner
New Richmond	Reo	Auto Equipment Co.
Reedsburg	Moline	A. Seifert Hdwe. Co.
Rhinelander	Chandler	C. A. Conro
Rice Lake	Briscoe	F. M. Smith
Rice Lake	Hupmobile	F. M. Smith
Schleisingerville	Oldsmobile	Klettin Brothers
Sturgeon Bay	Saxon	L. H. Nebel
Two Rivers	Oakland	J. Hamacheck & Sons
West Bend	Paige	F. W. Benkendorff
West Bend	Saxon	F. W. Benkendorff

Wyoming

Basin	Cartercar	G. R. Hoover & Co.
Basin	Metz	G. R. Hoover & Co.
Chugwater	Detroiter	F. Johnson
Ft. Steele	Metz	R. G. McGrew
Hudson	Chandler	H. O. Barber
Thayne	Metz	G. Hemmert

COMMERCIAL VEHICLES

California

Sacramento	Moreland	C. M. King

Indiana

Richmond	Koehler	Shirley & Gaar

Kentucky

Louisville	Republic	P. M. Andriot & Sons
Louisville	United States	Louisville Auto Exchange

Massachusetts

Boston	Rowe	E. F. Bunker
Boston	Denby	Denby Motor Truck Sales Co.

Michigan

Adrian	International	City Garage

Missouri

Eureka	Koehler	T. Blomes
Richwood	Koehler	Kagay Bros. & Shaffer

Nebraska

Hastings	Koehler	S. Schultz

New Hampshire

Manchester	G.M.C.	Bourne & Sons

New York

Cadyville	Koehler	F. M. Murray
Westbury	Koehler	M. Knipfling

Ohio

Bellefontaine	Koehler	Ford Sales Co.
Richwood	Koehler	Kagay Bros. & Shaffer

Tennessee

Nashville	Republic	Hatsfield Auto Co.

Utah

Ogden	G.M.C.	Fell Wright Co.

Virginia

Lynchburg	Koehler	Bowles Auto Repair Co.

Washington

Harrington	Federal	G. A. Kitt

Wisconsin

Rhinelander	Overland	Oneida Garage Co.
Schleisingerville	Oldsmobile	Kletti Brothers
Spooner	Imperial	Sutter, Simpson & Stengel
Spooner	Dort	Sutter, Simpson & Stengel
Spooner	Overland	Sutter, Simpson & Stengel
Spooner	Dodge	Sutter, Simpson & Stengel
Spooner	Buick	Sutter, Simpson & Stengel
Sturgeon Bay	Saxon	L. H. Nebel
Whitewater	Moline-Knight	A. A. Coburn & Son

The Week in the Industry (Continued)

Takes K-W Road Smoother Agency—R. S. Millard, of 1840 Euclid avenue, Cleveland, O., has taken the agency of the K-W road smoothers in connection with handling Hickmeyer devices.

Farewell Banquet Given Mansfield Men.—A farewell banquet was given at Mansfield, O., recently in honor of three employees of the Mansfield Tire and Rubber Co., who were transferred to the Columbiana Tire and Rubber Co.'s plant. They were E. A. Krannich, superintendent; L. J. Smith, production man, and Vern Andregg, who becomes assistant superintendent of the Columbiana plant.

Gasosava Office in Jeffersonville—The Auto Gas Saver Distributing Co., distributors of Gasosava, has opened an office at 1207 Spring street, Jeffersonville, Ind. It is claimed that the new device actually saves from 30 to 40 per cent. gas consumption, reduces carbon deposit, makes the engine run smoother by giving an even mixture, increases the mileage from 25 to 50 per cent. and prevents backfire.

Recent Wisconsin Garage News—J. R. Williams and George Richards, Winneconne, Wis., have formed a partnership to engage in the garage and repair shop business. A garage will be erected at once for the new concern by E. R. Williams, father to the senior partner. Sutter, Simpson & Stengel, Spooner, Wis., agents for several leading lines, the business being conducted in connection with a large wholesale and retail lumber business, have broken ground for a modern garage building to cost $5,000. It will be of brick and steel construction, one-story, 50 by 90 feet, and equipped with a complete repair shop. C. S. Anderson, an expert mechanic, of Lake Geneva, Wis., is establishing a general machine and automobile shop in that city and will make a specialty of sheet metal work.

Recent Michigan Garage Changes—John Cox, distributer for the Dort, Hollier and Paige cars in Flint, Mich., has leased the old Matson blacksmith shop, which will be remodeled and made into a garage and salesroom. Green & Judson, Fenton, have purchased the garage business of Ed. Jennings. Koontz & Troy, St. Joseph, are having a new garage erected on Main street. It will be 44 by 132 feet in size. W. R. Campbell, of Evart, has sold his garage to E. S. Gough. D. J. Miller, Diamondale, has purchased the Old Creamery building and will start into the garage and automobile repairing business, making a specialty of Ford cars. S. B. Campbell and Karl Steen have opened an automobile and machine shop in the Coe Mfg. Co. building, Fenton. The J. C. Cristy Sales Co., Pontiac, agent for the Studebaker cars, has opened its new showroom at 199 South Saginaw street. A. B. Winans, of Nashville, has opened a new garage and repair shop. M. E. Donnelly has opened a garage and taxi service at Sixth avenue and Chippewa street, Flint. The Wolverine Auto Co., Lansing, has bought the Coliseum Rink, East Ottawa street, and will remodel it as a garage, with showrooms for cars and accessories. The Kalamazoo Implement Co., Kalamazoo, Studebaker distributor, has moved into its new quarters at 114 East Water street. The old garage at 115 East Water street will be used as service station and repair shop. Ames & Unger, of Belding, Mich., have opened a garage and machine shop. An automobile accessory and supply showroom has been opened in connection with the other business.

Our national advertising campaign now running in the Saturday Evening Post—and in every important motor car paper—is carrying to millions of readers the message of DANN

SUCCESS

—one of the biggest in the history of the motor car industry DANN Insert is a wonderful production Motorists have waited for a ***perfect*** shock absorber for ten years They got it finally in DANN Insert

A Success? Our factory is swamped with orders—working overtime to meet the demand! DANN Insert took the motorists of two continents by storm

The tremendous interest of Ford owners proves that at $8 they realize that the greatest Ford shock absorber on the market is—

DANN INSERT

"The Inter-leaf Shock Absorber"

$8
for FORD CARS

DANN Insert places a real shock and vibration absorber in direct contact with every square inch of vibration and shock conducting surface of all four springs.

Every one of the [illegible] Ford owners [illegible] DANN Insert [illegible] his car at a [illegible] its installation at once.

DANN Insert [illegible] for all makes and models of cars. It is the only shock and vibration absorber [illegible] in direct contact with every square inch of shock conducting surface of the springs. It is the only [illegible] shock absorber, operating from the [illegible] throughout the length and breadth of the springs. Every car needs DANN Insert. Write for new booklet "[illegible] of the Inter-Leaf Shock Absorber." Use the coupon.

DANN Oil Cushion SPRINGS with DANN Insert ready installed can be supplied for all makes and models of cars. Write.

DANN SPRING INSERT COMPANY
2282 Indiana Avenue, Chicago

DANN SPRING INSERT CO., 2282 Indiana Ave., Chicago.
Please send me booklet "The Story of the Inter-Leaf Shock Absorber."

Name..

Address..

Car (make, year and model)..

$325 Less Than Last Year

This 1916 Overland is essentially the same as our 1915 Overland—the famous Model 80 that sold for $1075. It is the largest four cylinder Overland that will be produced this season.

Specifications:

- *35 Horsepower Motor*
- *High-tension magneto ignition*
- *5-Bearing crankshaft*
- *Thermo-syphon cooling*
- *Underslung rear springs*
- *33" x 4" tires: Non-skid in rear*
- *Demountable rims: with one extra.*
- *Electric starting and lighting system*
- *Headlight dimmers*
- *Rain-vision, ventilating type, built-in windshield*
- *Instrument board on cowl dash*
- *Left-hand drive, center control*
- *One-man top and top cover*
- *Magnetic speedometer*

Overland dealers are showing samples *now.*

New catalogue is ready. Please address Dept. 38.

The Willys-Overland Company, Toledo, Ohio.

"Made in U. S. A."

New Models Now on Display at the Panama-Pacific Exposition.

Automotive Industries

JUN 11 1915

HOUGH BRANCH

MAGAZINE LOAN COLLECTION

140

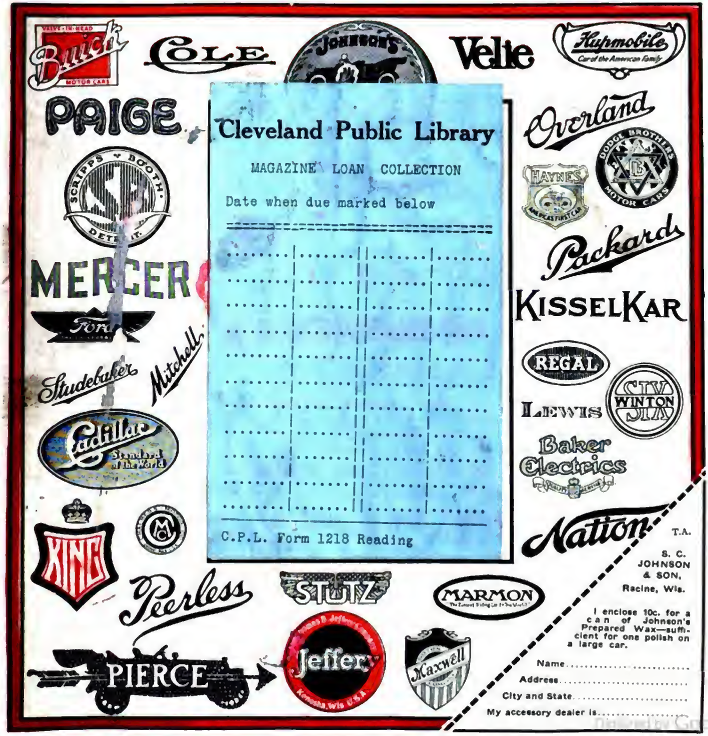
The AUTOMOBILE

MAGAZINE LOAN COLLECTION

Vol. XXXII
No. 23

NEW YORK, JUNE 10, 1915

Ten cents a copy
Three dollars a year



T.A.

S. C. JOHNSON & SON,
Racine, Wis.

I enclose 10c. for a can of Johnson's Prepared Wax—sufficient for one polish on a large car.

Name........................

Address........................

City and State........................

My accessory dealer is........................

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

BRISCOE

Individuality stands out all over the BRISCOE car. It is not a copy but a creation, possessing an air of exclusiveness that makes an instant appeal to every buyer—built to stand up indefinitely.

In representing the BRISCOE, you are selling a car that gives the purchaser greater value than anything else at anywhere near the price.

You are offering a foreign car, with all that term implies—an automobile of French design mechanically, as well as in graceful foreign body lines—*at an American price.*

The prospect feels instinctively that here is a car singularly worth while, and the more he studies it, the more positive he becomes—an enthusiastic worker on your behalf—a more valuable sales agent than money could buy.

This is one of many reasons that make the BRISCOE the easiest and most thoroughly satisfactory car for dealers to handle.

CONSIDER THE BRISCOE, FROM ITS UNUSUALLY SMART EXTERIOR TO THE INNERMOST PARTS OF ITS MECHANISM, AND YOU WILL FIND BY FAR THE BIGGEST VALUE, DOLLAR FOR DOLLAR, TO BE FOUND IN ANY CAR.

A liberal contract is offered to all responsible live-wire dealers who wish to increase their profits by the sale of BRISCOE cars. But territory is being allotted fast right now. Better get in touch with us without delay.

BRISCOE MOTOR COMPANY INC. JACKSON MICHIGAN

Vol. XXXII New York—Thursday, June 10, 1915—Chicago No. 23

The AUTOMOBILE

Special automatic machines working on shells for the famous 75 millimeter guns in a French automobile factory

War Rushes French Plants

Automobile Factories Working 24 Hours a Day on Ammunition, Aeroplane and Military Supplies

By W. F. Bradley

Special Representative of THE AUTOMOBILE with the Allied Armies in France

PARIS, May 26—French automobile exports have almost ceased to exist, private sales have been reduced to an insignificant figure, and yet the automobile factories of France have bigger staffs and higher pay-rolls than in normal times. The explanation of the apparent anomaly is that the automobile factories of France are a part of the war machine, and as such are working on the production of the material most necessary to the troops in the field.

The war trumpet cleared the automobile factories of men quicker than the dinner bell ever accomplished it. A few weeks fighting showed that the guns were using up ammunition faster than the state factories could furnish it, that the number of guns was altogether insufficient for modern requirements, and that the automobile service would have to be increased on a scale undreamed of by the most enthusiastic supporters of mechanical traction.

So far as the automobile factories were concerned, this work of supplying material was entrusted to the Service des Forges, which took on its staff the officials of one of the leading automobile trade associations, corresponding in general to the National Automobile Chamber of Commerce, Inc., in America. This association, knowing every detail of the automobile trade, could organize resources much more efficiently than the war department itself was capable of doing.

There were no men, for in the middle of September three-quarters of the automobile factories of France were closed down. The manufacturers who had accepted contracts for army material drew up lists of the engineers and workmen they required to complete such work. Soldiers in the trenches, in forts, and at bases, received orders to return home and take up their ordinary work. These men threw off the uniform, but they did not cast off military obligations. They received the wages they had been drawing before the war, compared with the payment of 1 cent per day while in the field, but they had no right to change their employment for higher pay or any other reason. It is with such military controlled workmen, supplemented by those who are free from army obligations, by refugees from the northern provinces of France and by thousands of Belgians, that the French automobile factories are manned at the present time.

The most important work undertaken by the factories is the production of the famous 75 millimeter shells. No figures can be given, but it is possible to state that the output of such shells is prodigious. Many factories are producing as high as 5,000 shells every 24 hours. The army provides the steel bars; the factories cut the bars to length, bore them, turn them, shape them under the steam hammer, heat treat them, test the metal for hardness, test the shell under hydraulic pressure, make and fit the time fuse, clean and pack them, then send them to the state powder factories.

Big Demand for Automatics

A fixed price is paid per shell. As many small shops with only a dozen or so men and very poor equipment are able to make a living wage on the army contracts, it is possible for the big firms, well stocked with automatic machinery, to clean up a substantial profit. This special war work has caused an enormous demand for American automatics, although the heads of some American machine tool firms in France deny that business is good. It is only necessary, however, to see the stacks of machinery at the various ports, and to note the additions in the factories, to realize that the American manufacturers are well supplied with orders. There are factory buildings around Paris which for years have stood empty, but which since the outbreak of the war have been filled with American machinery exclusively for the production of shells and other war material. Many examples could be given of small men who had the foresight at the beginning of this period to purchase a few automatics and accept army contracts. Within 3 months many of these men have wiped off the entire first cost of the machinery. The head of one of the leading French factories remarked to the writer: "The public notes that we are not delivering cars and assumes that we are in a poor condition. As a matter of fact we have more men employed than at any period of the firm's history; if the war stopped today we should still have 6 months' contracts in hand, and we are not losing money on any job we undertake."

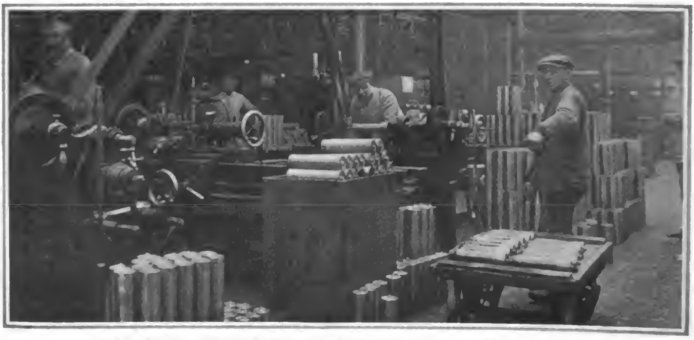
High-Power Aeroplane Motors Wanted

In addition to shells, the automobile factories are well equipped for producing tripods for quick-firing guns, aeroplane darts and bombs, aeroplanes and aeroplane motors, and of course the usual automobile material for military purposes. The quantity of aeroplanes and aeroplane motors required is one of the many surprises of this war. This matter does not particularly concern automobile manufacturers, although some French car manufacturers are building aeroplanes in their body shops, but it is worth noting that the monoplane has practically ceased to exist. Bleriot, the leading monoplane manufacturer, is supplying no more machines to the army, and is reduced to building biplanes for a rival firm. The objections to the monoplane are difficult vision and lack of weight carrying capacity. This change resulted in the adoption of higher powered motors and the use of a greater number of fixed motors than formerly. More Farman biplanes are supplied to the army than any two other makes combined. As nearly all these aeroplanes are fitted with the Renault eight-cylinder air-cooled motor, the result is a very great demand on this firm's resources. One aeroplane motor firm employing 300 men before the war is now running with a staff of 1,500.

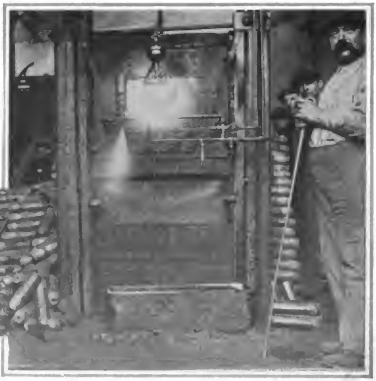
Although the French factories are capable of producing a small number of touring cars, they are not seeking to develop business on these lines. Cast steel parts are rare, forgings are difficult to get. As an instance, one firm having to purchase a set of axles to complete a series of cars, was obliged to pay $26 each for a forging which originally cost $4. When present stocks are exhausted, it will be impossible to produce more cars. Even those firms well stocked with material and having facilities for assembling are not trying to increase sales, for they realize that prices are bound to rise and that the demand will not fall off. Already prices have gone up. The rise began with the abolition of discounts. It was followed by a positive increase. Peugeot has placed $100 on the price of its medium cars. Darracq has increased the price of a $1,900 car by $500. Corresponding increases have been made in all other factories.

Castings and Forgings Required

Attention has been paid to the possibility of getting material, principally castings and forgings, from America. Up to the present factory managers do not appear to have secured what is needed. They state that American firms do not produce just the kind of material they need and are not sufficiently impressed with the size of the orders to go out



Typical scene in a French automobile factory, showing the manufacture of 75 millimeter shells of their way to make it specially for them. This problem of material is the most serious of the several automobile manufacturers have to face. Most of the forges and foundries are in the north, in the hands of the enemy. It is not known in what condition they will be when the Germans are driven out, nor what length of time must elapse before they can be put into working order. Even under the most advantageous conditions there must almost inevitably be a period during which the automobile factories will be held up by reason of shortage of material. One Belgian firm famous for its stampings, declares that it has got over the difficulty, and will resume business at the cessation of hostilities on the same scale as before, and without a moment's delay. The firm, which does not wish its name to be published, has opened a special factory in England, where it is already producing for the Continental automobile trade. If the Belgian factory, at present intact, should be destroyed, additions will immediately be made to the English establishment. If the Belgian works escape they will be manned immediately after the war to supplement the English factory. Practically the whole of the expert staff has emigrated to England and has been kept in the service of this company. This is a particularly favorable case due to energetic management. On the other hand, there are supply firms which will have the greatest difficulty in returning to the old conditions.



The heat-treating departments of the French automobile factories are now used for heat treating shells

No Paris or London Show This Year

There can be no automobile show in either Paris or London this year. The earliest possible date for a show is at the end of 1916. The war has not had the effect of stopping experimental work. It would be possible to mention the names of several French firms having been able to prepare entirely new models, and of others having incorporated improvements in ante-war cars. This has been rendered possible by the fact that the heads of departments have in most cases been returned to the factories to supervise the production of war material and while doing this can also undertake experimental work. Although new models are being designed, built and tested, it is altogether impossible to build them commercially, and no such steps can be taken until the close of the war. The point is that there will not be the serious gap in the course of development which might have been supposed by a person viewing the situation from a distance. The fact, too, should not be overlooked that every make of car on war service is being subject to a test which was never dreamed of in peace days. Manufacturers are learning lessons. As instances, one of the biggest and most successful English firms has had an epidemic of broken steering knuckles, a defect which was unknown before the war; another make of car has so frequently failed in the matter of suspension that it has been redesigned in this respect and a third has finished with thermo-syphon cooling.

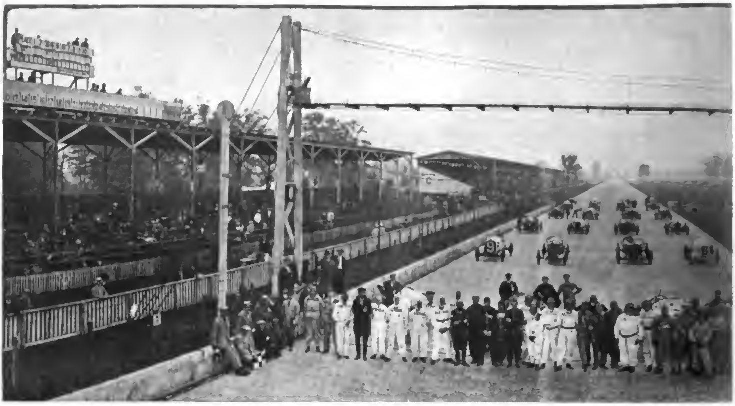
No One Would Buy Cars

Internal conditions in France are such that even if cars could be built nobody would buy them. Every car owner is liable to have his machine seized for military purposes, and with the possibility of losing $100 on the transaction, there is little inducement to purchase a new car. The only cars free from the attacks of the requisition officer are light, low-powered two seaters or cars having been in service more than 3 years. It is a difficult matter to evade the army impressments. Every automobile in France figures on a military census, together with all particulars regarding it down to the make and size of the tires. Some owners who wish to keep their cars for future service have had the idea of sending them to garages to be overhauled; giving instructions that the work should occupy several months; others have sent their machines to the bodymaker for repainting and storage. These attempts at evasion are overcome by army officials visiting the garages, seizing the car in its incomplete condition, having it repaired at the military shops, and deducting the cost of the work from the price paid for the car.

Automobiling Discouraged

Apart from the requisition danger, the use of automobiles by the non-military public is discouraged. In many cases there is absolutely no reason for this, for there is abundance of gasoline, tires can be had in any quantity and the roads are not encumbered by the military. The writer has frequently made runs of 200 miles each, over main highways, without meeting half a dozen cars, either civil or military. For a depth of about 20 miles back of the 400-mile battle front, there is an army zone into which no civil automobile can penetrate. Behind this zone is a reserved army zone, varying in depth from 20 to 100 miles, to travel in which it is necessary to have a pass delivered by the military authorities; the pass must bear the photograph and signature of every person in the car; it is available for a single journey, on a determined date, over a clearly indicated route, and if used under any other conditions the holder is liable to punishment and loss of the car. Even to travel in and around Paris a special police pass must be obtained and renewed every fortnight. Many doctors in the reserved army zone are not able to get passes to use their cars. The system of examination on the road is not as vexatious as in the early stages of the war. It is sometimes possible to travel 100 miles without having to show the pass, for guards are only placed at the entrance to important towns and on important

(Continued on page 1029)



Line-up of the drivers, mechanicians, officials and other direct participants in the 500-mile annual sweepstakes at the Indianapolis motor traveling at a rate of nearly 90 miles

The 500-Mile Race in Retrospect

Engineering Effect on Touring Car Design Likely To Be Pronounced—Future of Sixteen-Valve Motor

By A. Ludlow Clayden

JUST as the French Grand Prix race at Amiens in July, 1913, showed that the super-tuned standard type of motor no longer had a chance in any classic contest, so has the Indianapolis 500 in 1915 made clear the fact that only highly special designs can hope for future successes in America. In previous years we have seen the foreign cars win because their engines were more powerful than those being made in America. In the race just run the same thing has happened, but it has happened by a much narrower margin. What the Stutz company can do other American manufacturers can and will do also, and it is safe to predict that the supremacy of the foreign made cars in American racing is at an end. Just as the Peugeot designs used in 1912 created the vogue of the sixteen valve racing motor in Europe, so will the Stutz success create the same vogue here.

Effect on Touring Cars

In early days of racing the design of the touring car was decided by the battles of the road, cars in the lump were so bad that the racing vehicle could not be any stronger or more powerful than the car needed by the average private individual. So each year saw new ideas tried out on the road in contest with other people's ideas and the good notions survived, appearing in the next season's cars. Gradually, however, the effect of racing grew less easy to observe, first were eliminated the breaking of frames and axles, the dislocation of steering gears and the dropping off of small parts. Next the high-tension magneto did away with ignition troubles and last the long stroke motor displaced the original "square" type with equal stroke and bore.

All these things had a direct and immediate effect upon the touring car, and during 1910, 1911 and 1912 little motor details such as valve proportions, compressions, stroke to bore ratios and carbureter design were tried out and the good ones incorporated in regular series production. With the 1913 season however, a great change came about. The truth was that the standard type of motor with L or T head and two valves per cylinder had been made efficient up to the limit. The last ounce of power per cubic inch had been got from it and engineers were at the end of their resources.

Then along came the overhead valve Peugeot and showed the way to get greater power still, setting the new fashion in racing car construction. This motor was practically all the novelty in the chassis and it was good, yet we did not find the racing of 1912 reflected in the touring cars of 1913, not even in 1914 did the overhead-valve motor become popular among European touring car manufacturers and the new designs that were ready for 1915 and which have been with-

speedway before the start of the five-century grind on May 31, in which all speed records were broken by Ralph DePalma in the Mercedes an hour around the 2.5-mile track

held were not strikingly different from the standard practice of previous years. Either engineers did not consider the ultra high-efficiency motor as necessary for a touring car, or they were afraid of it.

Limit of Practicable Speed

Power was got from the types of motors used for racing previous to 1912 by increasing the revolutions per minute a great deal and increasing the force of the explosion a little. Greater power was got from the overhead valve motors by a little increase of speed and a considerable increase in the explosion pressure and in 1914 the speeds were increased again and a trifle added to the pressures.

Now, if the weight of the reciprocating parts, the size of the bearings and all other things are the same the motor which operates at the lesser speed will have the longest life, within reasonable limits and the life of the motor is also probably in fairly direct proportion with the force of the explosion. In a touring car there are so many things to be desired *in addition to power* that it becomes questionable how far it pays to go in crankshaft speed and cylinder pressures.

In 1912 it was a general opinion among British engineers that the usual touring car of 1915 would have a motor capable of 4,000 r.p.m. and geared about five to one. In 1914 these same engineers had found out that cars put into the hands of the ordinary user with motors intended to run frequently at 3,000 to 3,500 r.p.m. were likely to give trouble. They were extremely susceptible to carbon formation, called for extreme care in lubrication and were distinctly likely to wear out the connecting-rod bearings. Also they needed a good deal of keeping in good condition, a little slack on the valve tappets had a great effect upon the power, the engines were liable to become very noisy unless well looked after, and the carburetion was rather difficult.

Naturally these experiences did not encourage the idea of using a still more efficient type of motor and the general feeling in Europe just before the war was that it would need a few years more of racing before the overhead valve engine with sixteen valves could be worked out sufficiently to take a place in scheduled production. It may be observed that even the Peugeot company have never put out a series car in any way resembling their racing machines.

Overhead Valve Limitations

Made with a normally low efficiency, or perhaps it would be better to say a normally high power function, the overhead valve motor has been a great commercial success in America and has been used a good deal in Europe but this sort of engine has little akin to the racing motor. There is but little virtue in overhead valves *per se*, the reason they are used for racing now is simply that with them it is possible to get the greatest valve opening and so the highest speed revolution and the highest cylinder pressure. It is difficult to get quiet running with a large valve opening because a large opening means a large area of valve head and valve seat. It is similarly difficult to obtain quietness with a motor capable of very high speeds because they are got only by the use of quick lift cams which let the valves down fast instead of lowering them gently to their seatings and a quick valve descent means a snap as the valve meets the seat. We have never yet made use of the highest efficiency type of L head motor or the highest efficiency possible with two overhead valves so there is plenty of opportunity for power increase in touring car motors without going to the more expensive sixteen valve construction. This is not to say that it may not come some day, but merely to point out that there are reasons why the supremacy in racing of a particular type of motor does not make it *necessarily* desirable for ordinary cars.

Probably the most useful thing in racing experience today from the future private motorist's point of view, is the opportunity it affords for testing new materials. From racing experiments engineers find out valve metals that will

At one time during the race two of the three Maxwells were at the pits for tire changes and the pit crew had to put on top speed

stand and valve metals that burn up and, while the latter may give good enough service in a touring car it is certain that the steel that is best for the racing motor will give the longest life in a touring engine. Similarly with valve springs, with spark plugs, with light piston alloys and with high pressure lubrication systems; all can be tried to the utmost limit on the race track and the good that is in either thing can be used to advantage on ordinary cars, but these things do not show to the eye, being known only to those intimately concerned. In the race just finished the most important thing learned is that light metals will stand up for pistons and other parts, and a piston that gives no trouble during a speedway 500 is good for many years' work on the road. It is not next year that we shall see these light alloys coming more into general use, but in 1917 the effect of today's racing will certainly show. We have now demonstrated the use of aluminum in new compounds; it remains to put the production of those compounds upon a commercial basis that will permit their use in huge quantities. The writing on the wall suggests that we shall see much lighter cars in a few years time by reason of racing in 1915.

The Question of Gearing

Turning back to the high efficiency motor for a moment there is another reason which retards its general adoption, especially in America, and that is the fact that its power is obtained by virtue of its speed. Now, to use a high speed motor we must use its speed or we shall have too little power, and to utilize the speed calls for a low top gear ratio and demands gear shifting. Anent this might be mentioned the case of a popular car which is sold for a moderate price and has a fairly large four cylinder motor. As sold the power reaches a maximum of about 35 horsepower, at under 2,000 r.p.m. The makers are well aware that a slight alteration to the camshaft would give them over 60 horsepower at a correspondingly higher rate of revolution, but if they used the higher power the ability of the car to crawl on top gear would be lost, it would be necessary to change to second speed fairly often in traffic and one could no longer go very slowly up hill without shifting. Thus the power is almost cut in two and the maximum speed reduced enormously in order to give the high gear ability demanded by the user. This may be good, it may be ideal from the user's viewpoint, that is neither here nor there; but it does show that there is potent reason against the general use of a high speed engine designed to run normally at almost double the revolutions of what is now called a high speed touring car motor.

Actually one might say that the racing motor is ahead of our ability to handle it.

Motor Overdeveloped?

Just for argument's sake let us imagine a new form of transmission in which we could run the motor at a very high speed without any noisy or inefficient reduction gearing. Suppose some method for giving us an eight to one high gear ratio without any loss of power and then we might consider the possibility of using a very small motor with very high speed capability. As things are, the habits of the driver engendered by the types of car given to him for 5 or 6 years past, the nature of the transmission, the natural disinclination to attempt a reconstruction of all our ideas concerning chassis design, these things militate against any great changes in the motor.

Given the money for working out the idea it is probable that a wonderful car could be built with a 4,000 r.p.m. motor, but it would need some new sort of gearing, some new kind of gear shifting, and a tremendous advertising campaign to educate the motorist in the use and handling of the new type of car. Which simply means that to change over now and suddenly to the ultra high speed engine would be a disadvantage to everyone. The motor is years ahead of the rest of the

Anderson's Stutz at the pits for a tire change at the end of a 100-mile grind car and we cannot put it to everyday use till the chassis has caught up in modernity. That we can go much further in motor development is to be doubted, racing car engineers hope rather to find materials that will enable the motors they have got to stand up to their own internal stresses and, if we are going to make daily use of the high-speed motor when it is got right, some one will have to develop a chassis system to suit it. Even the electrical transmissions as made at present do not seem any too promising for use in conjunction with motors far above the speed range of the ordinary.

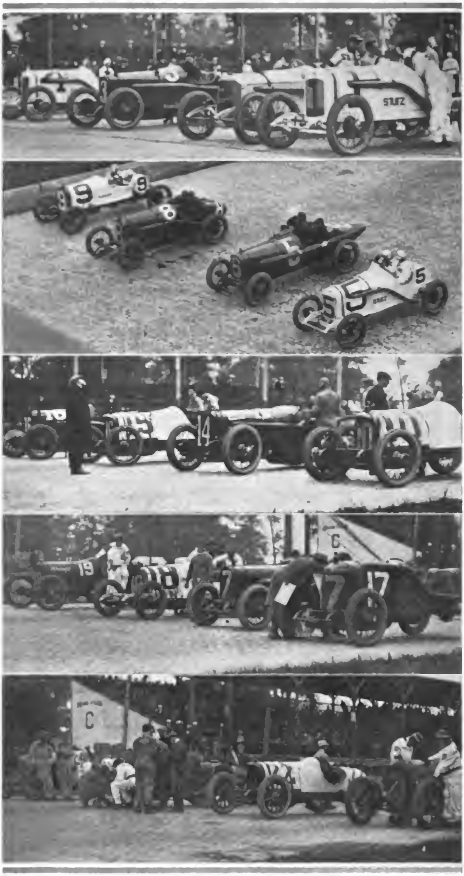
Analyzing the Troubles

It is perhaps most by analysis of the troubles that happen during a race that the lessons as they affect racing practice, are most easily appreciated. Those encountered by the Mercedes, the Peugeot and the Stutz were due to over stressed material rather than to faulty design so far as can be told. Perhaps the derangement of Resta's steering gear was due to the slacking off of a thrust adjustment merely, in which case the material ought not to be blamed, but the valve gear failures of one Stutz and the Mercedes are to be blamed on material without doubt.

Apart from these accidents far the most conspicuous trouble was with spark plugs. It was faulty plugs and faulty plugs alone apparently that put the sixteen-valve Maxwell out of the running, but it is not therefore to be assumed that the blame rests upon the plug maker. Rather it is more probable that in the motors where plug troubles were serious the point at which they were screwed into the cylinders was hotter than the corresponding point in the cylinders of the cars which had no plug trouble. Herein may lie a hint for makers of ordinary types of motor with a high power coefficient for it is well known that spark plugs do not give quite such good service in high speed motors as they used to do in the patterns most in use a couple of years ago. Since temperatures in engines rank higher as the power efficiency goes up it is safe to reckon that the faster burning up of plug points is owing to the higher heat. Just as it is necessary to care for the proper cooling of the valve seating and the parts of the cylinder adjacent thereto so is it desirable to keep the metal into which the plugs are screwed at the lowest heat.

Carburetion Lessons

Another thing which the race has shown is that there is no need to equip a racing car with a European carbureter. The success of the American instruments used on the Mercedes and Stutz shows this.



Line-up of the cars for the preliminary lap before the flying start. The pole is at the right and five of the six rows to start are illustrated, the first row being at the top and the others following in order. Drivers and cars are: Top—right to left—Wilcox, Stutz; R. De Palma, Mercedes; Resta, Peugeot; E. Cooper, Stutz. Second row—Anderson, Stutz; Porporato, Sunbeam; Burman, Peugeot; Klein, Kleinert. Third row—Alley, Duesenberg; Grant, Sunbeam; O'Donnell, Duesenberg; Babcock, Peugeot. Fourth row—J. De Palma, Delage; Von Raalte, Sunbeam; J. Cooper, Sebring; Carlson, Maxwell. Fifth row—Orr, Maxwell; Mulford, Mulford; Rickenbacher, Duesenberg; and Mais, Mais

The Engineers' Forum

The Cord Tire—Its Origin, Development and Construction—A New Flat Cord Type—The Ideal Tire

By John F. Palmer*

RIVERSIDE, ILL.—Editor THE AUTOMOBILE.—The question of the cord tire is uppermost in the minds of hundreds of thousands of motorists today, who have learned of the phenomenal performance of these tires on the racing cars at Indianapolis, where all of the eleven cars finishing the 500 miles were equipped with this type of tire. The cord tires in this race showed a marked improvement over those used a year ago, in that there was a noticeable absence of these tires being thrown from the rims, breaking of the bead, loosing treads with an exception or so, and being destroyed due to blow-outs. This race will unquestionably demonstrate the merits of the cord tire both from a standpoint of speed and also endurance. The race was one of the severest tire tests that could have been imposed, the average of 89.84 miles per hour for 500 miles being without parallel in racing history.

Origin of the Cord Tire

The name cord tire originated in England, about the year 1900, when the conventional type of cord tire was first used on automobiles to distinguish it from a lighter cord tire used on bicycles for 7 or 8 years previous. The original bicycle tire was known as the Palmer and the tire for automobiles known as the Palmer cord. The Silvertown cord tires, used on all the cars finishing at Indianapolis, is the English Palmer cord, made under license in this country by the Goodrich company.

While the present cord tire has shown its right to consideration, the writer believes that the final chapter in its development has not yet been written, and that much can be done in the way of improving the cord tire as well as in reducing the air pressure permissible.

In 1848 an Englishman named Thompson conceived the idea of binding a column of air on the rims of vehicle wheels as a cushion or insulation against the shocks due to road inequalities. Such was, and is the fundamental idea of a pneumatic tire. Its practical application has engaged the attention of a long line of inventors, as contributors to the better expression of the Thompson idea as applied to vehicles carrying their own power.

The idea of an air tire is old, yet it was 40 years or more, in the early '90's, before it was made of practical value, when J. W. Dunlop, a Dublin veterinary surgeon, applied it to the wheels of a bicycle, and the air tire came into its own, making possible comfortable road travel at high speed as compared with the then existing means and as well methods of construction of vehicles, bicycles and automobiles.

Two Requirements

None has ever found a better cushion than air; it has no fatigue point, it stores and returns the energy used in compressing it as opportunity offers and is always on duty, provided the conditions of such service are present, viz.: 1—An envelope impermeable to air under pressure that will bend out of its normal circular shape without friction or resistance other than that of the air it contains. 2—In addition to fulfill other and heavier duties, some contradictory in their nature.

Fine para rubber properly treated and vulcanized best meets the first condition. The second is the real problem; of what material and how to make that portion of the envelope that cares for all the strains incident to the air pressure in the tire and the weight of the vehicle and its load; the push of the motor in driving; the reverse strain of stopping by brake; the transverse strains of control by steering wheel; the blows of road inequalities against the air; and lastly, ignorance of its limitations, structure and care by the user.

Having in mind that most desirable characteristics in a tire envelope "that will bend or suffer distortion of its normal circular shape without friction or resistance other than the contained air-pressure," let us see how the square-woven fabric or canvas tire meets it:

First: There must be sufficient strength in the tire wall to sustain an air-pressure up to 120 pounds per square inch; multiply the pressure you carry by one-half the internal area of your tire in square inches and you get the measure of a constant duty of surprising proportions. Suppose your tire measures 100 inches in length with an internal area of 10 inches = 1-2 of 10 and 5 x 100 x 50. This gives a total pressure of 25,000 pounds, this is approximating the total constant pressure on a 32 x 4-inch tire at 50 pounds per square inch, add to this a factor of safety made necessary by the blows and shocks incident to use, and it will be plain that only by using a number of piles of such fabric can this duty be met.

What Square-Woven Means

It might be well to state that square-woven means threads of equal strength and number per inch in both warp and filler of the fabric used in the tire.

These several plies of thicknesses must be stuck or vulcanized together that they may operate as a unit. Each ply added increases the resistance to that action quoted above; and it is also found that inasmuch as the warp and filler of square woven fabric are normally disposed at right angles to each other, it is impossible to manufacture a tire of this fabric, even when it is cut on the bias and stretched over tire forms by machinery with even approximately a uniform angular placing of the threads without which a tire product with uniform performance cannot be secured. Warp is the technical name of threads running together lengthwise of a fabric and filler on warp designates the cross threads.

Second: By reason of the warp and filler threads being interwoven, and operating under high tension, there is further resistance to bending or distortion, with the added disadvantage that such bending sets up movement in the interwoven warp and filler of the square fabric with resulting heat and wear.

---

*EDITOR'S NOTE—John F. Palmer, inventor of the cord tire for bicycles which was used first in 1893 and also the Palmer cord tires for automobiles now used in England and the Silvertown cord tire used in this country, is still engaged in the further development of this type of tire.

Third: As such fabric cannot be woven of sufficient width for a section cut on the bias to furnish enough length of material for one complete circuit of the tire, there is of necessity two or more joints in each ply, and wherever such a joint is made the resistance to bending is doubled, the difficulty of uniform angular placing of thread made insurmountable and the balance of strain resistance in warp and filler dislocated; when this is multiplied by the number of plies made necessary by strength requirements, the wonder is that canvas tires perform as well as they do. Added to this the difficulty of holding the tire securely on the rim of the wheel is a problem that has taxed the ingenuity of manufacturers continuously since tires were made.

The Beaded Edge

Bolts, wires and bends are the means ordinarily used; of these, the beaded-edge tire engaging a rim with a hooked edge is the most popular, with the wire edge or straight-side type growing in favor by reason of superior ease in mounting and dismounting. Both are makeshifts, however, made necessary by the character of the best material heretofore available for tire construction, namely, square-woven canvas.

It is not my intention to dwell needlessly on the short-comings of square-woven fabric, but I felt the necessity of pointing out in a general way the major objections in its use in tire construction, in order that the reason for cord tires and their advantages be made as clear as the limits of this article will permit.

Develops Flat Cord Tire

The writer is at present developing a new type of cord tire, which differs in that a ribbon or flat cord approximately 1-2 inch wide is used instead of the round cord. The chief object in substituting it for the round cord is that it allows of different construction whereby you can do away with all beads, wires, or any other method of fastening to the rim, and can have a tire which with a pressure of not over 40 pounds cannot be thrown from the rim of a racing car at any speed, as was demonstrated on the Indianapolis speedway a year ago. The use of inextensible flat cords permits of their being placed in the tire at a tangent to the rim, that is right angles to the spokes of the wheel, which is the position to obtain the most efficient transmission of power from the rim to the tread. This also is responsible for using air pressures approximately half what has been used in fabric tires.

Now, again passing the question of air tube and tread as satisfactorily solved in present-day practice, I will attempt a parallel statement of the answer the Palmer flat cord tire gives to the same questions above considered.

First: A so-called cord tire is built on a form of the natural shape of a tire, using thread or cord, singly, or a number of threads held parallel by rubber as a band or ribbon and used as such in the construction of the carcass of a tire, by applying single flat cords at a predetermined angle and continuing such application until the tire carcass is complete and consisting of two or more layers or thread, cord or bands, each layer laid at an angle to its next inside or outside neighbor.

As to the question of strength, each flat cord being laid individually as best meets the conditions of its use and protected in action from the friction or cutting movement of cross threads we are able to avail ourselves of the whole strength of each individual cord in the tire. The whole number of cords being so assembled as to work as a unit, we have as a result a structure without seam or joint; perfectly balanced as to opposed layers and disposition of their strength.

The Method of Fastening

There yet remains for consideration the matter of fastening. In the flat cord tire we have dodged this question completely, the matter of secure attachment to the rim being incidental to the design of the tire. The disposition of the cords or bands in themselves, without addition of beads, wires, bolts or any other extraneous means, provides a security of attachment and ease in mounting and dismounting far beyond anything heretofore obtained.

So much for the points considered in square-woven construction. Now in what degree does this type of tire meet the other important points as first enumerated?

I have covered air-pressure and weight of vehicle and load, as to the power impulse of motor and the reverse strain of braking; it is axiomatic that force is transmitted in straight lines, hence, that tire in which the threads or cords best meet this condition will translate into motion or work a larger proportion of the power delivered at the rim by the motor through transmission, shaft, axle and wheel.

Now, inasmuch as the material connecting the last rigid point in the power chain with the road, against which the power is exerted, is soft and flexible, it must be used identically in office and position, as a belt on a pulley to get the best results, that is, the flat cord must be laid at a true tangent from the rim, or at a right angle to the spokes, and by reason of the long, flat arch described by each cord in the tire, it has under it a longer column of the supporting air.

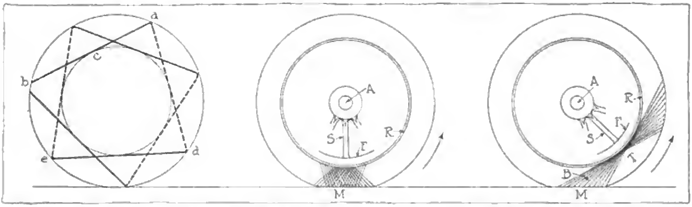


Fig. 1—Left—Construction of the Palmer flat-cord tire, showing how the cords are at tangent to any point c on the rim, one cord being represented by the line a b which, after crossing the tread at a continues at d. Similarly, all cords are tangentially placed or at right angles to the wheel spokes

Fig. 2—Center—Shows the threads in the fabric tire with their sharp angularity to the wheel rim. S indicates wheel spoke, R wheel rim, F felloe, A axle, and M that part of the tire which supports the weight, which is a relatively short section of the tire

Fig. 3—Right—Shows a section of the ideal flat-cord tire with the cords B arranged as tangents to the rim. The cords cross the tread at M and are distributed over a wide fraction of the wheel circumference so that the tire throughout a majority of its circumference forms a bridge construction supporting it at the point M

This reduces the air-pressure necessary to carry a given load, with a corresponding reduction in total strain due to air-pressure and strength required to meet it.

The above applies also to the reverse strain of stopping the car by means of brakes and contributes as well the ideal of maximum transverse rigidity necessary for positive control of the car through the steering wheel, the least motion of which is answered in full by the car to the skidding point of the front wheels. Also the blows of road inequalities are met by lower air pressure per square inch, hence a better, more receptive cushion against shocks or vibration.

The Ideal Tire

The ideal tire then would be:

1—One on which the vehicle is enabled to move along the road without shock or vibration due to inequalities of surface. This means easy riding, coasting quality, receptiveness.

2—To do this with the least expenditure of power per ton-mile; this means a combination of the coasting quality and efficient power transmission.

3—To control its course with absolute certainty up to the limit of wheel traction. This is steering wheel control, had by transverse and longitudinal rigidity in the tire carcass.

4—To bring it to a full stop in the shortest space of time. This is braking efficiency, and also is obtained by reason of longitudinal and transverse rigidity.

5—To be immune from puncture or other injury from external causes.

6—A method of attachment to the rim that is positively secure under all conditions of service yet admits of easy mounting and dismounting, and, I might add, all these without any attention whatever from the user. This latter is almost as attainable in some of the others as perfection.

Since it is impossible to incorporate in one structure the maximum of all of these ideal qualities, the tire designer is obliged to sacrifice in some measure the ideal in order to achieve the practical. For instance, easy riding, the quality first enumerated, if carried to extreme would necessitate the use of a power plant out of all proportion to the work to be performed even though the third quality, control, were not lost, as it would be in the above construction. No. 4, on braking efficiency, also is unattainable under the conditions of maximum cushioning quality or receptiveness. No. 5 would remain much as in other constructions, while No. 6, rim attachment, would be made very much more difficult than in any other type of tire. In short, the maximum of this quality of receptiveness or easy riding is an impossibility in a practical tire.

Nos. 2, 3 and 4 are bound up together and the maximum of number 2 results also in the best expression of 3 and 4.

Immunity from Puncture

The fifth desideratum, immunity from puncture is impossible of achievement in an air tire without great loss in all the foregoing and, inasmuch as a simon pure puncture is extremely rare, we can disregard this feature and devote our efforts to the elimination of rim cutting, blow-outs and pinched tubes. This latter trio embraces 95 per cent. of the trouble in pneumatic tires, aside from faulty material and construction. Rim cutting is due to bad association of rim and tire; this may mean any one of several faults covered by the above phrase, sometimes of the tire, sometimes of the rim and sometimes careless placing of the tire edges when it is put on the wheel, and often when ridden with very low or no air pressure.

Blowouts in tires, when not due to faulty manufacture, are the result of bruises, unfilled cuts in the tread which permit moisture and rot in the fabric, and breaking along the hinge or bending point through undersized tires being used, with consequent high air pressure necessary to carry the heavy overload. Fifteen per cent. is the maximum depression permitted in the Palmer tire; other tires are safe only at 10 and 12 per cent. depression.

The Ideal Fastening

The sixth ideal feature is had in the ideal tire, and in no other; the same construction that contributes maximum power, steering and brake efficiency contributes also a method of attachment that is really no attachment; that is, on inflation, the tire becomes practically a part of the wheel. This last word in joining tire and wheel has been the hope and despair of tire inventors since double-tube tires were made.

It is obvious that a tire composed of flat cords must have something to distend it forcibly in order that it may resist distortion. *This is the air pressure.* Also there must be a rigid base for the air to push against in order to distend the tire at all. *This is the rim.*

Now, as the lines of resistance, the cords must under the pressure of the air try to take the shortest route between their opposite points of attachment, the rim sides, in a canvas tire, and the cords being flexible and the pressure elastic, they will then describe an arch from one side of the rim to the other of a span dependent on the length of the cord. Now if this span describes an arch shorter than a double tangent and the rim edge, the tendency of the contained air pressure must be then to lift the tire bodily from the rim, proportionately as its angle departs from a true tangent. Hence, the various fastenings in current use of both clincher and straight-side wire edge types.

Now, in the ideal tire the lines of resistance, or the cords, describe the longest possible span in crossing from one side of the rim to the other, approximately a true double tangent as illustrated in Fig. 1. It will thus be seen that no cord stops at the rim *c*, but goes straight across to the opposite tread point *a* or *b*. It will be evident then that the lines of resistance of these cords describe what might be called the shortest route from a point on the tread of the tire to another point on the tread of the tire coinciding with a point on the rim falling within a straight line between these two points. We used to call this the chord of an arc in our school days.

Opposite Tread Points Equalize Pull

Now, therefore, if the lines of resistance, or the cords, are not attached to the rim at all, but only pass within the flange of the rim across to opposite tread points, the ideal tire cannot be said to be attached to the rim, but that opposite tread-points pull one against the other. For it must be remembered that there is no strength in a tire to resist air pressure beside the treads of which the carcass is composed, and these treads one and all take the identical course above described.

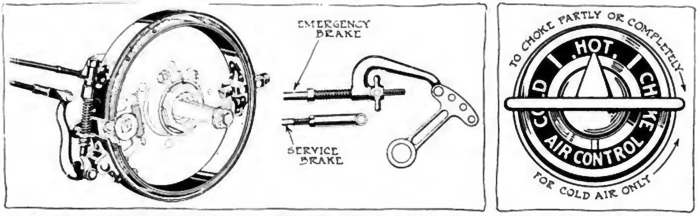
Hence, the impossibility of the radial pressure of the contained air lifting the tire from the rim in the smallest degree, as the tire simply is pulling against itself and the flanges of the rim only serve to restrain it from lateral expansion.

Limitations of the Pneumatic Tire

It seems opportune that a word as to the limitations of the pneumatic tire as a shock or vibration absorber be added here. Manifestly, this must be limited to its ability to receive into itself inequalities of and on the road surface, hence, the size of the tire again is vital and is its measure in cushioning equality, the springs assuming this function according to their ability when taking bumps beyond the capacity of the tire. In this connection, I would say that the best pneumatic tire is susceptible of as nice adjustment to its load, in size and air pressure, as are the springs, though all the resources of metallurgy be called on with all the experience of hundreds of years of spring building for vehicles.—JOHN F. PALMER, Riverside, Ill.

New Boat Body on 1916 Hudson

6-40 Continued—Refinements Increase Strength Without Adding Weight—Price $200 Lower—Few Changes



Left—Brake assembly on the 1916 Hudson. Center—Adjustment features. Four positions are possible on the lever illustrated. Right—New air control of carbureter

THE 1916 Hudson is a continuation of the six-40 of this year, with very few mechanical changes but a new type of boat design body. The price of $1,350 is $200 less than this year. Although the general characteristics of the car remain unaltered there are many details included that give greater accessibility and added strength without increasing the weight. Thus spring bolts are of larger diameter; the frame is stronger; hardened steel washers are used in places to avoid rattle; grease cups have been brought into more accessible positions; a side entrance carbureter located high on the cylinder block is used, and many other running gear improvements are found.

The new body lines incorporate an unbroken curve from one end to the other. The top edges of the upholstery are on a level with the body sides to give an unbroken line. Hood and cowl meet each other without interruption of the one curve, and the whole front shape is narrowed to meet the bonnet so that, looking at the car head on, it seems to have a gradual unbroken slope from the narrowest point at the radiator to the widest part at the rear seat.

All this has been done without in any way sacrificing roominess, and, in fact, all the compartments are even roomier than before. This is especially true of the tonneau, where more length is afforded by the tunneled-under rear of the body. The auxiliary seats are improved to fold into spaces in the floor and the back of the front seat. When closed, they disappear. The doors are wider, and fit snugly. Enameled leather upholstery has been adopted in place of the dull-finished variety heretofore used.

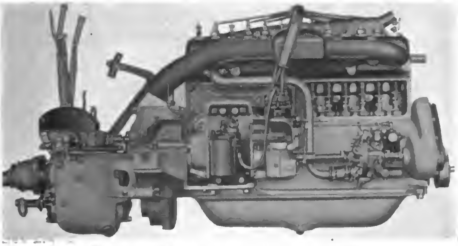
Along with the new shape of cowl, a neat and substantial form of windshield attachment has been worked out. The side supports, instead of running straight down to the body, curve in at the bottom and join rigidly to the body. This is a change which is in accord with the narrowing of the front curve, and makes the appearance consistent.

Chassis Improvements

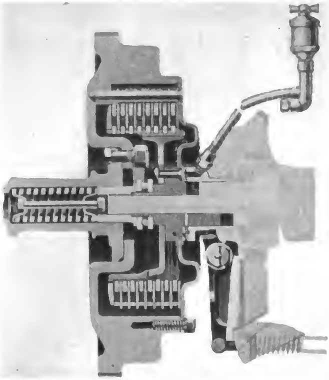
There are several small changes in the chassis and mechanical parts that would not be evident on reasonably thorough observation unless one had both chassis to compare. Most of these differences have been made with the thought of greater accessibility, less chance for rattles when the car has seen service and even better performance.

The mechanical details include a 3½ by 5, block-cast six-cylinder engine with disk clutch and three-speed gearset in unit, Delco combination ignition, starting and lighting; Zenith carbureter; left steer and center control; open drive member with Hotchkiss form of drive through the rear; three-quarter elliptic springs; tapered frame; floating axle with a pressed-steel housing; wheelbase of 123 inches; and 34 by 4 tires on demountable rims.

Among the minor improvements of rear; three-quarter elliptic springs; device on the carbureter so that the disagreeable fluttering and flapping of a trap type of valve is done away with. The new form is of barrel construction, and the entrance of hot air, cold air or the exclusion of all air is controlled by the rotation of a sleeve with slots to



Exhaust side of Hudson six-cylinder motor for 1916



How the grease cup for lubricating clutch throw-out collar is brought above the floorboards

register with either opening. To further aid in carburetion, the hot air stove, which formerly attached to the exhaust manifold, now is made integral with it. This serves as a better assembly proposition and at the same time gets the heat into the hot air tube faster.

Accessible Grease Cups

Looking to better accessibility, the grease cup for lubricating the clutch throw-out collar has been brought up above the floorboards and into the driver's compartment. A flexible tube extends from this cup down to the actual bearing surface.

With the idea of preserving the rigidity of the frame and to thus prevent movements which would tend to wear spring bearings, cause movements of the frame independently of the body, and consequently bring about rattles and squeaks much quicker, the front motor support has been stiffened, the frame is made of heavier stock, the rear cross member has been redesigned, etc. The frame stock is now 5-32-inch steel, which is slightly thicker. The channel is 5 inches deep with a width of 2 3-8 inches.

To carry rigidly the support of the front end of the rear springs, the rear cross member is now of what might be called a bridge type. Instead of having the same depth all the way across, it widens as it approaches the side members, thus making a better attachment to them. There are also gussets of pressed steel inside the frame channel and under the front end of the rear springs to prevent horizontal whipping and to keep rattles out of the shackles. To further aid in such rattle prevention, hardened steel washers have been placed between the spring eyes and the sides of the shackles to give a good wearing surface.

The spring bolts have been enlarged to 5-8-inch for the same reasons of better resistance to wear and rattle, and another noise preventative is the interposing of a strip of cotton duck between the apron and frame to avoid possible squeaks through this source.

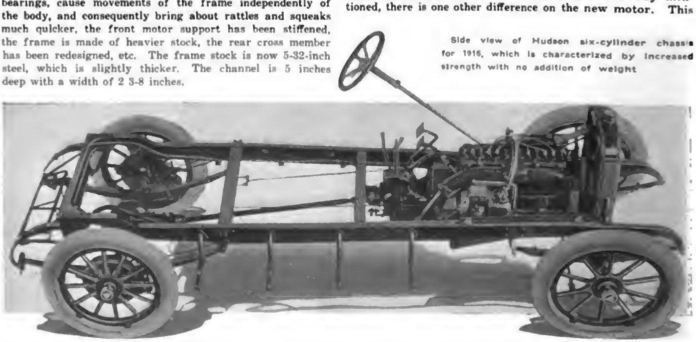
More Fuel Capacity

The cowl gasoline tank has been increased in capacity from 12 to 14 gallons, and it is, of course, of a new shape to conform to the different shape of cowl. Out of the car, it looks much like a crumpled reservoir, so odd is its shape. The idea was to give it as large capacity as possible without interfering with the space of the front compartment. The filler is accessible on the cowl apron, and the vent pipe has been brought all the way down to the bottom of the motor pan from the top of the tank so that any fumes coming from the tank will not get into the drive compartment, as they might do with the previous model, where the vent hole was not provided with a pipe. The desirability of having a means of getting a small amount of gasoline has been recognized also, for a drain cock has been fitted, this coming to a convenient point at the bottom of the car.

Though small in itself, the splitting of the front floor boards into two parts is important as the boards are in two halves, so that the right section can be removed without disturbing that part under the pedals. This right part permits access to the starter gears or the clutch. There is a trap door in the tonneau floor to reach the rear axle.

Adjustment of both emergency and foot brakes has been simplified. The former can now be adjusted by hand with a wing nut which is easy to reach. The foot brake adjustment is on the outside and the rod screws into a threaded socket with a set screw to hold the parts in place.

In addition to the very small change in incorporating the hot air stove with the exhaust manifold, as already mentioned, there is one other difference on the new motor. This



Side view of Hudson six-cylinder chassis for 1916, which is characterized by increased strength with no addition of weight is the use of a bronze water pump instead of die cast aluminum, as heretofore. There is an interesting reason back of this change. Though the aluminum pump worked very satisfactorily in nearly every part of the country, it was found that in certain sections where there is alkali water, this had a tendency to disintegrate the pump, so to take care of this the brass was substituted, the alkali having no effect upon this metal.

In the general layout of the Hudson motor, the valves, exhaust manifold, water pump and electrical unit are all arranged on the right side, with nothing on the left save Zenith carbureter, which, due to the tank being high up in the cowl, is bolted well up on the side of the cylinder casting to a single opening in the casting. Distribution of the gas to the valves is done through internal passages in the casting so that there is no exposed intake manifolding.

The cylinder block bolts to a conventional form of two-part crankcase, the upper aluminum part carrying the crankshaft bearings, which are three in number. Valves are of nickel steel and interchangeable and they have a 1 1-2-inch clear opening with a lift sufficient to give rapid gas flow. The grey iron pistons carry nickel-steel tubing wrist-pins, which are a press fit in the bosses and held in place by a set screw.

Connecting-Rod Details

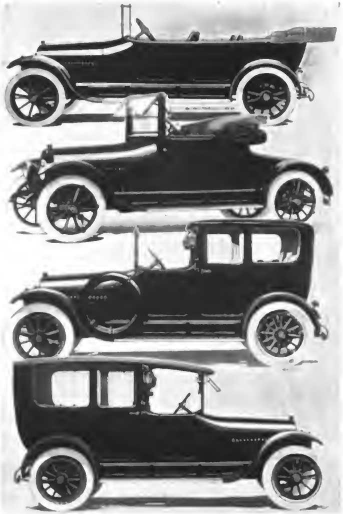
The connecting-rods are I-beam drop-forged type, and their caps are held in place by nickel-steel bolts, with castellated nuts holding cotters. The crankshaft is of a design such that the throws are so shaped as to make a running balance at all speeds, it is claimed. Nickel babbitt bearings are used not only for the main bearings but for the lower rod bearings and the camshaft. Timing gears are helically cut, and to insure quietness, they are made of a cloth composition.

A constant-level splash oiling is used in the engine, with the lower part of the crankcase the oil reservoir, it being exposed to cool the oil.

Better Delco Housings

The Delco unit has been changed to make it easier to assemble or take apart. The various parts of it are now made with their own individual housings, bolting together to make the complete unit. This is a change from the old way of having the one housing cover all parts. All bolts and nuts that were hard to get at have been extended so that they can be reached with a wrench or screw driver.

There is no alteration in the design or principle, however. The starting connection is made through the meshing of a train of reduction gears housed on right motor arm, while when acting as a generator, the unit is driven by an extension of the pump shaft, which in turn connects with the camshaft gearing.

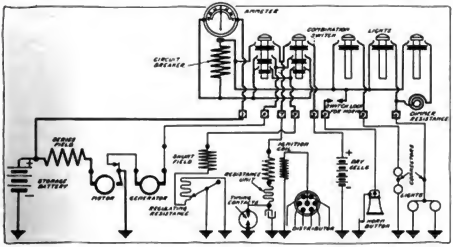


Hudson models for 1916. Top—Seven-passenger touring car. Upper middle—Roadster. Lower middle—Cabriolet. Bottom—Limousine

In the drive mechanism, the compactness of the units makes for a general lightness of construction. The clutch is self-contained in an oil-tight case which is a part of the flywheel. The disks are steel stampings with the driving disks provided with cork inserts. The gearbox attaches to the rear of the aluminum crankcase by means of arms which bolt to the cover which goes over the upper part of the flywheel. The main and countershafts run on roller bearings and gears are of the stub tooth shape to give strength.

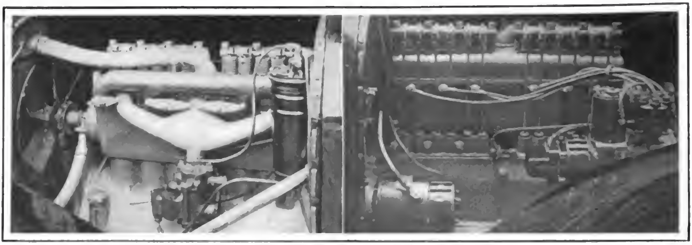
The Hotchkiss form of drive used saves much in weight, and is a design which Hudson was one of the first American makers to use. The torque and drive is taken through the rear springs, the master leaves of which are made strong enough for the purpose. The spring bolts at the front end of these springs are also enlarged to take care of it. In the Hudson car, these bolts have a 7-8-inch diameter. The drive shaft is a tubular form which is very strong with lightness. Two universal joints are fitted to the shaft, one at either end.

In the axle, the driving gears and differential bolt to the axle proper, and can be removed without disturbing the housing. The pinion shaft and differential case are mounted on taper roller



Wiring diagram of the Hudson six for 1916

(*Continued on page* 1029)



Left—Carbureter side of the new little six Oakland valve-in-the-head motor, showing mounting of the Stewart vacuum tank. Right—Valve rod side, showing mounting of the electrical units

A New Low-Priced Oakland Six

Overhead-Valve Block Motor 2 13-16 by 4 3-4 of Moderate High-Speed Design—110-Inch Wheelbase—Hotchkiss Drive Through Underslung Springs

AN entirely new car selling at the low figure of $795 in either five-passenger touring car or roadster form is to be built by the Oakland Motor Car Co., Pontiac, Mich., for 1916. It is really the little six which has been considerably talked of and speculated about in motor circles as coming out under the General Motors Co. name. But though the rumors were quite right as to the existence of the little six, it will carry the Oakland name, and be built in the Oakland plants.

Due to the purchasing power of the General Motors organization, of which the Oakland company is a subsidiary, and to the capacity of the latter concern to build a big volume of cars this year, it is explained that the price could be brought down to the low figure given above.

Built upon 110-inch wheelbase, the body is surprisingly roomy, with comfortable riding for five. The rear seat measures 46 inches across. The motor is of the overhead valve type, the product of the Northway plant in co-operation with Oakland. The bore is 2 13-16 and the stroke 4 3-4 inches, and cylinders are in a block with cylinder head and valve mechanism detachable.

Oakland Tapered Frame

Many of the principles of design which have characterized other recent models of Oakland make are to be found in this car. It has the tapered frame, Hotchkiss drive through the springs, floating axle, three-quarter elliptic underslung rear springs, rear gasoline tank with vacuum feed, cone clutch and three-speed gearset in unit with the engine, Remy electrical system, Marvel carbureter, splash oiling, centrifugal pump water circulation, and 32 by 3 1-2-inch tires. From these general specifications it will be seen that Oakland is offering a very completely fitted out little six at the price.

The motor, a moderately high-speed design, is said to develop 30 to 35 horsepower in average running, and at any rate, it handles the car well under any driving conditions, as was proven in a demonstration run.

The valve mechanism is exposed, with the lifter rods on the right. They actuate the valve rockers as in any conventional overhead valve type. The rockers are assembled on two shafts, each carrying half of them with a support between each two of the rockers, these screwing into the cylinder head. This should make it very easy to remove the parts if necessary.

The adjustment of the push rods is at the top where they come in contact with the rocker arms. The valves, due to the overhead construction are rather large for the cylinder size. They are 1 1-4 inch diameter in the clear and the lift is 5-16 inch.

Accessible Motor Layout

In its general layout, the motor is compactly arranged. The carbureter and the two manifolds are placed on the left, while the right is reserved for the Remy two-unit electrical apparatus with the generator forward and the starter unit to the rear. The spark plugs go into this side of the cylinder block, one being placed between each two of the valve rods. The ignition distributer is mounted on top of the generator unit, so the ignition wires are not very long.

The upper part of the crankcase and that which carries the three crankshaft bearings is integral with the cylinder casting, which is the usual construction where the cylinder head is detachable. The lower part admits of access to the bearings and serves as the oil reservoir and the mounting for the splash troughs.

The power plant rides in the frame at three points, resting upon cross members of the frame at front and rear, this construction differing from the conventional in that there is no integral crankcase arms at the rear. This should have a tendency to reduce weight without in any way sacrificing strength.

A neat construction is that at the front which makes a combination of the water pump impeller, fan and fan bearings. The fan and water pump are really one unit, and the construction may be seen in the left side view of the engine. The water connection couples from this upper point direct to the radiator connection. The pump case is part in the casting of the cylinder block and part in the mounting of the fan. The drive for fan and water pump is through belt connection with the crankshaft. A simpler construction of these parts could not be imagined.

Separate Motor Manifolds

Both intake and exhaust manifolds are separate from the cylinder castings and are held to them by dogs or spanners drawn down at the center by bolts screwing into bosses in the side of the cylinder head. Due to the use of the Stewart vacuum tank, on the back of the dash, the carbureter is brought well up, and there is very little vertical part to the intake manifold. The supply tank is at the rear of the chassis.

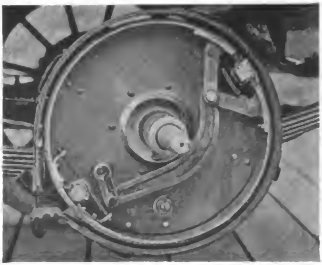
A very efficient mounting of the generator and the starting motor is employed, in that the housings of these units bolt directly to the housing of the flywheel in the case of the starter and to that of the front gears in the generator construction. Such a mounting positions the shafts accurately without possibility of putting the units back wrong. This is harder to do where a base is used to carry such units, or where some form of strap is utilized. There is a reduction of weight due to fewer parts.

Bendix Starting Drive

The starting unit connects through gear with the flywheel and through the intermediary of the Bendix drive. This is more or less familiar to the public, being fitted to several well-known makes of car now. In its principle it consists mainly of a threaded shaft on which a pinion screws loosely. This shaft is carried by the extension of the motor armature. The pinion is weighted, which weighted feature serves to carry the pinion into engagement with the flywheel teeth when the current is sent to the motor. Thus the shifting is automatic. In the Oakland application, the entire mechanism is compactly housed, with only the rear end of the starter shaft exposed. The starter ratio is 11.5 to 1.

Six-Volt Electric System

The generator and distributer combination at the front is driven by gear connection with the camshaft gear, all being completely housed. The generator is driven at 1 1-2 to 1 ratio, and from it, the vertical distributer shaft is operated by a spiral gear connection at the same speed. The electric system operates at 6 volts, and with it is used a Willard battery placed under the front seat.

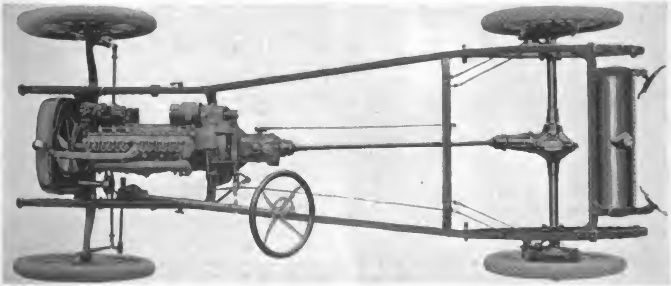


Brake mechanism on the new little six Oakland, showing the two concentric bands

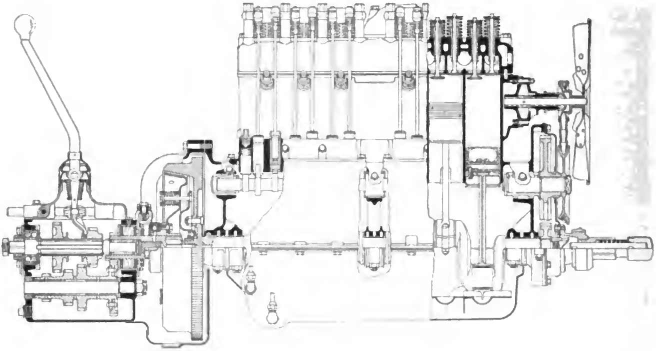
Internally the new engine shows nothing radical. Both the camshaft and the crankshaft have three main bearings, those of the latter measuring 1 7-8 inch in diameter. The pistons and connecting-rods follow the usual form. The motor oiling embodies the circulating splash system, with circulation maintained by a plunger pump operated by eccentric on the camshaft. The oil is forced first to a dash sight feed, and thence down to the splash troughs and the bearings. An oil level indicator is placed on the crankcase.

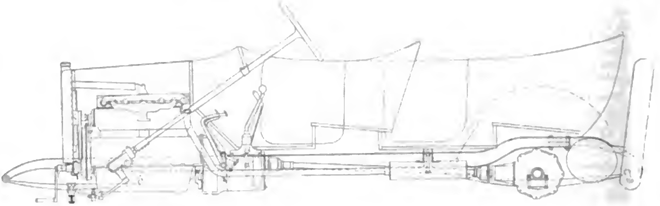
Hotchkiss Drive Employed

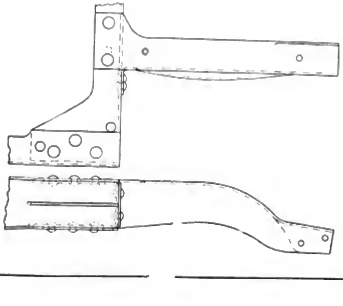
Back of the engine, the drive has been worked out as simply as possible, due to the Hotchkiss principle employed. Coming from the cone clutch with its ball bearing release shoe, and going through the gearset, the power next passes through the forward universal joint, then through the tubular shaft and rear universal joint to the rear axle. In the Hotchkiss type, the car propulsion and the torque are taken through the rear springs, the master leaves and the front shackle bolts of these springs being made strong enough to take care of these duties. This makes a very simple arrangement and is adaptable to cars of the weight of this Oakland in very nice shape. Torsion tubes, torsion arms and radius rods are entirely



Chassis of the new little six Oakland, showing lightness of construction and tapered frame







Oakland Little Six

For the first time the Oakland has a valve-in-the-head motor, this construction being used in its new block little six. Details of valve operation are illustrated in the section above as well as the construction of the cone clutch and three-speed gearbox

The simplicity and neatness of design are brought out in the chassis outline which also gives an idea of the boat lines of the new body used on the Oakland little six. Note how the frame channel is split at the rear where it takes the end of the three-quarter elliptic spring. This is also illustrated in detail at the left. The steering column, it will be noted, is braced to the cowl. The line of the rear mudguards is dotted. Note the round fuel tank supported at the rear of the chassis frame. Provision is made for carrying spare tires as indicated done away with, as will be evident from a study of the chassis view.

The rear springs are underslung. One very nice constructional detail is the method of attaching the upper portion of the three-quarter elliptic springs to the frame. The rear end of the side member is split so as to receive the spring end within it. Then a bolt goes through the frame end and the spring, and back of that a U-bolt is used. This is in contrast to the usual mounting of this part of a spring, it generally going below the frame, or in a bracket attached to the member. But by this new means of support, the rear end of the frame is lowered by an amount equal to the depth of the spring at this point—in this case 2 1-2 inches. Further, it gives a construction with fewer parts and is also extremely rigid. These advantages are aside from the niceties of assembly which are made possible. The tank mountings incorporate the tire carrier in unit and are shaped so as to fit the round form of the tank, bringing it up close to the rear member without needless overhang.

The Weston-Mott axle has a ratio of 4 1-4 to 1, and the design is the same as used on the model 38, the well-known Oakland small four. It is a one-bearing floating type with 12-inch brakes.

Also as in former Oakland design, the frame is so tapered that it follows, throughout its length, the body lines, thus giving good support all along. The depth is 4 1-2 inches, and no running board apron is used, the running boards extending in to meet the line of the body and frame. This is also used in previous Oakland design, and does away with one more or less unnecessary part. Fenders are heavily crowned.

In body work and fittings, the little six is well taken care of. The lines are very well worked out, with a good slope throughout, and a well-shaped cowl meeting the hood. The instrument board is metal-faced, and a distinctive touch is given by the turning over of the metal sides to make a rounded upper edge to the body. That is, the cushions do not extend out over the body edge.

Leather upholstery is featured. In the matter of equipment, everything is fitted that is generally regarded as a part of the up-to-date machine. There is a one-man top and tires are on demountable rims, with one extra rim.

New Boat Body on Hudson for 1916

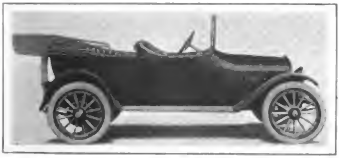
(*Continued from page* 1025)

bearings which are immersed in a bath of oil for lubrication.

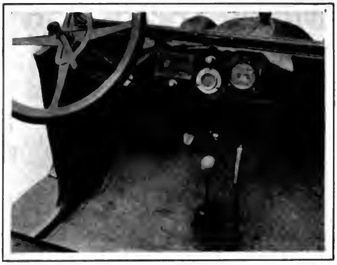
Spring suspension has been well worked out, with the rear springs 54 and the front pair 39 inches. Leaves are 2 inches wide, and they are assembled with graphite between them. The spring eyes are equipped with phosphor bronze bushings, and the maximum of grease cups are fitted.

Complete Equipment

The new Hudsons are completely fitted out, with one-man tops, dimming headlamps, Exide batteries under the front seat, trunk rack at the rear, speedometer driven from the drive shaft, electric horn with the button in the center of the steering wheel, carbureter air adjustment on the instrument board, and the other features more or less standard on the modern car. The color is a dark blue.



Five-passenger touring car body mounted on 1916 Oakland little six chassis. This car sells for $795, with complete equipment



Driver's compartment on the new Oakland little six, showing control members and the neat mounting of the gearshift and emergency brake levers

War Rushes French Plants

(*Continued from page* 1015)

bridges and strategic points. But if the pass cannot be produced when asked for, the car will not be allowed to advance another inch. As it takes on an average a week to get each pass, the automobile is the last mode of locomotion the private person considers.

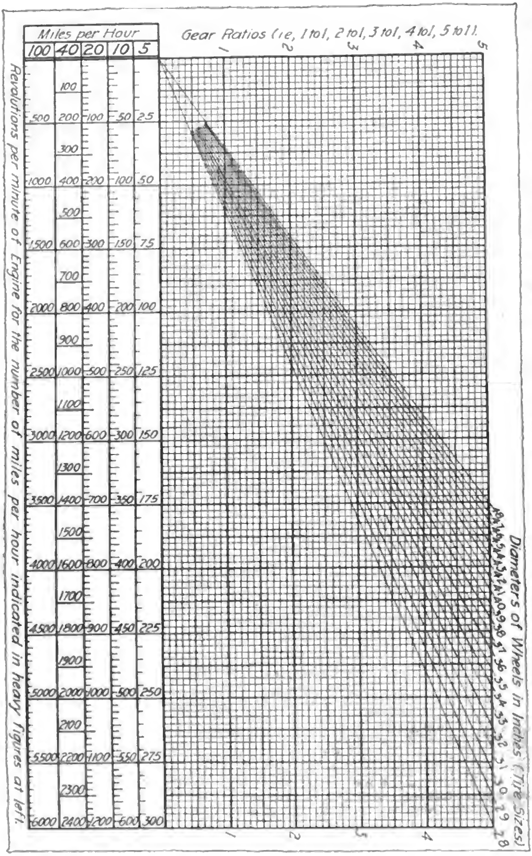
Gasoline Higher—Benzol Supply Cut Off

While there is no shortage of gasoline, and the price is but 2 or 3 cents a gallon higher than a year ago, the supply of benzol has been entirely cut off. This does not seriously affect the private motorist, but is a matter of considerable concern to taxicab drivers. Owing to its lower first cost, as well as to the fact that town duty is about 10 cents per gallon less than on gasoline, every taxicab driver uses benzol. The whole of the available supply of this fuel has been requisitioned for making explosives, thus forcing taxicab drivers to consume gasoline. The result is an increase in the running costs of $1 to $1.50 per day, this cost being borne entirely by the driver. The Paris General Omnibus Co., which is about to put 100 buses into service after a suspension of more than 9 months, is affected to a rather less degree. This company uses benzol but does not have to pay town duty on its fuel. It will now be obliged to burn gasoline.

The rubber situation appears to be very satisfactory from the standpoint of the army. Up to recently the tire factories in France were given monthly contracts and were allowed a sufficient number of men to deliver the goods. This has been changed, the army now placing definite orders from time to time. Indications are that the army possesses stocks of solid and pneumatic tires for a long period ahead and can maintain them without working the factories at more than a fraction of their strength. Orders have been placed for milimeter size tires to be fitted to American trucks as soon as the inch size tires need replacing. The French factory of the Goodrich company is doing much of this work. The disadvantage to the tire companies under these new conditions is that they have less guarantee that the men will be allowed to remain at work. Some annoyance is caused by the calling up of men of more than ordinary value to the factory, and when a new man has been trained there is no assurance that he may not receive notification to join the army.

Motor Speeds and Gear Ratios

A Diagram Which Facilitates Determination for Ratios Up to 5 to 1



WITH the coming of the high-speed engine there is a growing interest in gear ratios. Any statement of gear ratios taken alone is without meaning and any direct comparison of them is more than likely to be misleading. The diameter of the rear wheels is of equal importance, and the combination of the wheel diameter and gear ratio must always be considered. If one wishes to know the speed of the engine, another factor, the speed of the car, must enter into the calculation.

This calculation is not likely to be attempted by those without technical training, and being rather long and somewhat complicated, will not be undertaken even by an engineer except for strong reasons. The accompanying diagram gives the engine speeds at a glance for all sizes of wheels and all gear ratios up to 5 to 1 for several car speeds in miles per hour.

To Read the Chart

As an example of its use, suppose it is desired to find the engine crankshaft speed of a car equipped with 32-inch tires, gear ratio 3.8 to 1, which is being driven at 10 miles per hour. Follow downward on the sloping line marked 32 at the top of the chart until it intersects the horizontal line for the gear ratio of 3.8. The point of intersection is on a vertical line marked 400 in the horizontal scale for 10 miles per hour at the bottom of the chart. The engine is therefore running at 400 r.p.m.

There are also horizontal scales for car speeds of 5, 20, 40 and 100 miles per hour. In the above example the engine speeds corresponding to them would be 200, 800, 1,600 and 4,000 r.p.m. respectively.

Should it be desired to find the speed of the engine for 25 miles per hour, for example, the speed for 10 miles per hour may be multiplied by 2.5 or the speeds for 5 and 20 miles per hour may be added, giving 1,000 r.p.m.

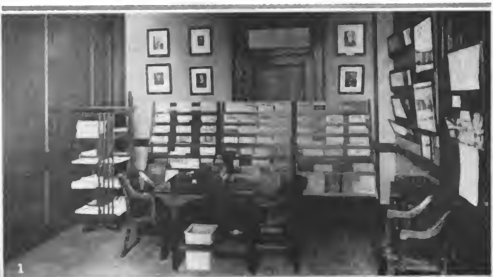
Herewith is given a table of some engine speeds determined by the aid of the diagram.

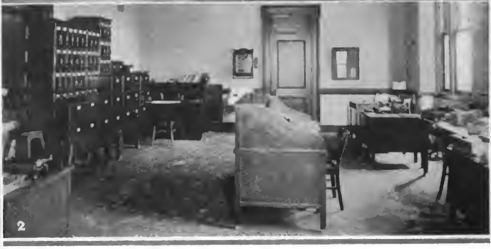
S. A. E. Headquarters Well Laid Out

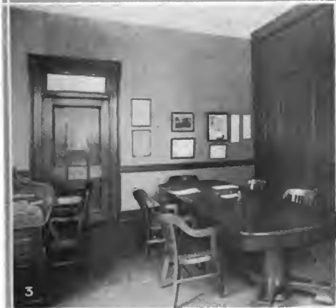
NEW YORK CITY, June 5—Now that the Society of Automobile Engineers has become settled in its new quarters in the Engineering Societies Building, at 29 West Thirty-ninth street, a great amount of interest attaches itself to the efficient layout of the suite of rooms in which the administrative end of the society is housed. Four rooms are used for handling the work of the society.

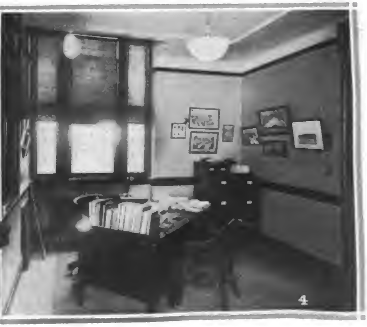
Entering the S. A. E. suite from the corridor on the sixth floor, one is led directly into the spacious general office, in which the clerical force of the society has its desks, filing systems, etc. This room, which is illustrated at 2, is centrally located, and from it one passes into the members' room to the right, shown at 1, and to the editorial room of the society publications to the left. The latter is illustrated in 4.

Passing through the members' room, another door leads into the council room, shown in 3, and between these two rooms is a folding partition which can be pushed back, throwing both rooms into one for use at Standards Committee meetings, etc.


1


2


3


4

The Rostrum

No Timing Is Most Efficient

EDITOR THE AUTOMOBILE:—Are there any rotary sleeve valves in use, and if so, will you give me a description of them?

2—What is considered the most efficient valve timing of a gas engine?

3—Where is the best place for the spark-plug in any type of engine?

4—Is there any reason why engine designers do not put the spark-plug over the center of the piston?

5—What is the best formula for figuring the proper size of a valve for a gas engine?

Trinidad, Col. W. H. ORTH.

—There are a large number of rotary sleeve valve motors in use throughout the world which have been described from time to time in the American and foreign automobile journals. Space does not permit here to go into a lengthy description. The Speedwell company used the Mead rotary valve motor as a regular part of the equipment of the car in their 1914 model. This was fully described in *Motor Age* for November 19, 1914. The Mead rotary valve is a double-valve design having two rotating sleeves, one for the intake and the other for the exhaust. The position of these sleeves at different parts of the cycle is shown in Fig. 3. These diagrams give an accurate idea of the functions of the double sleeve arrangement.

2—There is no such thing as the most efficient timing on a gas engine. The ideal timing for any two motors will not be the same. The reason for this is that the manifolds, piston displacement and various other factors have a marked influence on the proper timing.

3—The best place in the combustion space for a spark-plug is that the point of purest mixture. This will vary with different types of motor owing to the differences in shape in the combustion chamber. The reason for this is that where the charge is less diluted by unscavenged gases, it will burn quickest and surest.

4—In some designs engineers do put the spark-plug directly over the center of the piston. One example of this is the Moline-Knight engine.

5—The method for determining the proper size of the valve depends upon the gas velocity through the valve and the piston speed. Gas velocities are calculated on the basis of piston speed and a full opening of the valve. For the ordinary 45-degree poppet valve the gas passes through a space between two cones. The perpendicular distance between the two being one-half the valve lift times the square root of 2.

To express this in the terms of a formula, if h is the lift, and h' is the normal distance between the two cones, formed by the valve and the valve seat, then $h' = \frac{h}{\sqrt{2}}$ when the angle of the valve is 45 degrees.

If the smallest diameter of the valve is D the gas will pass through a space equal to the area of a truncated cone whose side has a length h' and whose small diameter is D and whose large diameter is D + h. The mean diameter of this truncated cone is equal to the sum of the small and large diameters divided by 2 or $D + \frac{h}{2}$. The area of the opening is equal to

$$\pi\left(D + \frac{h}{2}\right)h'$$

or, in terms of the lift

$$h, \quad \frac{2\pi Dh + h^2}{2\sqrt{2}}$$

This formula holds true for any valve in which the distance h' does not equal the face width of the seat. If S' is the velocity of the piston in feet per second, the proportion of piston speed S' to gas velocity V_g for an engine of bored in inches, is therefore as follows:

$$\frac{S'}{V_g} = 2.84\frac{Dh}{d^2} + 1.4\frac{h^2}{d^2}$$

This will give you the proportion you desire.

If you give any of the variables in this last equation the proper value and substitute for the constants such as the bore, valve lift, and valve diameter, the proper values, the theoretical valve proportions will be given.

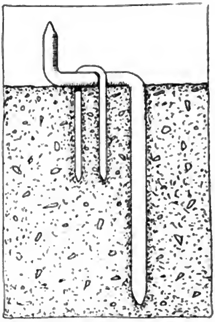


Fig. 1—Stake trap used by road vandals to puncture tires

Stake Trap for Automobilists

Editor THE AUTOMOBILE:—A new method of inflicting trouble on the motorist was invented by a French half-breed some 26 miles from Winnipeg. The instrument made and used is shown in the accompanying illustration and proved extremely effective in bringing the passing cars to a stop. Unfortunately for the culprit, one of the victims hunted over the road with a light to find what had caused the trouble to his tires and found the contrivance sticking up in the rut. On his arrival in Winnipeg the matter was reported to the Winnipeg Automobile Club and an immediate investigation was made which resulted in the arrest and conviction of the offender resulting in his having time to spend in jail and regret the time that he spiked a motorist.

Winnipeg, Man. A. C. EMMETT.

Wheelbase of Racers Shorter

Editor THE AUTOMOBILE:—Would you kindly inform me if racing practice has followed along the lines of touring car practice in the matter of lengthening the wheelbases of the cars? I am referring particularly to the cars used in the Indianapolis races during the past 4 years.

2—Was the Knight type of motor which was entered in the race, but which did not qualify, a high-speed design, and was its exterior appearance similar to other Knight motors? I am referring to the design known as the F. R. P.

New York City. J. E. S.

—The wheelbases of the Indianapolis cars, as has been pointed out in THE AUTOMOBILE, have become steadily shorter. Taking the average of the three leading cars for the years of 1911, 1912, 1913 and 1914, it will be noted that they have steadily become shorter. Referring to the diagram, Fig. 2, the proportion of decrease will be noted.

2—The Knight design, known as the F. R. P., which was entered for the Indianapolis race, was distinctively a high-speed type, as will be noted from the horsepower curve shown in Fig. 5. According to this curve, the maximum horsepower was attained at somewhere about 4,000 r.p.m., at which time the motor developed over 120 horsepower. The exterior appearance of all Knight motors differs, some being block cast and others singly cast as in this instance. The Knight engine in the F. R. P. cars is shown in Fig. 4.

Horsepower by the S. A. E. Formula

Editor THE AUTOMOBILE:—Can you kindly inform me as to the horsepower of a six-cylinder automobile engine, 3 3-4-inch bore by 5-inch stroke as figured by the S. A. E. formula?

Medical Lake, Wash. A. S. O., JR.

—A six-cylinder motor of the dimensions you give will have an S. A. E. horsepower of 33.75.

Seamless Steel Tubing for Shaft Repair

Editor THE AUTOMOBILE:—I have a Buick model 17 which I am rebuilding into a truck. After the body is cut off behind the front seat the frame is too short so I thought I would get a longer frame to make the wheelbase 3 feet longer. What would be the best way to lengthen the driveshaft from the transmission 3 feet?

2—What is a good flux for welding aluminum by the oxy-acetylene process?

Earlham, Iowa. GEO. PHILLIPS.

—If you intend to carry the rear axle back a distance of 3 feet the best method of lengthening the driveshaft would be to cut it somewhere in its length and drive a piece of seamless steel tubing over each end of the shaft a distance of 6 inches or more. The tubing can then be brazed or welded to the shaft and a good connection made between the two. It must be remembered that in lengthening the wheelbase of a car it throws the entire steering layout out of arrangement, and as a result of this you will find a tendency of the car to skid. The center lines of the hub of the two front wheels must intersect the line of the rear axle produced at a common point and this will not occur if you carry the rear axle back in its original position.

2—It makes a great difference whether you are welding sheet aluminum or cast aluminum what flux you should use. Zinc chloride is used quite frequently, but best satisfaction can be secured by purchasing from the large welding concerns the proper flux. These are secret formulas which have been worked out by the chemists of these concerns and while you will have to pay a little more for them, the better results justify their use.

Chloride of Zinc Used as Aluminum Flux

Editor THE AUTOMOBILE:—Can you give me a formula for a solution to be used in soldering aluminum as muriatic acid is with sheet iron? I wish to use a copper and common solder with a little aluminum added.

Millersburg, O. B. L.

—The flux generally used with aluminum is chloride of zinc, but with the solder you speak of this might not prove to be the best.

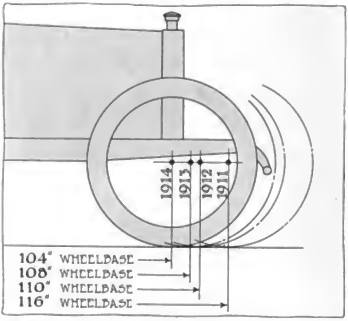


Fig. 2 Diagram showing average wheelbase of first three cars to finish the Indianapolis race in 1911, 1912, 1913 and 1914

Experimenting on Boron for Resistance

Editor THE AUTOMOBILE:—I would like to ask you if there are any boron cutouts or current regulators used in the electrical equipments of automobiles?

Denmark, Wis. A. W. BROBERG, M. D.

—The use of the element boron for cutouts and regulators for electrical apparatus, has been tried out by different concerns and in fact many are conducting experiments at the present time, but it has not yet proven satisfactory. The quality of boron in having the resistance increase with its temperature due to the passing of an electrical current through it, would seem to make it ideal for use in regulators; especially since it has a fixed point at which the current does not further increase. It seems to be short-circuited upon itself and holds the current at a steady voltage.

However, the disadvantages have proven so many, that as yet no satisfactory use has been made of the boron.

Magnets Probably Have Become Demagnetized

Editor THE AUTOMOBILE:—Will you kindly inform me through THE AUTOMOBILE regarding the following:

I have a Ford and have just installed a new magneto and

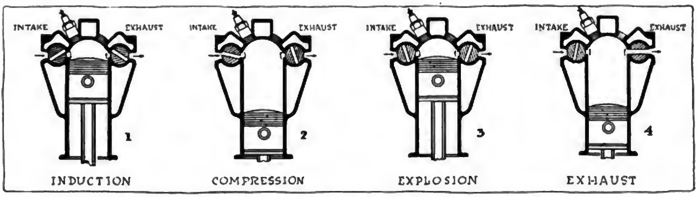


Fig. 3—Showing Mead motor at different parts of the cycle with reference to valve position

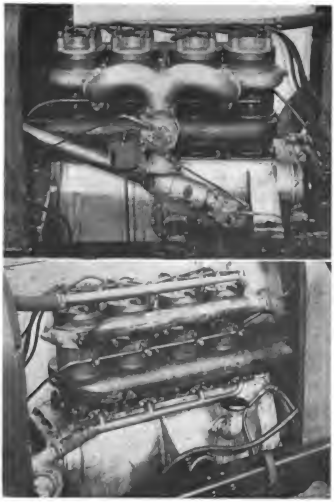


Fig. 4—Intake and exhaust side of the Porter-Knight motor, showing manifold and cylinder construction

tested magneto coils and find all O. K., but the magneto will generate only 3 1-2 volts which will not run the motor. I tested direct from magneto and know that the magneto plug is all right. It will not generate enough to light one 6-volt 12-candle power lamp.

Honeoye, N. Y. H. M. Patterson.

—If you are sure that all the wiring and connections are correct, it is probably due to the fact that the magnets have become demagnetized, that the magneto will not operate. The magnets should be tested and if they are weak, should be charged.

Origin of the Cantilever Spring

Editor The Automobile:—When was the cantilever spring first used and on what car?

2—Please name the next few cars to employ this construction, naming them in order of adoption?

3—Name the various types of axle suspensions and drives used, and give one or more representative cars using each design.

Chicago, Ill. G. S. C.

—The cantilever spring was first used on the Lanchester car made by the Lanchester Motor Co., Birmingham, Eng. While it may possibly have been used on experimental vehicles previously, there was no doubt that the Lanchester was the first car to which it was fitted as stock design.

2—It is not quite clear who was the next one to adopt it after the Lanchester as it was used by a variety of makers of small cars. The Daimler company, Coventry, Eng., and the Rolls-Royce company, Derby, Eng., also adopted it at the same time. It has been used in France by several makers and now has been adopted by the Wolseley company, Birmingham, England.

3—It is not quite clear what you mean by axle suspension. There are only two ways of attaching an axle, one being above and the other beneath the springs. Both are very common practice in America and are used in various combinations with different methods of drive. For instance, in the Hotchkiss drive, where all the drive and torque are taken through the springs, it is practically universal practice to mount the axle under the springs and in the various modifications of the Hotchkiss drive where supplementary torque stays, etc., are used, the axle is generally over the spring. On cars where the torque and drive is taken by various kinds of tubular arrangements, the axle is found over and under the springs in representative cars. Cars which drive through the springs, such as the Franklin, Hudson, and Hupmobile and a large number of other representative American designs generally have the axle under the springs, but it has become a growing practice to undersling the three-quarter elliptic. There are three main features to be considered in arranging the drive and a practically unlimited variation is made in the detail arrangements for handling drive, torque and radius action. The method of taking the drive in all the American cars was listed in The Automobile specifications published December 31, 1914.

Adjustment of Main Bearings

Editor The Automobile:—How many miles should a Paige 36 run before the engine main bearings need adjustment?

2—What per cent. of grade, paved with asphalt should the Paige 36 which weighs 3,600 pounds with passengers, be able to climb on high?

Santa Barbara, Cal. E. F.

—You should be able to run the car an average of 10,000 miles before the main bearings need adjustment, but if you have driven improperly with spark advanced too far, for instance, or attempted to take every hill on high gear and do various other things with the car which put extra strain on the crankshaft and bearings, it will sometimes happen that a set of bearings will wear out in 2,000 miles.

2—The Paige should be able to take a short hill of 12 per cent. on high gear, but on a long hill a 7 or 8 per cent. grade would be the maximum.

Parts Wanted for 1911 Warren Car

Editor The Automobile:—Where can I get a set of cylinders for a 1911 Warren-Detroit car?

Jersey City, N. J. David Patterson.

—Parts for the Warren car can be secured from the Puritan Machine Co., Detroit, Mich. In writing for parts of the car you should mention the serial model number in order that you will be sure of securing the proper part numbers.

Wants to Install Starter on Moline

Editor The Automobile:—What starter would you recommend which will do the work and can be installed on a 1912 Model M 35 Moline?

I have had several customers for this but up to date have been unable to find one. Would appreciate drawings and any information you may have at your disposal.

Mt. Sterling, Ill. Auto Service Station.

—To install an electric starter on this car means a great expense, as machine work and special parts are necessary. The Moline company has installed Ward Leonard systems on two or three cars of this model and the work necessitates a new crankcase bottom, new brackets and a new flywheel. It is this system that has been recommended by the Moline company whenever inquiries have been made to them. On the other hand, several instances are noted where the Crescent air starter has been installed very reasonably and it is stated that it operated satisfactorily. With the air starter, the work necessary in making the installation is not as great, but should an electric be desired by the fitting of the parts mentioned a satisfactory job could be made. It must be remembered that the cost is so high that, according to men who have had this work put through, it would pay the owners to sell their cars and purchase up-to-date models.

Tire Pressure Same Throughout Tire

Editor The Automobile:—Kindly give me the following information, all questions referring to a 34 by 4 tire, car weighing 3,000 pounds and the rear tire having a direct load of 800 pounds:

When an inflated tire is in a stationary position at which point is the highest pressure?

2—How much more pressure is at this point than at a point directly opposite?

3—Outline mathematics necessary for working out the result.

4—When a car is traveling 20 miles an hour with what force does the tire strike an object?

5—Is it true that the air inside of the tire travels in a direction opposite to that of the tire?

Detroit, Mich. J. M. Kearney.

—The pressure is the same throughout the tire. It is one of the fundamental physical properties of gases that when a mass of gas is inclosed in a vessel, it exerts a uniform pressure against every square inch of the surface of the vessel, and also that at any point in the fluid mass the pressure is the same in every direction. Were this not so, the gases in the tire would not be in a state of equilibrium and hence, although the tire was stationary, the gases would be under constant motion as the part having higher pressure would tend to flow toward that having a lower pressure.

2—This is answered under question 1.

3—There is no mathematics necessary in arriving at this conclusion.

4—When a car is traveling at 20 miles an hour the force of its impact against a stationary body depends upon the weight of the car. There is no direct answer to the question: "With what force does a moving body strike?" The energy contained in a moving body cannot be expressed in pounds simply, but only in foot-pounds, which is the product of the mass into one-half the square of the velocity. Thus, if a car is traveling at 20 miles per hour, or 29.3 feet per second, the energy contained in that car is equal to $\frac{W\ v^2}{2g}$: where W is the weight of the car, v the velocity in feet per second, and g the acceleration due to gravity. For the particular case you mention, the energy contained in the car is 13.34W foot-pounds. For 2,000-pound car the energy would be 26,680 pounds through a distance of 1 foot or the pounds and feet may be divided in any way so that their product equals 26,680.

5—It is not true that the air inside the tire travels in a direction opposite to that of the tire. It travels with it.

Dead Axle Requires Chain Drive

Editor The Automobile:—What is a live axle?

2—What is its advantage over the other types of axle?

Rutherford, N. J. C. M. Daniel.

—A live axle is one which is a part in the transmission of power and hence is in motion during the time the power is transmitted. It is the opposite of a dead axle which merely has the function of carrying the wheels and which does not revolve with them. With a dead axle, it is necessary to get the power back to the wheels by means of chains, whereas, with the live axle, the more silent shaft drive can be used.

American Used Teetor Motors

Editor The Automobile:—Kindly advise me by mail who made the motor that was used in the 1912 American Tourist underslung car?

Jersey City, N. J. A. H. Kopetschny.

—Some of the motors used by the American company were of the concern's own manufacture but in the particular car you mention they were made by the Teetor company. This is now the Teetor-Hartley Motor Co., Hagerstown, Ind.

Fan Dynamometer Is Fairly Accurate

Editor The Automobile:—I have a motor in Maine, the power of which I wish to determine without sending it here to be tested. I find I can purchase an air fan with the paddles arranged so that they can be moved in and out, thereby allowing the motor to run at varying speeds. The power can then be determined according to a test formula which shows that with the air paddles in certain positions and the motor running at a certain number of revolutions so much power is developed. Is such a device accurate or reasonably accurate? If so, is it the most simple and least expensive means I can employ?

New York City. Willard Wadsworth.

—The fan dynamometer is the simplest type of brake horsepower measuring outfit which you can secure and is fairly accurate.

Burman Made Fastest Time in 1911

Editor The Automobile:—Can you possibly tell me what is the greatest speed ever attained by a motor car? Also, where and by whom?

Waltham, Mass. Henry M. Stanley.

—The fastest time of which any recognized record is held in an automobile is that made by Bob Burman at Daytona Beach on April 23, 1911, when he made 1 mile in 25.40 seconds in a Blitzen-Benz.

Porter-Knight Develops 122 Horsepower

Editor The Automobile:—Will you kindly publish the maximum horsepower developed by the Porter-Knight racing car which was entered in the Indianapolis Race. If possible I would also like to see the motor illustrated.

Detroit, Mich. B. H. S.

—The horsepower curve of the F. R. P. Knight motor is shown in Fig. 5 on this page. It will be noted that the curve extends above the 122 horsepower mark at a speed of about 4,000 r.p.m. Exterior views of the motor are shown in Fig. 4.

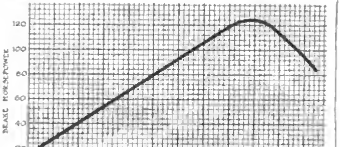


Fig. 5—Horsepower speed curve of the Porter-Knight high-speed motor

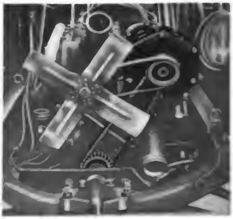
ACCESSORIES

Dyneto for Fords

A NEW single-unit starting and lighting system for Ford cars has been brought out by the Dyneto Electric Co. The motor generator is practically the same as that which has been furnished for the Franklin and throughout the entire electrical design is similar to the larger models of motor generator. The windings are such as to prevent overcharging of the battery by limiting the output to within the maximum charging rate. This is accomplished without the use of any external regulators.

The motor generator is attached to the car by means of a carefully designed bracket which holds the equipment firmly to the motor. The method of installation is so simple that, according to the manufacturer, anyone can install it in approximately 3 hours. No drilling or machine work is required. The outfit comprises the motor generator, storage battery, starting switch and a complete outfit for the mounting and driving of the unit. The Dyneto is installed on the left of the engine with its shaft forward so that a chain drive can be used directly from the Dyneto shaft to the crankshaft. No extra chains or gears are required. The wires are all cut to length and numbered so that by carefully following directions any layman can make the installation. The battery is a 12-volt Willard inclosed in a pressed steel running board box complete with bolts for mounting.

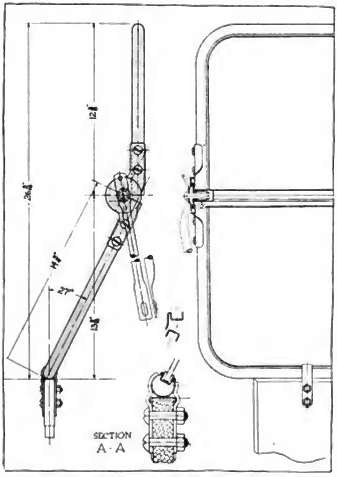
Besides the starting switch, an ignition switch is also furnished and the regular ignition switch on the coil box can be discarded. In starting it is only necessary to move the switch to the extreme right position and allow it to stay there. When in this position, the motor generator is acting as a motor at the lower car speeds and as a generator at the higher speeds. The machine begins to charge the battery at a little less than 10 miles per hour, delivers its maximum of from 10 to 11 amperes between 15 and 20 miles per hour and drops to about 6 or 8 amperes at higher speeds. The complete outfit, including full instructions, sells for $75.—Dyneto Electric Co., Syracuse, N. Y.



The new Dyneto electric starting and lighting system for Ford cars

High Speed Hand

The manufacturer of the Corbin-Brown speedometer has incorporated in this branch of its product an improvement which it expects to be of great service to automobilists and motorcyclists but particularly to owners and operators of commercial vehicles. This improvement consists of an individual maximum speed hand as shown in the accompanying illustration. This hand is colored red and is entirely distinct from the regular speed indicator, being locked to the trip odometer in such a manner as to render it impossible for anyone to reset it at zero unless provided with the key. As the name implies this hand registers the highest speed made during the day or trip and remains at that point until unlocked.—Corbin Screw Corp., New Britain, Conn.



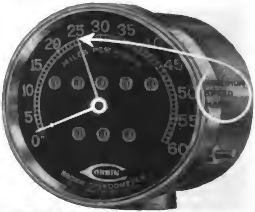
Details of Diamond windshield for Fords with sectional views

Windshield for Fords

Specially adaptable to the Ford as now made, is the Diamond windshield. This shield is of the black enameled tubing type and has two glass parts, as illustrated herewith. As attached to the Ford the lower glass is tilted inward at an angle of 27 degrees, there being supports running from the pivot point for the upper glass to the sides of the body. The upper glass may be swung into any position around its base pivot. The width of the shield is 42 3-8 inches, and the height (with the lower glass at an angle) 26 3-16 inches.—Diamond Mfg. Co., Detroit, Mich.

Gaso-Tonic for Fuel

Gaso-Tonic is a motor power fluid which is claimed to increase power and mileage from 25 to 50 per cent. when 1 ounce of it is poured into 5 gallons of gasoline. The maker states that the use of the fluid removes carbon from the cylinders and that there is no acid or other ingredient in the preparation which could injure the motor.—White Mfg. Co., Cincinnati, O.



Corbin-Brown speedometer incorporating the new maximum speed hand

Resilience No True Gauge for Tire Efficiency and Efficiency No Measure of Needs

A Discourse Based on Contrary Views in Letter by Mr. Duryea

By M. C. K.

CURRENT opinions on a subject such as that of automobile tires, with regard to which those interested have ample opportunity to gather experience, may be expected to contain some truth if not all of it. Yet the letter reproduced herewith, from Charles E. Duryea, the well known pioneer builder of light automobiles, relates that most people want tires to be thick, so as to resist puncture, but that he, after 25 years of experience and study, wants them to be thin and as resilient as possible. He also expands this view so as to make it include other tires than air tires, and claims that these, too, should be as resilient as possible. Mr. Duryea's views are no doubt entertained by a great many others, being followed quite widely in tire-manufacturing practice, so far as cushion tires and solid rubber tires are concerned, and they have a large following also for air tires, obscured only by the demand for knobby treads and the fear of punctures. They are therefore entitled to be spread on the records, but, as they point in the wrong direction for progress, the partially dissenting opinion of the writer is registered at the same time. The situation seems to be similar to that which gave the United States very bad coffee to drink for many, many years. It was the current opinion that good coffee should be hot, and the popular inference was that hot coffee was good. The result was that coffee was always piping hot—sometimes superheated, in fact—and all effort for improving its quality in a more rational manner went by the board. With regard to tires, the observation that tires which are good—meaning in most cases only those which win races or give large mileage for a given expenditure of power—are highly resilient has been followed by the fallacious inference that the most resilient tires are the best. This inference would lead inventors and manufacturers to seek for improvement in the direction of resiliency.

The remarks referred to in the opening passages of Mr. Duryea's letter are the following, which appeared in THE AUTOMOBILE of May 20, page 903.

"Certain tires," D. says, "will give 25 per cent. more mileage per gallon of fuel than others BECAUSE they are more resilient . . ." The BECAUSE seems arbitrary, even if the tires referred to are in fact more resilient. The reason for saving power by using them might be that their resistance to flexion is smaller, and not that they extend with nearly the same force that is spent in flexing them. It is possible to imagine a tire flexing with small resistance yet resuming its shape slowly.

Mr. D. seems to believe that the power absorbed in flexion is returned by a resilient tire in form of help for the propulsion, but the saving effected is really due to the smaller acceleration of masses which the tire flexing with small resistance makes possible; the vehicle body, for example, is moved less, and less rapidly. But the extension of the tire to its normal shape returns no power in a useful manner. This objection also covers Mr. D.'s rapid conclusion from his racing experience in 1896. The flat tire had to be flexed all the way round, yet saved no load lift or acceleration.

Duryea's Argument for Resiliency

Editor THE AUTOMOBILE:—' have read and re-read your exception to my expressions concerning the reason why some tires require less power to propel them and their load than others. Whatever you mean, I cannot allow it to pass unchallenged. I have been through this subject too often in the last 25 years to not have arrived at a conclusion that will take more than mere assertions to dislodge.

We seem to differ in our conceptions of the tire structure. I cannot imagine any reasonable tire structure that would not be equally flexible each way. If it yields easily to pressure from the outside it will yield easily to pressure from the inside. Or in other words if it is an air tire instead of a stiff fabric tube it will absorb the pebble and not lift the load. This seems to be what you mean by "smaller acceleration of masses." This swallowing of the small inequalities is the reason for the air tire. It smooths the road and on most road surfaces requires less power than a solid tire which does not have this action. I think we agree thus far.

I can of course imagine a tire having many dash pot plungers attached to the inside of its tread and arranged to compress easily but restrained from regaining its proper shape by the slow action of the dash pot plungers. The point between us seems to be this: that you believe such a tire would propel just as easily as the usual air tire, which pushes against the ground as it leaves it almost as forcibly as it pushes against the ground where and when it meets it. I am sure that it would not. So long as both of these tires were standing, the pressure behind and before the center of contact would be the same. But roll them and the slow one has much resistance to compression ahead of contact and no assistance to propulsion behind. The perfect air tire has as much help from behind as it has resistance in front. This is stating the theoretic extremes. Of course any tire that resumes its former shape will get some propulsion assistance from that resumption tendency unless mechanically restrained from resuming its shape till it no longer touches the ground. The slower the wheel movement the greater the amount of power returned to the wheel. The faster the wheel motion the greater the loss due to this compression and slow expansion of even the air tires, but since at higher speeds the air tire smooths the road and saves other losses we use them and find them valuable.

One more shot. In the imagined dash pot tire the work of compression would heat up the dash pots by the friction of the slowly returning plungers. In other words the heat of the work of compression would be found in the dash pot liquid. But in the tire which I claim kicks the wheel ahead where does the work put into the tire by the compression go to? I claim it expends itself by pushing against the ground, less of course such slight heat as the flexion of the fabric causes. The dash pot tire would have that fabric heat also. I trust this makes it plain that "the extension of the tire to its normal shape" does return "power in a useful manner." This matter is easily proved by running the different tires on a floor or similar smooth surface where there is nothing to cause the wheels and axles to rise or fall. No "acceleration of masses" unless the small amount of tire tread disturbed be considered a "mass." Tires to be inflated to carry the load alike, i.e., with the same degree of flattening. The stiff tire containing much fabric will require far more power to roll the wheel than is required by a tire that has a very thin fabric and carries its load on air, which is perfectly elastic, rather than on fabric which is very inelastic. Our resiliometers used in the cycle days showed differences of as much as 25 per cent. and it is likely that there is a greater difference in auto tires. Electric car makers ought to be able to give us the facts in this matter. They know by actual miles driven that one tire will use many per cent. more power than another.

The recent economy tests of the Franklin cars showed that the cars which made the larger mileages were mostly equipped with "cord" tires. The advantage of the cord tire is its greater flexibility. Flattening a tire at its point of contact absorbs a certain amount of power. Part of this is lost in the friction of bending the tire structure but most of it is available for work. Part of this work is done in restoring the fabric to its normal shape and the remainder is expended in pushing the wheel ahead and helping to overcome the resistance of the original compression. We should all work to see that this latter part is as large as may reasonably be.

So long as the auto was "the plaything of the rich" the matter of economy did not enter, but now that it is each day becoming more the necessity of the poor and extending to our daily work we should give prominence to those things which make for economy. Most buyers need education on this tire matter. They give no thought to tires except to hope they are so thick they cannot be punctured. They do not know that a thick tire must be kept inflated so hard that it will not properly smooth the road or else it will quickly break its fabric, whereas a thin one can do its duty and still have long life because a thin piece of anything will bend more times than a thick one, before breaking.

Philadelphia, May 21, 1915. CHAS. E. DURYEA.

Even the gold nugget at the end of Mr. D.'s letter, to the effect that a tire with thin and flexible fabric can be used with lower inflation than it is necessary to employ for a stiffer tire to avoid expense, cannot be accepted at 24 karats, as practice shows that thickening of the tread at intervals by means of rubber-compound knobs projecting from a flexible casing produces easy riding with moderately hard inflation, the knobs serving to localize the flexions caused by inequalities of the road and the flexible fabric between them easing these flexions, while some of the inequalities are taken up in the intervals between the knobs. In conjunction with very flexible side walls for the tire, which reduce the need of flexion at the tread, this compromise-construction probably serves comfort, economy and convenience (protection against punctures) more acceptably than the tire casing which is thin and flexible throughout can do, at least on hard roads. On soft country roads, where the inequalities are mainly in the form of waves and depressions, it is the quality of the spring suspension, rather than the tires, which counts for comfort and protection, the needed tire flexions being no more abrupt than may be properly demanded of any air tire.

Two Properties Confounded

Reverting to Mr. D.'s main argument, which runs to the effect that resiliency is the secret of tire efficiency, but lapses in spots (as where cord tires are mentioned) to the admission that it is flexibility which saves power, it seems that he considers these two properties identical because they are so closely associated in air tires, and perhaps he overlooks for the moment that an air tire, besides absorbing road obstacles by local flexion also acts as a spring, flattening out against an elastic resistance, much as any other kind of spring does. In so far as this plain spring action, which comes into play, for example, at any gradual rise in the road, is needed to help out vehicle springs which are too stiff, it is evident that it assists in reducing power consumption just as more flexible vehicle springs would do, and if this action in practice depends upon the resiliency of the air, it is not far off to maintain that the resiliency makes for tire efficiency—only it would be more correct and to the point to insist that the tire flexion assists the spring suspension to save power.

If 50 per cent. of the resistance to such flexion took the form of friction—the friction of air passing through the capillary openings of a spongy structure, for example—the assistance to the spring suspension would remain the same and the flexibility would be the same as before, but the resiliency would be much reduced and the tire would not rebound at once. The rebound would not throw the axle upward, because, even at slow speed, it would not act till after the road formation causing the spring action was passed and would then take effect to restore the tire to its original shape. Theoretically such a tire would be an improvement over any existing air tire, when only the action and not the weight is considered, giving the same effect for all speeds that is now obtained from air tires only for the high speed, but it is probably true that it would be extraordinarily difficult to produce a tire of this character which would be durable and light and in which the flexibility would be equal to that of a standard air tire with a thin and flexible casing. In comparison with cushion tires and solid rubber tires the possibilities look different, however, the theoretical fact remaining, after the speculation has been dismissed so far as any immediate or practical influence on the construction of air tires is concerned, that a resiliency which takes effect directly from the road obstacle, and causes bouncing of the running-gear and of the vehicle as a whole, is undesirable for any type of tire, whether it is unavoidable in air tires or not. Cushion and solid tires have not the plastic flexibility to wrap themselves around small road obstacles, but have so much resiliency as to make them bounce, and it is entirely pertinent to the question of their improvement to make it clear that it is not their resiliency which should be increased but their flexibility, if possible and consistent with other requirements.

Source of Air Tire Efficiency

Mr. D. apparently does not remember that this idea was advanced in the first place with reference to tires of this general type and not with reference to air tires, to which it applies in the abstract, however, with equal correctness, notwithstanding that it may be difficult to "imagine any reasonable [air] tire structure that would not be equally flexible each way." (It would be too captious here to remark that an air tire has just that quality when the casing is not deformed.)

The efficiency of air tires as power savers is probably due mostly to the fact that the compression of the air caused by the load remains constant on smooth roads and consumes no power, the air being merely chased around slowly as flexion of the fabric advances from one point of the casing to the next, while in tires of other kinds all the elastic material must be flexed successively as the wheel revolves. It is especially worth noting that this advantage of the air tire holds good whether the inflation is high or low. In all cases only the flexion of the fabric makes demands upon the power, except when shocks are received. Comparison between air tires and solid tires in this respect points perhaps to a reduction of both resilience and flexibility in heavy duty tires in conjunction with a superior development of flexibility in the spring suspenson.

Interaction with Springs Neglected

Referring again to the spring action of the air tire in connection with a vehicle whose leaf springs are too stiff and the advantages in the way of reduced power consumption which may be recorded if the tires are highly resilient, there seems to be occasion for calling attention to two slips in the reasoning. One consists in ascribing the advantage to the resiliency alone when other properties, notably flexibility, are also involved. The other one lies in failing to record the flexibility of the springs with which the tires co-operate, since it is more than probable that the same tires which show superiority in connection with stiff springs would show an inferior efficiency, as power savers, in connection with more flexible springs. The road condition should, of course, also be recorded, since it is an established fact that hard and rigid steel tires give the smallest traction resistance on a perfectly smooth and dry road. In whatever manner power consumption records are established, they are almost valueless for ascertaining tire requirements unless they are completely co-ordinated with records of the loads, the properties of the vehicle springs and of the roads.

To have the spring equipment the same for all tests is not sufficient. There must be different springs, different loads for each set of springs and different road conditions for each combination of springs, loads and tires. Speed variations must further multiply such tests to make them scientifically acceptable.

It is simpler to go a little farther and deeper with reasoning alone and begin testing only when the logic begins to totter.

Various Distinctions

If the "mere assertions" to which Mr. D. refers are these: "That flexibility is another property than resiliency" and "that springs reduce acceleration of mass," by either transforming a shock into movement or a sudden movement into a slower one, there is, for brevity's sake, nothing to be said. They will have to stand—as 2 x 2 make 4—till more definitely contested. The elastic tire saves shock, kinetic energy, work, power, not only by absorbing the pebble, but also by its other spring action. It has to have resiliency in order to regain its shape after flexion and because resiliency is the most practicable property by which the resistance to flexion can be increased somewhat in proportion with its degree; otherwise flexibility would be sufficient—a flexibility operating with an initial resistance equal to the support of the load.

If a carpenter falls from a building and is saved by striking a board of the scaffolding, bending and breaking it, he gets the benefit of its flexibility while destroying its resilience; it does not rebound when broken.

Vehicle springs must be highly resilient in order to get back to work quickly (and to obviate fatigue of the steel), but the compressed portion of an elastic tire has a whole revolution of the wheel before it must be in shape again. It may be doubtful, therefore, how much elasticity and resiliency, which are not necessarily quite identical, are required of it.

In vehicle springs we sometimes reduce the resiliency by adding shock absorbers and save power by this modification. We especially moderate the rebound. We frankly throw away the power stored in the rebound, not knowing how to utilize it, except for returning the spring to its best position.

No Single Property Decisive

Not a single reason points to the need of perfect resiliency in a tire. Every reason points to the need of some resiliency coupled with the greatest practicable degree of flexibility in a tire. The limits of the flexibility are determined by (1) the need of supporting the load on smooth roads with a minimum of flexion and a minimum of power spent in flexion, (2) the limited dimensions at disposal and (3) the desirability of avoiding heating, wear and deteriation of tire material. The last consideration operates in favor of not giving the tire too much work to do but allowing it to transmit the larger portion of the spring work to the vehicle springs. The possibility of overloads also militates against gauging the flexibility so closely that large deformations of tire materials are apt to take place on smooth roads. Durability is here an intricate factor. But resilience, in needlessly repeating deformations, is against durability.

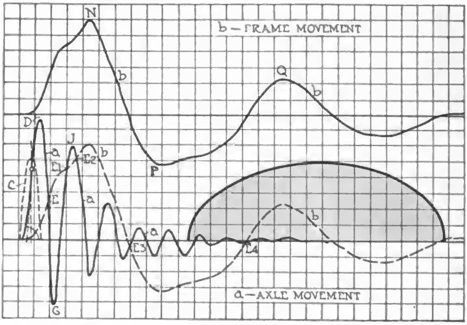
The aim of the tire constructor must be to reconcile these factors, but not blindly to produce the maximum of resiliency. Quite likely the use of materials which are highly resilient affords the readiest compromise solution, since none other has been devised; and air confined in flexible fabric has the enormous advantage that it yields to a pressure covering 1 square inch with a resistance only a percentage more than one-tenth of its resistance to a pressure covering 10 square inches. This property makes it absorb the small obstacle. But this advantage is abandoned in tires of other types, while the resiliency which causes undesirable reaction movements is conserved at the expense of desirable flexibility. Only Mr. D.'s argument to the effect that the resilient reactions are utilized for propulsion standa against aiming for reducing resiliency and increasing flexibility if possible, in airless tires.

The Back Thrust Theory

He claims the air pushes against the ground behind it as the tire rolls on. The resilient material in a solid or cushion tire should do the same, on the principle he advances.

The pressure-center of the push to which he refers would, with 4-inch length of ground contact area, be about 1 inch behind the axle plane, on level ground. The push is toward the axle. It has no effect to turn the wheel in either direction. The upward push is offset by the downward push, so there is no relief of ground pressure or driving-resistance. What does it do except expanding the tire to its full shape? In front of the wheel, on the other hand, there is the absolute work of flexing the fabric and compressing the air, but on smooth roads the compressing of the air by the load is constant, and only the work of flexing the fabric remains. This is completely lost. (If the tire is flat, as in the race to which Mr. D. referred in his first letter, the flexion is greater—much greater—the spring benefits are nil and the constant reshaping of the tire is also taken out of the power.)

Therefore, the flexibility of the fabric and the degree of inflation, which rules the amount of flexion work, determine air tire efficiency on smooth roads. Resiliency only reshapes the tire. This agrees perfectly with the statement by Mr. D. that "a stiff tire containing much fabric will require far



Automatic shock record, showing function of resilience with air tires at 14 miles per hour vehicle speed more power to roll . . ." It certainly will, if the load is sufficient to flex it, despite its stiffness.

Cord Tires and Inflation

Superior flexibility in cord tires arises mainly from the inextensible cords preventing the traction resistance from deforming the fabric in the tangential direction, where the resistance to such deformation is great, yet smaller than the traction pull. In an underinflated tire this sort of deformation is at its worst, hence loss of power and rapid deterioration of fabric. Nevertheless, it is authentically established that soft tires give maximum comfort for slow to medium-fast driving on rough roads. Their flexibility is higher and their resiliency is lower than if the inflation were normal. The fact therefore serves as a reminder that resilience is a secondary factor for some of the purposes for which tires are employed, and also points to the futility of judging tires solely on a basis of their power efficiency.

Action Under Shock

If Mr. D. will glance at the accompanying illustration (reproduced from Fig. 9, page 197, of THE AUTOMOBILE, Jan. 28), which is an automatic record of axle and body movements taking place when a vehicle with properly inflated air tires and going at about 14 miles per hour, passes over an obstacle about 1 inch high and shaped as shown in the shaded space, he will observe that the axle is raised a little less than the height of the obstacle when over the middle of it (the letter C indicating the obstacle foreshortened to the horizontal scale of the diagram). The tire is only a trifle compressed. Its rebound therefore began taking effect while the wheel was still climbing and behind the obstacle. The resilience could therefore under no circumstances, at this moderate speed, act to turn or push the wheel in any useful direction.

It throws the axle into the air; and that is just the objection to the unrestricted resilience. The flexibility, on the other hand, helps the wheel over the obstacle.

At higher speeds (see Fig. 11, page 198) the tire is off before rebound begins and expands against the atmosphere.

The evidence from automatic records is overwhelmingly against the theory that the resilient reactions help in propulsion, but shows conclusively that they cause the axle to bounce remarkably and uselessly at the low vehicle speeds.

In the case of airless tires it is no longer so hopeless to try to imagine a structure permitting ample flexion and avoiding immediate rebound, and thus producing somewhat the same effect that an air tire produces at high speed. This would of course be very acceptable even if the power spent in flexions for shocks were much greater than that similarly spent in a racing tire, as it could be offset by small flexions on smooth ground—where tire economy is mostly determined.

But it must be admitted that so far no material or arrangement of materials has been devised which will allow large flexions under shock while nevertheless sustaining a load with small flexion. The idea of such a material and of the manner in which it would have to be used—large wheels and large contact area—represents only an aim more rational than the aim for higher resiliency.

Resilience Rejected as a Measure of Tire Efficiency by S. A. E. Standards Committee

IN connection with the preceding article, special interest will be taken in a portion of the report rendered at the meeting of the S. A. E. Standards Committee in April by the Electric Vehicle Division and the action taken by the Committee in rejecting its repeated recommendation to accept an instrument for measuring the resilience of tires as standard for testing the efficiency of solid tires.

The opinions expressed at the meeting are rendered in substance in the following extract from the official report appearing in the S. A. E. Bulletin for May.

A. J. Slade, chairman of the Electric Vehicle Division, in re-submitting the former recommendation regarding efficiency tests of solid tires, said: "The rebound instrument developed by E. R. Whitney has been in use by him for several years. He buys all the tires for the Commercial Truck Company of America on the basis of tests with that instrument. F. A. Whitten has been buying all the tires for the General Motors Truck Company on the basis of tests with the instrument. Several other members of the Division who are manufacturers have been using it. I, personally, immediately after the rejection of the report last winter, incorporated the test in the specifications which I drew for motor tractors for New York's street cleaning department.

"It is of course a matter of indifference to the electric vehicle makers, all of whom are represented on our Division, whether the recommendation is rejected, because most of them are using the instrument and more of them are going to use it. It is only a question whether the Society wants to recommend it. It is in use. It has become a standard."

C. B. Whittelsey had no doubt that the instrument was all right in the hands of its designer but was skeptical about placing it in the hands of the people who generally purchase tires. He was quite sure that three or four of the largest tire manufacturers in the country are not using it in their factories. His own company had found too much friction in the instrument, due to rust. In conclusion he said: "We might produce a tire of a compound that would give a very high rebound test but very poor mileage. As Mr. Hall had said at the Society meeting, the shape of the tire makes a difference. It seems to me that a more practical test could be developed."

W. H. Allen: "We question whether the rebound test, which seems to indicate resiliency only, is necessarily indicative of what a tire will do, in so far as efficiency is concerned. In other words, we seem unable to establish a definite link between efficiency and resiliency. In making tests to determine this, we have found that certain non-resilient tires over certain surfaces gave the highest efficiency tests. On a smooth and hard surface a steel tire is most efficient, so long as there is no slippage. On a very rough road some very soft tire seems to be more efficient. It seems that there is no definite relation between the efficiency shown by the rebound test and by road test. I think that it would be best to have such points settled, tested out to a conclusion, before we decide that rebound testing indicates what a tire will do in service."

C. B. Whittelsey: We have been trying for over two years to develop the rebound instrument so that it could be used practically. We are now developing at great expense a current consumption testing machine. I think it gives much better information.

W. H. Allen asked not to be misquoted as denying all relation between resiliency and efficiency, but they had not been able to establish it for solid tires. It was very well known that there is a relation in certain other tires, for example in pneumatic tires, which are highly resilient and highly efficient under some forms of construction.

The section of the report under discussion was laid on the table pending further investigation by the tire companies and the vehicle manufacturers.

The AUTOMOBILE

PUBLISHED WEEKLY

Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, June 10, 1915 No. 23

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Ave., Phone Harrison 7707
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - Autoland, New York
Long Distance Telephone - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - One Year, $3.00
Canada - One Year, 5.00
Foreign Countries - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.

Member of the Audit Bureau of Circulations.

The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

The Bottom

THE 1916 car buyer has two major factors perplexing him: First, he is amazed at some of the price reductions with no apparent reduction but rather increase in the total quantity of car offered. Second, he is still further amazed at the possibilities of cylinder multiplication and wonders where the end of such will be and where is the bottom of prices. Hand in hand with this comes fabulous stock dividends, automobile war stocks steadily rising and he wonders if it is all profit in building cars, particularly if you build the car the people want and can sell it at figures which the public did not think was possible.

King Solomon when he wrote "of making many books there is no end" might have added "of making automobiles there is no end." The enormous demands of today in the face of a world war, the increasing outputs of factories building cars for the masses but reminds us of the vastness of 100,000,000 population and the unmeasured fecundity of the soil of the great Mississippi valley agricultural territory. Perhaps some of our makers had better study more closely this great productive area, and then turn an attentive ear to the enormous possibilities in South America, to the field in Africa, to Russia, to Siberia, to the Canadian west, to Australia, and then take a firmer grip on life and business, going forward with the assurance of success.

Board Speedways

THE building of board speedways in America is nearly on a par with war order business is motor trucks. Every week brings some new one into the limelight, and if the present pace is maintained it will be but a short time until we have not enough cars and drivers to fill the schedules and dates. Today the board speedway is an uncertainty, it is looked upon to give higher speeds than brick or cement, but there is the possibility of skidding more easily, particularly when wet or greasy. The use of pans under the cars should prevent this. One pronounced advantage of wood will be the freedom from vibration as compared with brick.

The new board speedways will differ from the existing Indianapolis speedway in one other essential, namely, that they are banked for much higher speeds and it may be possible to drive the curves at speeds of over 100 miles per hour without having to shut off the motor. If this prove so, and it is to be hoped it will, a new aspect will be brought forward in racing, that is, a possibility of continued high-speed work with not a second of let-up. The momentary shut off at the turns on Indianapolis have been rest periods for the engines, and drivers will be facing an entirely new order of motor test if these momentary tests are eliminated. Designers will then have to work to meet a higher order of test and the test supreme will be administered.

South American Etiquette

WHEN in Rome do as the Romans do and when transacting business with the Latin nations of South America begin your business along the lines that these people have been accustomed to do business in. Do not start as a revolutionizing radical but rather as an astute student of merchandising, finding out first what South America wants and then endeavoring to give it in the way she wants it.

Business deals are not infrequently opened by personal letters and these should be the subject of extraordinary care, not the flippant type you write to a dealer who has handled your line for 6 years but rather the carefully edited letter of the diplomat. The letter must be written in Spanish if that is the language of the city for which it is destined. It must be in South American Spanish and not New York Spanish. Such letters must be signed in ink by the sender, not signed by some clerk or with a rubber stamp. These are minor formalities that must receive primary consideration. Then, too, it will pay to get out special letter heads for South America, preferably in Spanish for Spanish-speaking cities. Naturally, if these conform to the South American standards of severe business plainness they will be best received. If after several years of close business associations and after you have met your South American merchant face to face in New York or in Buenos Ayres, you desire to change your stationery you may do so, but at the start follow the course of least resistance and lend an attentive ear to the tutor of Latin-American methods.

Packard 12's $2,600 and $2,950

1916 Prices Are $1,150 to $1,800 Lower Than for 1915 Models

DETROIT, MICH., June 7—The prices of the 1916 Packard cars have been announced and show a reduction of from $1,150 to $1,800 as compared with the prices of the 1915 models.

All open bodies of model I-25, or the small twelve, are listed at $2,600, which is the lowest price at which a Packard was ever listed and is $1,150 lower than the price of the 1915 3-38 runabout. Model I-35, which is the big twelve, is listed at $2,950 for all open bodies. This is $1,800 less than the price of the 1915 model 5-48 runabout, or big six.

The original schedule was for an output of between 7,000 and 8,000 twelves for next season, but, at the present time the dealers and distributors have already contracted for practically the entire production and there seems to be no doubt that action will be taken for a much larger production than originally planned.

Herewith are the prices of all the body styles of the 1916 Packard:

Model I-25	
All open bodies	$2,600
Coupé, 3 passengers	3,550
Limousine, 6 passengers	4,000
Landaulet, 6 passengers	4,000
Brougham	4,050

Model I-35	
All open bodies	$2,950
Limousine, 6 passengers	4,350
Brougham, 4 passengers	4,400
Limousine, 7 passengers	4,400
Limousine with cab side	4,450
Landaulet with cab side	4,450
Imperial limousine	4,600

Daniels Co. to Build Eights in Reading

READING, PA., June 4—Application will be made to the governor on June 25 by G. E. Daniels, N. E. Parish and J. A. Archer, of this city, for a charter for the Daniels Motor Car Co., Reading. The corporation is to be capitalized at $100,000.

As was stated in THE AUTOMOBILE for May 20, the company will manufacture a medium-priced eight-cylinder car. It expects to manufacture 500 the first year.

Auburn Continues Six and Four

NEW YORK CITY, June 8—The two models which will constitute the 1916 Auburn line will be much the same as the 1915 cars in general construction, but many detail improvements have been made; the price of the six remains at $1,550, while that of the four has been reduced from $1,075 to $985.

The motor of the smaller car, the 4-38, has been increased from 3 3-4 by 5 to 3 7-8 by 5; Remy starting, lighting and ignition equipment is fitted; wheelbase is 114 inches; rear axle Weston-Mott three-quarter floating, and tires have been increased from 33 by 4 to 34 by 4.

The larger model, 6-40, has Continental motor 3 1-2 by 5, 126-inch wheelbase, full seven-passenger body with auxiliary seats that fold entirely out of the way and when in use are supported from the front, electric starting and lighting and complete equipment.

Both cars have cantilever springs and the bodies in both models are alike in their lines, having round-edged, tumble-home sides and a straight line from radiator cap to back of tonneau.

Eight-Cylinder Mitchell at $1,450 for 1916

RACINE, WIS., June 5—The Mitchell-Lewis Motor Co. is bringing out an eight-cylinder car to sell at $1,450 in roadster and five-passenger touring form; deliveries will be commenced later in the summer. The car is equipped with a 3 by 5⅛ V-type motor, the connecting-rods being side by side and the cooling on the thermo-syphon plan. The feature of the motor will be the combination of water and intake manifold, the carbureter being mounted between the cylinder block and feeding horizontally into the manifold, with the cooling water circulating in a jacket around the intake manifold. As is customary, the cylinder blocks have L-heads with the valves inside the V. The regular Mitchell clutch and transmission mechanism is employed. The wheelbase is to be 116 inches and tires will be 34 by 4, the rear springs being three-quarter elliptic. Regular equipment includes Westinghouse lighting and starting, vacuum gasoline feed, non-glaring headlamps and one-man type of top.

Moore Car a Newcomer

MINNEAPOLIS, MINN., June 4—The Moore Motor Co., Minneapolis, has begun preparations for the production of a new car called the Moore 30 which will sell for $660, in five-passenger touring form. The Moore employs a Pontiac chassis, made by a new concern in Pontiac, Mich., which builds chassis only. The Pontiac was described in a recent issue of THE AUTOMOBILE. Bodies for Moore cars will be purchased of the Wayne Works, Richmond, Ind., and equipment from well-known makers. The concern's schedule calls for 500 cars to be produced by January 1, starting actual work this month.

The Moore has a 106-inch wheelbase, 30 by 3½ tires, and is fitted with a four-cylinder, 3¼ by 4½ block motor. The price given includes Disco cranking and lighting system, demountable rims and the other regular equipment.

Enjoined from Using Hanlon Shield

N. A. C. C. Members Lose Windshield Suit — Court Issues Injunction

CLEVELAND, O., June 5—By a decision handed down this week the Rauch & Long Carriage Co., of this city, and all members of the National Automobile Chamber of Commerce, Inc., with the sole exception of the Anderson Electric Car Co., which is licensed under the patent, are enjoined from using the Hanlon patented windshield in automobiles. This injunction comes as a sequel of a decision handed down last March, which declared the Hanlon patent valid. At its annual meeting, held this week in New York, the National Automobile Chamber of Commerce, Inc., voted to appeal against the injunction. The case in question is particularly important in that many manufacturers are using the Hanlon idea of windshield, which is a double glass with the outer or forward glass divided and the top half adjustable so that it can be inclined forward to serve as a rain vizor if necessary. It is reported that should the vizor be made stationary it does not infringe the Hanlon patents.

R. & L. Agent of N. A. C. C.

The injunction has been issued by the U. S. District Court for the Northern District of Ohio, Eastern Division, and is in the case of William B. Hanlon et al against the Rauch & Lang Carriage Co., involving the re-issued patent No. 13,653 and follows the decision handed down in March by Judge Clark in the District Court. The National Automobile Chamber of Commerce acted as a co-defendant in this suit with the R. & L. company, the latter company acting as its agent.

Eagle—New Electric Car

DETROIT, MICH., June 4—The Eagle Electric Automobile Co. has been incorporated, the capital stock being $100,000. The company was formed several months ago to build an electric motor car according to the design of Herman A. Schmidt. Temporary quarters were taken at 169 Howard street, where the first models were completed. The incorporators of the concern are: Herman A. Schmidt, Cass C. Smith, Henry Clay Judson.

Grant Clover-Leaf Roadster

FINDLAY, O., June 5—The Grant Motor Co., of this city, has in a state of completion a clover-leaf roadster. It will be completed within the next few weeks.

Cleveland Electrics Merge

Baker and Rauch & Lang Unite as Baker R. & L. Co.—Capital Increased

CLEVELAND, O., June 7—The Rauch & Lang Carriage Co., and the Baker Motor Vehicle Co., both well-known manufacturers of electric passenger cars have merged into one, this action becoming effective today and henceforth the two concerns will operate as one under the firm name of Baker R. & L. Co. The agencies of the two companies will be combined in all cities.

In order to bring about the merger Rauch & Lang increases its capital stock of $1,000,000 to $2,500,000, of which addition $750,000 is 7 per cent. preferred and the balance common. The capital stock of the Baker Co. is $600,000. This gives a total capital stock of $3,100,000. In order to complete the merger inventories and appraisals are being made but for all practical purposes the business of the two firms is being conducted as one from this date forward. It is not known whether the name of the cars will be changed in any way to conform with the new organization.

In the list of officers many of the old officers of both Baker and Rauch & Lang companies have been continued and are as follows: President, C. L. F. Wieber, president of the Rauch & Lang Co.; first vice-president, F. R. White, vice-president and general manager Baker Co.; second vice-president Chas. E. J. Lang, vice-president and treasurer Rauch & Lang Co.; treasurer R. C. Norton, treasurer Baker Co.; secretary, G. H. Kelly, secretary Baker Co.; counsel, F. W. Treadway, secretary Rauch & Lang Co.

This is the second merger that has taken place in the electric car field, the other occurring in January, 1914, when the American Electric Car Co. was formed by the merging of the Argo Electric Vehicle Co., Saginaw, Mich., the Borland Grannis Co., Chicago, Ill., and the Broc Electric Co., Cleveland, O.

Bossert Co. Increases Capacity

UTICA, N. Y., June 7—The Bossert Co., this city, manufacturer of special automobile parts and accessories, is erecting a new building increasing the size of its oxy-acetylene plant which is stated to be one of the largest in the United States. They are also putting up a new 25 by 100-foot building to increase by 50 per cent. the size of the finishing department which does whatever machine work is necessary on automobile parts as they come from the presses. Still another building is being started which when completed will double the polishing, nickel plating and enameling departments. Along with the increase in floorspace there has also been a notable increase in machinery one of the recent orders being for a $20,000 press for the production of pressed steel parts for the automobile trade. This will particularly include axle housings, brake drums, etc.

To Be United States Light and Heat Co., Inc., of N. Y.

NEW YORK CITY, June 4—The United States Light & Heat Co., Inc., of New York, is to be the new name of the United States Light & Heating Co. of Maine. The capitalization is to be $3,000,000, 7 per cent. non-cumulative preferred, $4,000,000 common stock, and $1,000,000 authorized first mortgage 6 per cent. 20-year sinking fund gold bonds, of which $50,000 are to be issued at once, the remainder being reserved for capital purposes. The bonds are dated June 1, 1915, due June 1, 1935, are in coupon form and in denominations of $100, $500 and $1,000.

The stockholders' protective committee of the U. S. L. company has issued a circular to the stockholders announcing that more than 90 per cent. of the preferred and 70 per cent. of the common stock deposited by the committee have already paid the subscriptions provided in the plan. The time for the payment has now been extended to June 19, both for the stocks and bonds of the company.

1916 New Era Sells for $650

JOLIET, ILL., June 4—The New Era Engineering Co., this city, has announced its 1916 touring model selling at $650. A bloc motor, 3 1-8 by 4 1-2, inclosed valves, developing 27 horsepower at 2,000 r.p.m. is used. Other features are cellular radiator thermo-syphon cooling, Allis-Chalmers single unit starting and lighting system, multiple disk clutch; four-speed selective transmission, three-quarter floating rear axle, semi-elliptic springs in front and full elliptic in rear, and Atwater-Kent ignition. The wheelbase is 104 inches and the tread 56.

Dayton New Era Chief Engineer

JOLIET, ILL., June 4—W. O. Dayton has resigned as engineer of the Crusader Motor Car Co. and is now chief engineer and one of the principal stockholders of the New Era Engineering Co., manufacturer of the New Era automobile.

Chevrolet Makes Record Shipment

NEW YORK CITY, June 9—On June 3 the Chevrolet Motor Co. shipped and delivered to its dealers 541 cars valued at $334,173. This is the largest shipment for any single day in the history of the company and exceeds by nearly 100 per cent. the previous high record.

April Exports $8,045,222

Over $5,000,000 Ahead of 1914 Mark and Lead All Previous Records

WASHINGTON, D. C., June 8—*Special Telegram*—A world's record was established in April when automobile and commercial vehicles, valued at $8,045,222, were exported. This is $5,212,068 ahead of April, 1914. Two thousand, two hundred and sixty-seven commercial vehicles, valued at $5,240,481 and 3,078 passenger vehicles, valued at $2,804,741, were shipped.

During the 10 months ended April, the exports were 8,580 commercial vehicles valued at $23,977,968 and 14,641 passenger cars, valued at $12,356,472. For the same period in 1914, the exports were 23,762 cars and trucks, valued at $21,598,810.

Harry Lozier to Re-Enter Car Building Field

DETROIT, MICH., June 7—Harry A. Lozier, who was the founder and head of the former Lozier Motor Co., from which he retired in 1912, has been quietly at work on a new automobile organization for the past year and a half, and is now about ready to make known the details of the new enterprise. All facts about the car that is to be built, and about the men who are to be associated with him are withheld for the present but the plant is to be located in Cleveland, O. It will be built for the new concern on an advantageous site. Plans now contemplate a production for the first year of 3,500 cars.

Interviewed by a representative of THE AUTOMOBILE, Mr. Lozier made clear his reasons for wishing to withhold details at this time, but enough information was given to permit it to be said that he will again enter the manufacturing field with a most efficient organization, and with ample capital. None of it is to be put upon the market.

The design and full details of the car have been definitely settled upon.

Lippard-Stewart Reduces Prices

BUFFALO, N. Y., June 7—Without altering the construction of two of the types of commercial vehicles which it is producing, the Lippard-Stewart Motor Car Co. has made substantial reductions in its prices. Effective May 25, the 1,500 pound chassis with bevel gear drive and pneumatic tires lists at $1,500; the same chassis with worm drive and either pneumatic or solid tires lists at $1,600. The reduction represents a cut of from $150 to $175.

Ford's $48,000,000 Dividend

Eight Stockholders Divide It—Henry Ford Gets $27,840,000—Capital Raised

DETROIT, MICH., June 5—At a meeting of the Ford Motor Co., today the capital stock was increased from $2,000,000 to $100,000,000 and the directors declared a stock dividend of $48,000,000, which will go to eight directors. In addition there was a large cash dividend declared on the original capitalization of $2,000,000, details of which are not available. Henry Ford alone profits to the extent of $27,840,000 by this stock dividend, and James Couzens, vice-president of the company, receives $5,472,000. This stock dividend, which represents 2,400 per cent., will be paid in July.

The stock increase brings the issued capital stock of the company to a valuation of $50,000,000, and the remaining $50,000,000 will remain in the treasury to be used as conditions may demand in future. The object of the capital increase, as given by Treasurer Couzens, is to have the outstanding shares more nearly represent the value of the property of the company.

In the distribution of the stock dividend eight, or rather the eight only holders of stock in the Ford Motor Co., of Detroit, will share. They are:

Henry Ford, president, who is credited with owning 11,700 shares out of the total of 20,000, or 58.5 per cent., and will thus receive $27,840,000.

James Couzens, vice-president, credited with holding 2,280 shares, or 11.4 per cent., and will receive $5,472,000.

David Gray, vice-president of the Detroit Leather Specialty Co., who is said to own 2,000 shares, or 10 per cent., and will receive $4,800,000.

John F. Dodge, president and treasurer of Dodge Bros.; Horace E. Dodge, vice-president and general manager of Dodge Bros.; Horace H. Rackham and John W. Anderson, both attorneys, all said to own 1,000 shares, or 5 per cent., and who will thus receive $2,400,000, and R. V. Couzens, son of Vice-President Couzens, reputed to own 20 shares, or one hundredth of 1 per cent., who therefore is to receive $48,000.

Concerning the rebate which is to be paid to Ford purchasers during the fiscal year ended July 31, and which is to be made good only in case 300,000 Fords had been sold, it is stated by an official that probably fully 350,000 cars will be the total entitled to the rebate, and that the amount will be between $16,500,000 and $17,500,000.

The last balance sheet of the Ford Motor Co. is dated September 30, 1914. At that time the company had a surplus of $48,827,032.07. Its total assets then were $61,632,257.16, of which $27,441,468.79 was cash in the banks.

Through its increase of capital the Ford Motor Co. is now on top of the list of all automobile manufacturing concerns in the world as to its capital. With the exception of the United States Rubber Co. which has an authorized capitalization of $120,000,000, no other concern in the automobile car or parts business has as large a capital as the Ford company. The accompanying table was made with a view of showing especially the capital standing of some of the larger concerns:

CAPITALIZATION OF SOME AMERICAN AUTOMOBILE MANUFACTURING CONCERNS

Ford Motor Co., Detroit	$100,000,000
†General Motors Co., Detroit	60,000,000
Studebaker Corp., Detroit	15,000,000
Maxwell Motor Co., Detroit	37,000,000
Willys-Overland Co., Toledo, O.	30,000,000
Packard Motor Car Co., Detroit	16,000,000
Peerless Motor Car Co., Cleveland, O.	10,000,000
Mitchell-Lewis Motor Car Co., Racine, Wis.	10,000,000
Chalmers Motor Co., Detroit	6,500,000
Dodge Brothers, Detroit	5,000,000
*Olds Motor Works, Lansing, Mich	4,000,000
Reo Motor Car Co., Lansing, Mich.	3,000,000
White Co., Cleveland, O.	3,000,000
Regal Motor Car Co., Detroit	3,000,000
*Buick Motor Co., Flint, Mich.	2,600,000
Chevrolet Motor Co., Flint, Mich.	2,500,000
Anderson Electric Car Co., Detroit	2,500,000
Hudson Motor Car Co., Detroit	2,500,000
*Cadillac Motor Car Co., Detroit	1,500,000
Hupp Motor Car Co., Detroit	1,000,000
Winton Co., Cleveland, O.	1,000,000
Rauch & Lang Carriage Co., Cleveland, O.	1.000,000

CAPTALIZATION OF SOME AMERICAN AUTOMOBILE PARTS MANUFACTURERS

Stewart - Warner Speedometer Corp., Chicago	$11,000,000
Timken-Detroit Axle Co., Detroit	3,000,000
Continental Motor Mfg. Co., Detroit	2,500,000
*Weston-Mott Co., Flint, Mich.	1,500,000
‡Fisher Body Co., Detroit	1,500,000
‡Fisher Closed Body Co., Detroit	600,000
Detroit Lubricator Co., Detroit	1,000,000
Hayes Mfg. Co., Detroit	750,000
Kelsey Wheel Co., Detroit	1,000,000
C. R. Wilson Body Co., Detroit	750,000
McCord Mfg. Co., Detroit	1,000,000
Northway Motor & Mfg. Co., Detroit	1,000,000

CAPITALIZATION OF SOME LEADING TIRE MAKERS

U. S. Rubber Co.	$120,000,000
B. F. Goodrich Co., Akron, O.	90,000,000
Morgan & Wright, Detroit	5,000,000
Firestone Tire & Rubber Co., Akron, O.	4,000,000
Goodyear Tire & Rubber Co., Akron, O.	15,000,000
Kelly-Springfield Tire Co.	7,757,200

---

†Among the companies which are part of the General Motors Co., are the Olds Motor Works, Buick Motor Co., Cadillac Motor Car Co., Weston-Mott Co.

*These are subsidiary companies of the General Motors Co.

‡These two concerns might be considered as one, being owned and directed by the same men.

Ford Has Built 819,922 Cars

DETROIT, MICH., June 4—Up to June 1, 1915, the Ford Motor Co. has built and sold a total of 819,922 Ford cars. The company started in business June 16, 1903, and has been building Fords for 12 years. Practically 55 per cent., or over 400,000 cars, were made during the past 2 years.

English Firm Gets Lauth-Juergens

Succeeded by H. G. Burford Co.—War Orders Factor in Reorganization—New Blood

FREMONT, O., June 5—The H. G. Burford Co. has been organized in this city to take over the Lauth-Juergens Motor Truck Co. for the purpose of manufacturing the Burford motor truck, orders for 2,000 having been secured from Great Britain. The officers of the new company are: President, H. G. Burford, London, Eng.; vice-president, J. W. Worst; secretary, John M. Sherman, and treasurer, R. J. Cristy. The new company is incorporated for $250,000, of which $100,000 is in preferred and $150,000 in common stock.

Mr. Burford, the president of the new corporation, who has been in this country for several months studying conditions in the truck industry, is also president and managing director of the H. G. Burford Co., Ltd., London, Eng., one of the pioneer motor vehicle concerns of Europe. The London company has numerous branches in Great Britain and her colonies and in other European countries. Mr. Burford formerly operated and controlled the business of Milnes Daimler, Ltd., who represented the manufacturer of the Mercedes, and the truck business in England was of considerable volume and international in character. In the past three months Mr. Burford has taken about 150 trucks from the Lauth-Juergens factory.

H. S. Chipman, of Chipman, Ltd., who is also a member of the board of directors of the new company, is an exporter of New York City.

Mercer to Add 24,000 Square Feet

TRENTON, N. J., June 9—The Mercer Automobile Co. will again enlarge its plant. Contracts have been let for the construction of a new building which will contain 24,000 square feet of floor space.

The plans call for a structure 60 by 400 feet, and the steel and glass form of construction will be employed. When completed, the building will house the various paint departments, as well as the final assembly.

Torbensen Gear Buys Cleveland Plant

NEWARK, N. J., June 9—Increased business of the Torbensen Gear & Axle Co., this city, has forced the company to look elsewhere for factory space, the local plant having become inadequate. The company has secured a factory at Cleveland, O., with five times its present capacity, where it will be located after June 15.

Booster Meeting for Detroit S. A. E.

Addressed by Four Past-Presidents—Hint at Great Extension of Activities

DETROIT, MICH., June 8—*Special Telegram*—A well attended meeting of the Detroit Section of the Society of Automobile Engineers was held here tonight for the purpose of encouraging general enthusiasm in the Society's work. The meeting was addressed by four past-presidents, namely: Howard Coffin, vice-president of the Hudson Motor Car Co.; H. W. Alden, chief engineer of the Timken-Detroit Axle Co.; Henry M. Leland, president of the Cadillac Motor Car Co., and Henry Souther, vice-president of the Ferro Machine & Foundry Co. The other speakers of the evening were Coker Clarkson, general manager of the Society, and K. W. Zimmerschied, metallurgist of the General Motors Co. and chairman of the standards committee. George W. Dunham, consulting engineer, presided.

Among other remarks Mr. Coffin hinted that great extensions of the Society's activities may be expected, including the resuscitation of the old A. L. A. M. engineering digest of the technical news of the world, the establishment of a large permanent library, etc. It was also stated that the Detroit Section should have proper permanent headquarters in this city. Members were urged to encourage executive men to join the Society as they had to carry out the ideas formulated perhaps by engineers. The meeting was voted one of the most successful and instructive ever held in Detroit.

Chicago Speedway Finished

CHICAGO, ILL., June 9—The wooden bowl of the new $1,250,000 Chicago speedway was finished this week. In 36 actual working days, the 9,000,000 feet of lumber of which the track is constructed were laid and spiked down. The last nail was driven home Monday and the course was open for practice the following day. Two of the drivers, Billy Carlson and Billy Chandler, who worked out their cars on the track before it was completed, pronounced it especially fast.

Although the entry list does not close until tomorrow at midnight, the field of starters to date for the inaugural event includes the following twenty-six cars: Stutz, Anderson; Stutz, Cooper; Stutz, Wilcox; Mercedes, Ralph DePalma; Sunbeam, Von Raalte; Sunbeam, Porporato; Duesenberg, Alley; Duesenberg, O'Donnell; Duesenberg, Haupt; Maxwell, Carlson; Maxwell, Rickenbacher; Maxwell, Orr; Delage, Chevrolet; Bugatti, Oldfield; Peugeot, Burman; Peugeot, Resta; Peugeot, Babcock; Sunbeam, Grant; Sunbeam, Limberg; Mulford Special, Mulford; Mercer, Henning; Berwyn Special, Zucker; Du Chesneau, Brown; F. R. P., Keene; F. R. P., Hughes; and F. R. P., Devore.

Barney Oldfield has entered the Bugatti but will not drive it. Barney has purchased one of the Grand Prix Peugeots and if it arrives in time, will substitute it for the Bugatti.

Louis Chevrolet has secured the Delage that John DePalma drove at Indianapolis, and has been working on it at the Marmon plant in order to get it in shape for the Chicago race.

Elimination trials have been postponed until next Monday, Tuesday and Wednesday in order to give the drivers more time to get their cars in shape for the time tests. Only five machines have arrived to date—the three Maxwells and the two Peugeots to be driven by Resta and Babcock.

The promoters are confident that 100,000 persons will witness the inaugural race. The grandstands, along the home stretch and in front of the pits, will seat 25,000. The bleachers on the back stretch will accommodate 27,000. There is parking place for 5,000 cars within the inclosure. In addition, temporary bleachers, seating 25,000, will be erected back of the parking places. The track has been pronounced safe by A. A. A. and municipal officials.

Kelly-Springfield Tire on 24-Hour Schedule

AKRON, O., June 9—The plants of the Kelly-Springfield Tire Co. are operating a 24-hour-a-day schedule. Business already contracted for calls for a continuance of this rate of operation during the next 6 months at least.

Last week sales showed an increase of 72 per cent. over the same period a year ago, and in the previous week the gain was 100 per cent. Business so far this year is running at the rate of $8,000,000. The 1914 sales were approximately $5,000,000.

The company is now putting out 1,000 tires a day, or at the rate of over 300,000 tires a year.

Large earnings, said to be close to 30 per cent. on its common shares, compared with 22 per cent. in the year ended December 31, last, will probably bring forth an extra disbursement on that stock as a cash dividend this fall.

Kelly-Springfield Tire Dividend

NEW YORK CITY, June 9—Kelly-Springfield Tire Co., regular quarterly dividend of 1 1-2 per cent. on first preferred and 1 3-4 per cent. on second preferred, payable July 1 to stock of record June 15.

Wagon Men Favor One Tread

N. A. C. C. Meets with Vehicle Makers to Standardize 56-Inch Tread

WASHINGTON, D. C., June 8—Considerable progress was made today in the question of arriving at some standard tread for vehicles in the southern states, where automobile manufacturers have been compelled to furnish 60-inch treads because of the wider wagon treads used. The National Automobile Chamber of Commerce has been for over a year endeavoring to see if the 60-inch tread cannot be discontinued and, with this object in view, Alfred Reeves, general manager of the N. A. C. C., had a conference today with representatives of the various wagon and vehicle associations in conference in this city. Today the wagon makers passed resolutions favoring a standard tread for the near future and looking to the automobile makers to lead the way in this movement during the next 12 months. For the present the wagon makers will continue 54 and 60-inch treads, but are agreed that improved road conditions demand the adoption of a standard tread for all vehicles.

Objections to 60-Inch Tread

The various wagon and vehicle associations were represented as follows: National Wagon Manufacturers' Assn., J. D. Hollowell, chairman of the Tread Committee; National Implement and Vehicle Assn., E. W. McCullough; Southern Wagon Manufacturers' Assn., B. P. Thornhill. Others in the conference were: Logan Waller Page, of the United States Bureau of Good Roads; D. E. Parsonage and Alfred Reeves. Mr. Reeves emphasized the fact that fifteen out of ninety-five manufacturers who are members of the N. A. C. C. manufactured wide-tread cars, that is 60-inch treads, and that the majority of automobile dealers in the South are strongly in favor of discontinuing these treads because they hold up deliveries. Manufacturers object to them in that they seriously handicap production and make it impossible to switch shipments from a point in the North where standard treads are used to one in the South where the wide tread is desired. Wagon manufacturers are agreed in this argument. Mr. Page, representing the government good roads favors a standard tread and considers it highly desirable now that the movement for improved roads in the South is under way.

The Southern Wagon Manufacturers' Assn. meets in Norfolk, Va., tomorrow, and some action may be taken.

Federal Commission Hearings Bring Out Weaknesses in Export Trade

Develop Need of Combines for Foreign Commerce—Shipping Facilities Needed—Government Bonded Warehouses Proposed—Common Selling Agencies Advocated

NEW YORK CITY, June 5—The recent visit of the Federal Trade Commission to this city on June 3 and 4 brought out an assortment of complaints and facts gleaned from some thirty prominent business men who offered testimony as to trade conditions, bearing mostly on the proposition of getting and holding considerably more export trade. The purpose of the hearings, as stated by Chairman J. E. Davies, was to exercise the powers conferred by subdivision H of section 6 of the Federal Trade Commission act passed by the late Congress. This portion of the act provides that the Commission composed of W. H. Parry, E. N. Hurley, W. J. Harris and George Rubles, shall have power to investigate, from time to time, trade conditions in and with foreign countries where associations, combinations or practises of manufacturers, merchants, or traders, or other conditions, may affect the foreign trade of the United States, and to report to Congress thereon, with such recommendations as it deems advisable.

Out of the great diversity of opinion and questioning a few threads stood out to show the following needs to increase the export trade:

The Sherman Law a Factor

The desire to clarify the situation as affecting prospective trade combinations to carry on export business as related to the Sherman anti-trust act; the question of providing adequate shipping facilities; the matter of credits; the advancement of fair trading methods between the United States and the other countries; a more direct form of government aid; more combinations of our business units to compete with foreign competitors; an anti-dumping law; low-priced government bonded warehouses for Latin-America, and the establishment of common selling agencies.

Doubt Is Prohibition

Proceeding on the assumption that it is practically impossible to cope on even terms with foreign interests in the absence of combines of United States traders in the export field, the doubtful interpretation of the Sherman law as bearing on such combines loomed up as the most substantial barrier. This doubt, it was agreed, is holding back business men, big and small, and there will be no considerable improvement until the doubt is cleared away. This thought was forcibly expressed by Henry P. Davison, of J. P. Morgan & Co. on the first day of the hearing. Following his advocacy of an improvement in shipping conditions, Mr. Davison said:

"The question must be solved if we are going to look for a material increase in foreign trade. Some form of combination of our business units must be devised if we are going to do much in the foreign markets. Combination would make it possible to cut down costs and effect concentration. Nobody knows what the Sherman anti-trust law prohibits, so the effect would be just the same if it did prohibit."

No Domestic Monopoly

In answer to questions Mr. Davison gave it as his strong opinion that a combination for foreign trade could be easily kept free of a monopolistic tendency as affecting the domestic trade and that there is no fear of increasing costs to the consumer of this country through the proposed action in export branches. This statement seemed to impress the Commission and was received with general interest as bearing on a point raised some time ago by President Wilson in his suggestion that it might be advisable to permit combinations of United States business concerns to compete with similar combines formed by foreign competitors. In making his statement, it is recalled, the President stated that he would be in favor of such action if it could be put through without detriment to the American consumer, but made it equally clear that he would be against it if such detriment should be likely to follow.

The Matter of Dumping

Many of the witnesses went into the need of an anti-dumping law, there being an apparent apprehension that the close of the European war will see the practice carried out on a larger scale than ever before, the expectation being that the Europeans will open their factories and operate them to capacity, absorbing the losses on surplus production sold below cost. The situation was discussed comprehensively by W. H. Taylor, president of the David Williams Co., publisher of *Iron Age, Hardware Age, Metal Worker, Plumber and Steam Fitter and Building Age*. Mr. Taylor cited the case of T rails as exemplifying the evils of the practice, calling attention to Canada's high tariff on this class of merchandise, which makes it difficult for the American producer to find a market in that country, while having no means, such as an anti-dumping law, to prevent the Canadians from underbidding our manufacturers, even when selling at a loss. In the case of a purchase of 35,000 tons of steel rails needed by the Illinois Central Railroad some time ago, according to Mr. Taylor, the domestic producers bid on the basis of $28 a ton, the standard price, while the Canadians got the business by offering the rails at several dollars a ton less, even at a time when the product was selling in Canada at $32 or $33 a ton.

"Of course," said Mr. Taylor in substance, "I don't blame the railroad for placing the order on the most favorable terms but urge that such a condition would have been impossible if we had had an anti-dumping law similar to Germany's and those of other countries. The practice of selling rails at a standard price makes for stability. Under a condition of fluctuating prices a railroad may raise the funds necessary for a purchase of a needed quantity of rails and then when it goes into the market may find the price had risen and be unable to make the purchase with the funds on hand. The stable price obviates this possibility."

Mr. Taylor displayed some interesting exhibits in the shape of German-made locks and keys destined to be sold here at absurdly low prices, far beneath current prices here. In answer to a question Mr. Taylor admitted he could not see how there could be any profit to these goods. He ascribed the condition to the German practice of operating the factories to capacity and following the dumping process in the event of a surplus.

Fighting without Rules

A convincing presentation of the case for export combines was made by John D. Ryan, president of the Amalgamated Copper Co. and a member of the National Trade Council. After describing the methods of foreign combines in export markets and in import transactions as well, and touching on the lack of co-operative action among producers and traders of this country, Mr. Ryan drew a comparison between this situation and the case of a prizefighter who finds himself in the ring against a man who makes his own rules. "You can understand," he explained, "that the poor fellow has little chance if he sticks to Marquis of Queensbury rules, while the other fighter takes privileges not allowed under that code. He would be overcome rather easily. And in our foreign trade we have not only to contend with each other, but also with combines of other nations who don't observe our rules."

Under existing conditions, according to Mr. Ryan, copper produced here is bought up at sub-market prices by foreign cabals, the result being that the American manufacturer pays 7-8 of a cent per pound more than the German. This 7-8 of a cent represents the cost of manufacture, so the German maker owns his finished product at the price the American manufacturer pays for the raw material. In absorbing fashion and at length Mr. Ryan described the manipulations of foreign cliques and their schemes for setting the Americans to quoting against the alleged prices of their competitors. "Our principal competitor," said Mr. Ryan, "has offices less than two blocks from mine. Yet when a foreign buyer comes to me and tells of my competitor's quotations, even when I am certain he is not telling the truth, do you think I dare call up my competitor to challenge the foreigner's statement. No, I am afraid of the Sherman law, as it may be interpreted."

Whereas it was Mr. Ryan's view that all concerns, irrespective of size, be allowed to combine, since the "big fellows" would be anxious to take in the little ones through selfish interest, if for no other reason. Roger W. Babson, of the Babson Statistical Agency, took the view that it would be better to let the larger corporations shift for themselves, while permitting the smaller concerns—those of $1,000,000 capital or less to form into combines. Mr. Babson was not inclined to take an optimistic view of the prospects of American business in the foreign markets until such time as our young men—"flesh and blood" of this generation of producers—have been trained in the countries of their future activities and sufficiently imbued with the spirit of the various peoples to meet them on a basis of understanding and sympathy.

Mr. Babson's centention that the large corporation can carry on its foreign trade without combines was disputed by Waldo N. Marshall, president of the American Locomotive Co., who stated that his concern, capitalized at $50,000,000, found it not feasible to finance selling agencies in various parts of the world. "This condition," said he, "existing for us in some sections, must exist for some smaller concerns in the foreign field as a whole." Mr. Marshall touched on the matter of unfair competition when he declared that German competitors made use of many of his company's trade secrets, gleaned from documents passing through South American banks controlled by Europeans.

Warehouses for Latin-America

A suggestion that received close attention was the proposal of Woolsey H. Field, of the United Export Bureau, to establish government bonded warehouses in Central and South America. These warehouses could be employed to store goods included in advance orders until such time as demanded by the purchasers. According to Mr. Field's plan, a form of certification of deposit could be issued to the manufacturer, upon which funds could be advanced at a low rate of discount, varying according to the nature of the goods. This plan, in Mr. Field's judgment, would remove much of the inconvenience of the prevalent system of long term credits.

Mr. Field also urged some means of protecting United States trade marks against traders in South America who make a practice of appropriating them to their own uses, imitating and infringing with impunity. He also made a strong plea for an efficient supervision of American traders who in imposing upon the credulity of the Latins injure the reputation of our traders generally and make it difficult for any to secure business. The witness cited a case where a fake concern collected $5,000 for moving picture films as advertised and failed to fulfil its part of the contract by delivering the goods. It was Mr. Field's idea that our consuls be given wide authority and instructions to investigate advertisements of United States traders in Latin-American newspapers and magazines. Under present conditions a United States consul would not presume to take action, even in a case where the element of fraud is apparent.

Tricky Competition

The matter of tricky competition was also discussed by Walter Wyman, Export Manager of Carter's Ink Co. He told of a case where a Japanese concern imitated the Carter trade mark, substituting the title "Cart's" but following other details of the label closely. This sort of occurrence, according to Mr. Wyman, is not at all unusual in the foreign trade.

George H. Richards was also one of the few to appear in behalf of the specialty field, advocating common selling agencies. He took the stand that the "big fellows" would not care to enter into combination with little ones and "hold the umbrella while the little fellows get in out of the rain." George E. Smith, president of the Royal Typewriter Co., spoke in favor of combined selling effort in the foreign field.

William E. Saunders, chairman of the Board of Directors of Ingersoll-Rand Co., maker of machinery, came before the Commission with a well ordered digest of the ethics of foreign trading as he viewed it. Mr. Saunders may be said to have summed up the wishes of all the witnesses when he urged that legislation be enacted to the effect that combinations for foreign trade, which do not restrain or monopolize trade within the United States, shall be lawful.

Chili Shipments Are Rough

Country Has No Docks and Shipments Are Roughly Handled —Address in Spanish

New York City, June 8—Of the three most important countries in South America, Argentine, Brazil and Chili, the last is the only one that has no docks, and consequently shipping to its ports is correspondingly difficult and careful crating of automobiles consigned to Chili is essential. Steamers for Chili must lie off the coast discharging their cargoes onto lighters and if the sea is rough the crates containing automobiles get badly broken unless they are particularly rigid. Manufacturers will not find it necessary to take the automobiles apart in order to export to Chili, but it is desirable to make specially heavy crates.

In marking these crates the reading matter should be in Spanish and not English, this applying specially to such expressions as "top" and "bottom" which in Spanish are "Arriba" and "Abajo." Write these words very plainly in large letters on all sides of the crate.

American automobile firms when writing to South American merchants should be careful to personally sign all typewritten letters. Letters received in Latin America with signatures that are typewritten or stamped lose materially.

Any automobile makers desiring translations or further information on the South American market will receive prompt attention through the United Export Bureau of The Automobile.

Boston 1916 Car and Truck Show March 4-11

Boston, Mass., June 4—At the annual meeting of the Boston Automobile Dealers' Association it was decided to hold the 1916 motor show in Mechanics' Building the second week in March, and there will be an exhibit of commercial vehicles in the basement the same week. More than a score of dealers have filed applications for membership and it augurs well for the show next year. The treasurer's report shows that after paying dividends on the past show a good surplus remained. The election of officers resulted as follows: President, John H. MacAlman (Stearns); vice-president, Josiah S. Hathaway (White); treasurer, F. A. Hinchcliffe (Winton); secretary, Chester I. Campbell; board of directors, the above officers and Ernest A. Gilmore (Allen and Lewis), J. W. Maguire (Pierce-Arrow), John W. Bowman (Maxwell), Charles E. Fay (Ford), Charles P. Rockwell (Jeffery) and Frank E. Wing (Marmon).

Clifton Heads N. A. C. C. for 1916

Seven Companies Elected to Membership—Work for Standard Tread

New York City, June 6—Charles Clifton, treasurer of the Pierce-Arrow Motor Car Co., Buffalo, N. Y., was re-elected president of the National Automobile Chamber of Commerce, Inc., at the annual meeting held here yesterday, which was characterized by a record attendance of members of the chamber. The other officers were all re-elected, as follows: First vice-president, W. C. Leland, vice-president and manager Cadillac Motor Car Co.; second vice-presidents (gasoline passenger car division), Hugh Chalmers, president Chalmers Motor Co.; (commercial vehicle division) Windsor T. White, president White Co.; (electric vehicle division) H. H. Rice, president Waverley Co.; secretary, R. D. Chapin, president Hudson Motor Car Co.; treasurer, George Pope, receiver Pope Mfg. Co.; general manager, Alfred Reeves.

Three New Directors

Beside re-electing three directors whose terms had expired, the chamber elected three new ones for a 3-year term. These are J. Walter Drake, president Hupp Motor Car Co.; R. E. Olds, president Reo Motor Car Co., and C. H. Pelton, secretary Maxwell Motor Co., these taking the places of Messrs. H. O. Smith, L. H. Kittredge and C. C. Hanch. Those re-elected were Alvan Macauley, manager Packard Motor Car Co.; W. E. Metzger, American Electric Car Co., and C. W. Churchill, general manager Winton Co.

Seven new companies were elected to membership at the directors' meeting on Wednesday, as follows:

L. P. C. Motor Co., Racine, Wis.
Scripps-Booth Co., Detroit, Mich.
Lexington - Howard Co., Connersville, Ind.
The Touraine Co., Philadelphia. Pa.
Pratt Motor Co., Elkhart, Ind.
W. A. Paterson Co., Flint, Mich.
The Sternberg Co., Milwaukee, Wis.

Reports of the year's work were made by the committees on patents, traffic, commercial vehicles, good roads and legislation, and after a spirited discussion of the jitney bus situation the conclusion was reached that the movement should be encouraged and supported by car manufacturers. Proper regulation was also advocated, it being agreed that there should be careful supervision of drivers, with payment of a license fee for the use of the streets and provision for indemnity against accidents. A special committee is continuing this work.

A special committee was appointed to make recommendations in regard to the proper time for making annual announcements of car models.

Statistics supplied at the meeting indicate that the automobile year ending June 30 will see a greater number of cars made than ever before in the industry, while the manufacturers are continuing their preparations for the following year in the most optimistic way.

It is not unlikely that one or two of the general membership meetings of the chamber may be held in Detroit, although the annual meeting will naturally be held each year at the general headquarters in this city, as required by the incorporation of the N. A. C. C. in this state.

It was voted to appeal from the decision of the Cleveland Court in the suit brought against Rauch & Lang Carriage Co., a member of the chamber, by William B. Hanlon and others, charging infringement of Hanlon patent re-issue No. 13,653, covering the well-known Hanlon windshield construction.

Market Changes Few

New York City, June 8—Market prices last week were steadier with the usual changes. There was a big demand in the metal markets yesterday. The leading rise was in lead when it rose from $4.90 to $5.60, a total gain of 70 cents. The largest producing interests are still asking 19 1-4 cents delivered 30 days for electrolytic copper while Lake copper had the same demand with a gain of 1 cent for the week. Tin was active and higher, making a change of $1.37. Aluminum rose 2 cents, while the rest of the metals remained unchanged. Cottonseed oil was a little steadier with a fair volume of trading. Rubber markets were firm and lacked new features of importance. Fine Up-River Para was firm with a slight rise of 1 cent on Friday, while scrap rubber went down 1-2 cent. Manufacturers continued to restrict their purchases to comparatively small lots, but the demand for such quantities showed some increase. The markets in London were somewhat dull with plantation rubber easier, although shipments are coming in regularly from London and Singapore. The oil and lubricants markets were steady with a moderate demand in all products and with no changes during the entire week.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum	.25	.26	.26	.27	.27	.27	+.02
Antimony	.35	.34½	.34½	.34½	.34½	.35	......
Beams & Channels, 100 lbs.	1.31	1.31	1.31	1.31	1.31	1.31	......
Bessemer Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Copper, Elec., lb.	.18¾	.18¾	.18¾	.18⅞	.18⅞	.19¼	+.00½
Copper, Lake, lb.	.18½	.18½	.18½	.19	.19	.19½	+.01
Cottonseed Oil, bbl.	6.26	6.26	6.27	6.25	6.20	6.20	—.06
Cyanide, Potash, lb.	.24	.24	.24	.24	.24	.24	......
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	4.90	4.90	5.00	5.20½	5.20	5.60	+.70
Linseed Oil	.67	.67	.67	.67	.67	.67	......
Open-Hearth Steel, ton	19.50	19.50	19.50	19.50	19.50	19.50	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, refined	.85	.85	.85	.85	.85	.85	......
Rubber, Fine Up-River, Para	.61	.61	.61	.61	.62	.62	+.01
Silk, raw, Ital	3.90	..	3.90	.	..	3.90	......
Silk, raw, Japan	3.42½	..	3.30	..	..	3.30	—.12½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	37.63	37.63	37.35	38.00	38.48	39.00	+1.37
Tire Scrap	.05	.04¾	.04¾	.04¾	.04¾	.04¾	—.00¼

Eisemann's Business Gains 300 Per Cent. in 1914

New York City, June 4—During the fiscal year ending the last of this month the Eisemann Magneto Co. will show a gross business three times as large as in any other 1 year since its inception.

In addition to this condition the Eisemann company has under contract at the present time enough business for the coming fiscal year to double this last year's tremendous business.

The present plant in the Bush Terminal has been practically tripled during the past year. In spite of this fact more floorspace has been leased and is being occupied as rapidly as the new machine equipment can be installed.

In point of numbers the greatest output is the four-cylinder waterproof type G4 followed by the automatic spark control type and the waterproof GN, which is the six-cylinder model.

S. O. Gasoline Price Dropped 1 Cent

Chicago, Ill., June 7—The Standard Oil Co. of Indiana today reduced the price of gasoline 1 cent to 8 1-2 cents for deliveries of 100 gallons at a time. The quotation for naphtha was lowered 1-2 cent to 8 cents for 100 gallons at one purchase.

This reduction has greatly surprised the trade here. All indications have pointed to further increases in gasoline prices during the current month in various parts of the country.

So far only New Jersey and vicinity have been affected by advanced prices, and these were made only where gasoline was selling at its lowest level.

Independent oil men say that they

have been advised of Standard's gasoline reduction only in Illinois and Indiana but the latter company states that it will take effect forthwith in the company's entire sales territory. The recent drop in crude oil prices, it is stated, is the cause of the reduction.

S. G. V. Plant Being Sold in Separate Lots

READING, PA., June 9—The S. G. V. Automobile Co. plant in its entirety is being sold at absolute auction in separate lots, only to the highest bidder, without limit or reserve, for cash at the plant in this city. The sale started yesterday and will continue until everything is sold.

The plant, consisting of name, good will, patterns, drawings, jigs, dies and the right to continue the business will be offered; also the service department in its entirety, thirty-two complete chassis of the latest model 1915, 100 assorted up-to-date Quinby and Fleetwood bodies, a large quantity of radiators, etc.

$1,000,000 Paid for Stevens-Duryea Automobile Plant

NEW YORK CITY, June 4—The New England Westinghouse Co. has deposited checks for the purchase of the J. Stevens Arms & Tool Co. and the Stevens-Duryea Automobile Co., Springfield, Mass., the price of the former concern being over $1,000,000 and of the latter $1,000,000. These plants were sold in the middle of May to the Westinghouse company to take care of a rush war order. After this order is taken care of the usual line of Westinghouse products will be manufactured at the plants. About 8,000 men will be employed.

Security Prices Higher

Sturdy Demand in All Stocks—General Motors Makes High Record

NEW YORK CITY, June 7—Except for a few fractional declines, most of the stocks that changed made substantial gains in this week's security quotations. The upward sweep in the stock market last week was attributed to the resumption of the main upward movement which began some months ago as a result of the growing realization of the advantageous position that this country occupies in the financial and business world. Uneasiness over the German situation has been offset by evidence that the rise in stock prices was in the nature of an expression of this confidence rather than a mere speculative boom.

Securities this week were unusually higher. General Motors common featured the market with a 16-point rise, closing at 151, at an absolute high record. The strength of this issue was attributed to expectation of early dividend action. It is stated that the company will have a net profit for the fiscal period of more than $9,000,000, meaning a balance for the common of nearly 50 per cent.

Automobile stocks in general are at present in the limelight. Already many traders are looking to the time when stock of the Ford Motor Co. shall be listed on the Stock Exchange, though no indication has been given that it will.

Tire issues showed substantial gains, much higher than usual. Firestone common went up 10 points; Goodyear common, 4 points; Goodrich common, 3 1-2 points; Kelly-Springfield, second preferred, 15; Portage common and preferred, 3 points each; and U. S. Rubber common, 3 points.

The majority of the automobile stocks showed gains. Willys-Overland common rose 15 1-2 points while its preferred gained 1 1-2. Studebaker common went up 4 points.

The Detroit issues showed gains of from 1 to 10 1-2 points.

Moon's May Business Shows 33.1% Increase

NEW YORK CITY, June 4—Reports from the Moon Motor Car Co., St. Louis, Mo., show that during April, 1915, the shipments and sales showed an increase of 24.7 per cent. over last year, and in May a gain of 33.1 per cent. over the same period last year.

New Automobile Co. for Jackson

JACKSON, MICH., June 4—It is rumored that a new automobile manufacturing concern is in the course of organization here and that it will build a six-cylinder car at $800. A Detroit firm will make the power plant.

Now Singleton-Tripp Co.

CLEVELAND, O., June 5—The Singleton-Tripp Co., general advertising agent in the Citizens Bldg., has succeeded to the business of the J. T. Singleton Co. W. H. Tripp was recently elected vice-president of the company.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Ajax-Grieb Rubber Co, com.	229	..	300	..	..
Ajax-Grieb Rubber Co. pfd.	99	100	101	..	..
Aluminum Castings pfd.	99	100	98	100	..
J. I. Case pfd.	84¾	90	..	80	..
Chalmers Motor Company com.	98	102	89	94	..
Chalmers Motor Company pfd.	94	96	95	98	..
Electric Storage Battery Co.	51	52	51	53	..
Firestone Tire & Rubber Co. com.	305	310	485	490	+10
Firestone Tire & Rubber Co. pfd.	107	110	110	113	..
General Motors Company com.	94	95	151	153	+16
General Motors Company pfd.	94½	95	99	100	+1
B. F. Goodrich Company com.	24	25	46½	48	+3½
B. F. Goodrich Company pfd.	88	89½	101	103	— ¼
Goodyear Tire & Rubber Co. com.	173	178	244	248	+4
Goodyear Tire & Rubber Co. pfd.	98	99½	105¼	106	+ ½
Gray & Davis Inc. pfd.	95	102½	..	..	..
International Motor Co. com.	..	5	14	15	..
International Motor Co. pfd.	3	10	37	39	+3
Kelly-Springfield Tire Co. com.	..	..	129	132	..
Kelly-Springfield Tire Co. 1st pfd.	..	..	83	85	+ ½
Kelly-Springfield Tire Co. 2nd pfd	..	..	130	135	+15
Maxwell Motor Company com.	14	14½	46	47	+3½
Maxwell Motor Company 1st pfd.	42½	44	87	88½	+1
Maxwell Motor Company 2nd pfd.	17½	18	39	41	+2
Miller Rubber Company com.	..	..	180	185	..
Miller Rubber Company pfd.	..	..	104	105	..
New Departure Mfg. Co. com.	..	..	106½	..	..
New Departure Mfg. Co. pfd.	..	..	136	141	..
Packard Motor Car Co. com.	103	..	102	104	..
†Packard Motor Car Co. pfd.	98½	100½	96¼	..	..
Peerless Motor Car Co. com.	18	25	67	70	..
Peerless Motor Car Co. pfd.	..	62½	94	96	..
Portage Rubber Co. com.	..	40	35	38	+3
Portage Rubber Co. pfd.	..	90	85	88	+3
*Reo Motor Truck Company	9½	10	15	16¾	+ ⅛
*Reo Motor Car Company	20	22†	32¼	33¾	..
Splitdorf Electric Co. pfd.	40	50	..	..	..
Stewart-Warner Speed. Corp. com.	47	49	68	69	+4
Stewart-Warner Speed. Corp. pfd.	97½	99½	103	105	..
Studebaker Corporation com.	33½	34	71	72½	+4
Studebaker Corporation pfd.	87½	89	99	101	+1½
Swinehart Tire & Rubber Co.	73	80	80	90	..
Texas Company	146½	147½	128	130	+1½
U. S. Rubber Co. com.	58¼	58¾	65	66	+3
U. S. Rubber Co. 1st pfd.	102½	103	106	108	..
Vacuum Oil Company	226	229	204	208	+4
White Company pfd.	107	110	103	108	..
Willys-Overland Co. com.	74	75½	130	131	+15½
Willys-Overland Co. pfd.	92	95	101½	103½	+1½

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS.

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ges
Chalmers Motor Co. com.	101	105	..	92	+1
Chalmers Motor Co. pfd.	94	96¼	95	98	+1
Continental Motor Co. com.	..	180	180	200	+10
Continental Motor Co. pfd.	..	75	84½	86	+ ½
General Motors Co. com.	93	96	146	150	+10½
General Motors Co. pfd.	94½	..	99	100	+1
Maxwell Motor Co. com.	14	14¼	43	46	+2
Maxwell Motor Co. 1st pfd.	42	44	86	88	+ ½
Maxwell Motor Co. 2nd pfd.	17	19	38	40	+1½
Packard Motor Car Co. com.	103	..	102	104	..
Packard Motor Car Co. pfd.	97	100½	96¼	..	+2¾
*Reo Motor Car Co.	18	..	32½	33¼	— ⅛
*Reo Motor Truck Co.	9½	10	14⅜	15½	..
Studebaker Corp. com.	..	..	67	69	+1
Studebaker Corp. pfd.	..	..	..	100	+1

INACTIVE STOCKS

*Atlas Drop Forge Co.	..	21	..	26	..
Ford Motor Co. of Canada	..	550	950	..	..
Kelsey Wheel Co.	185	..	200	..	..
W. K. Prudden Co.	..	20½	19½	21	..
Regal Motor Car Co. pfd.	20	..	..	25	..

BONDS

General Motors, notes, 6s, 1915	101	102	..	..	..
Packard Motor Co. 5s, 1916	95	98½	98¼	..	..

---

* Par value $10; all others $100 par value †Ex-dividend.

Prest-O-Lite Buys Battery Plant

Secures Pumpelly Factory with All Patents—To Use Present Service Depots

INDIANAPOLIS, IND., June 5—By purchasing the Pumpelly Battery Co. of this city, the Prest-O-Lite Co. has entered the electric lighting field and will carry on the manufacture of this battery under the new name of Prest-O-Lite battery and handle it through the wide chain of service depots through which it has marketed its gas tanks. James Allison, vice-president of the Prest-O-Lite Co., made the purchase of 50 per cent. of the Pumpelly stock, and by the deal Harry Murphy, who was president of the Pumpelly company, becomes vice-president of the Prest-O-Lite Co. and will be in charge of the new Prest-O-Lite battery department. Thus the Pumpelly personnel has been absorbed into the Prest-O-Lite organization.

Mr. Allison, at present vice-president and treasurer of the Prest-O-Lite Co., will continue to serve in that capacity with Mr. Murphy as an additional vice-president.

The Pumpelly company has been manufacturing storage batteries, starting, lighting and ignition systems, and has been shipping about 400 batteries a day for the past year. Officers of the Prest-O-Lite Co. declared that they intend to increase the scope of the business to become contenders in the electric lighting and starting field as well as in the gas lighting industry. Acquisition of the Pumpelly Battery Co. places the concern in a condition to compete in both fields, and the batteries will be manufactured for the present in the old plant of the Pumpelly Co., but buildings will be erected later at the Prest-O-Lite plant. Battery service stations and agencies will be maintained wherever Prest-O-Lite service is offered. The company has thirty-five factory branches and over 20,000 agencies.

Overland Breaks Its Single Shipment Record

TOLEDO, O., JUNE 5—What is probably the largest single shipment of automobiles ever made leaves the Toledo factory of the Willys-Overland Co. on Friday. The entire shipment, which has a total valuation considerably in excess of one-third of a million dollars, is consigned to the C. T. Silver Motor Co., Overland distributor for New York. During the week ending May 29 shipments were made of 1906 cars from the Toledo plant. During the present week this will be exceeded by at least 100. Reports from the company state that orders now on hand for immediate shipment are approximately 17,000 in excess of shipments. This is in spite of the fact that many departments of the factory are working both night and day in an effort to make the supply meet the demand. More than 9,200 men are now being employed at the Overland factory.

H. H. Hower, for the past eight years with the F. B. Stearns Co., is the latest Knight motor representative to join the forces of the Knight division of the Willys-Overland Co. He started his new duties June 1 as assistant to Joseph McDuffie, salesmanager of the Knight division. The division has acquired the services of L. T. Wagner, former manager of the Argonaut Motors Co., San Francisco, distributor for the Stearns and Pathfinder cars. Mr. Wagner will make his permanent headquarters at San Francisco.

Colby Plant Sold for $32,800

MASON CITY, IA., June 4—The plant of the Colby Motor Co., was sold on May 26 at a receiver's sale for $32,800 to Allan Beck, of Beck-Walker Co., this city. The sale included five buildings comprising office and factory and much personal property, such as 100 radiators, 100 frames and other items including steering gears, windshields, springs, etc. About 7 acres of land were included in the sale. S. A. Schneider was the receiver. The probabilities are that the plant will be converted into separate factory buildings. Just what will be manufactured has not as yet been decided upon.

Fedders' Radiator Factory Addition

BUFFALO, N. Y., June 3—A four-story addition to the Fedders Mfg. Co. plant will be ready for use the latter part of July.

Concurrently with the occupation of the new addition the company will bring out a new patented type of radiator. This radiator is claimed to be the lightest in weight of any radiator built and very simple to manufacture. The reports of the company show that it is turning out 50 per cent. more material at this time than it has done in the history of the organization and in order to keep up with the shipping it is working a complete night shift.

French Continental Tire Factory Has $100,000 Fire

PARIS, FRANCE, May 19—A fire, causing damage valued at $100,000, has destroyed all the upper portion of the main building of the Continental Tire Co.'s French factory, in the suburbs of Paris. The fire broke out on Sunday evening on the top floor of the building. In the building where the fire originated large stocks of raw rubber were kept; as there were no electric wires in this portion of the building and no workpeople were present, the cause of the fire is so mysterious that experts are investigating.

As soon as the war broke out the Continental company's factory was seized by the French authorities; the company's offices and store rooms in Paris had been closed the previous day prior to the departure of the staff for Germany, or the concentration camps.

Burd Increases Capital $150,000

ROCKFORD, ILL., June 4—At a special meeting of the stockholders of the Burd High Compression Ring Co., held at its office in Rockford, Illinois, on May 19, it was voted unanimously to increase the capital stock of the company from $50,000 to $200,000.

The additional capital was voted for the purposes of adding to equipment, and enlarging the business.

Federal Rubber Running Overtime

MILWAUKEE, WIS., June 4—The Federal Rubber Mfg. Co., this city, has added 700 men to its force since the opening of spring. The plant is running overtime, and the total working force is 1,700 men.

About 60 per cent. of its product is automobile tires, and 40 per cent. mechanical goods. The company recently purchased 6 acres just north of its present plant, with a view to possible expansion. It is said to be contemplating the erection of a large factory building.

Champion Ignition to Add

FLINT, MICH., June 4—The Champion Ignition Co., Flint, Mich., manufacturer of A C, A C Titan and A C Cico spark plugs, has given a contract for a building which will give it an addition of 18,000 square feet. It is lining up now for an output of 50,000 plugs a day.

Double Recovery in Compensation Act

TRENTON, N. J., June 7—The Supreme Court today held that under the New Jersey Workmen's Compensation act, a man hired in New Jersey and hurt in Pennsylvania, can recover compensation in both states.

The case was that of a brakeman on the New Jersey Central, against that railroad. He was hurt at Odenweiler, Pa. The lower court held the Federal Employers' Liability law prevented the applicability of New Jersey's compensation act.

The supreme court upheld the contention and also said recovery in two states is no more unjust than recovery upon two policies of accident or life insurance.

With this decision comes the announcement that workmen's compensation has been admitted into Pennsylvania, effective January 1, 1916.

To Abolish Florida State Tax

Counties to Sell License Tags—Fees Graduated on Seating Capacity of Car

TALLAHASSEE, FLA., June 7—Senator Igou's automobile license bill, completely changing the system now in vogue in Florida of registering automobiles at the state capital, having passed both the house and the senate of the general assembly, awaits only the signature of Governor Trammel to become a law.

The present law, which was recently upheld by the high courts, charged a $3 state tax and allowed taxation for license in counties also.

The new law abolishes the state registration, and provides for the sale of license tags in the different counties. The county license is graduated on the seating capacity of the automobile. A motorcycle license will be $2.

25 Miles Legal in Wisconsin

MILWAUKEE, WIS., June 5—Wisconsin limits of 15 miles per hour in cities and 25 miles per hour in country districts have been permitted to stand by the Wisconsin legislature. A movement to reduce country speeds to 20 m. p. h. was effectively opposed by the motor clubs. The 8-mile limit when passing school grounds is enlarged to include county or state hospital or poor farm grounds and cemeteries. The following acceptable provision is retained:

"No person shall operate or drive any automobile, motor cycle or other similar motor vehicle recklessly or at a rate of speed greater than is reasonable and proper, having regard to the width, traffic and use of the highways and the general and usual rules of the road, or so as to endanger the property, life or limb of any person......"

The provision which prohibits any county, city, village or town from passing or enforcing any law or rule in contravention to the state statute is retained. This insures uniform motor legislation throughout Wisconsin for 2 years more.

Wins Car Guarantee Suit

INDIANAPOLIS, IND., June 7—An interesting decision regarding guarantees on motor cars has just been handed down by the Indiana supreme court in affirming a decision of the lower court awarding $6,500 damages to the Indianapolis Motor Car Co. against the Hart-Kraft Motor Co., Philadelphia.

The local company held an agency for Hart-Kraft trucks. It alleged that it lost considerable money under a maintenance contract under which the trucks were sold. It alleged the trucks were wrong in principle of construction and that its damage was greater than that covered by the written guarantee issued by the company manufacturing the trucks.

Safety First Recommendations

DETROIT, MICH., June 4—The committee of the Safety First Federation of America, which assembled here today, decided to present recommendations embodying the following important rules and regulations to the first annual convention of the federation which is to be held in this city in October: Adoption of a standard plan for traffic lanes for pedestrians; licensing of drivers of all motor vehicles; standard signals for all traffic work; standard ordinance covering traffic regulation; standardization of all accident reports by municipalities; standardization of left-hand turns at street intersections; standard size, color and attachment for all traffic signs; fixed location for traffic officers; uniform instruction in the education of traffic officers; time limit of from 15 minutes to 1 hour for automobile parking; near-side stops for street cars; guards on all chain-driven motor trucks; abolition of all steps on horse-drawn and motor trucks; laws giving police power to control pedestrian traffic; exclusive use of siren for police and fire vehicles.

Hearing on Georgia Law June 12

SAVANNAH, GA., June 4—State Attorney General Warren Brice will represent the state at the hearing on the automobile registration law to be held here June 12. The hearing is on a temporary injunction granted in the Superior Court of this county restraining the city from requiring automobilists to register with the clerk of the council and temporarily preventing the state from collecting the $5 registration fee.

Chicago-to-Seattle Relay Run

CHICAGO, ILL., June 8—To prove that every mile of the route from Chicago to Seattle, Wash., is in condition for touring, officials of the Yellowstone Trail Assn. will hold a relay motor run over the transcontinental highway next week. Twenty-one cars will participate and the trip from Chicago to Seattle will be made in 100 hours, driving day and night to cover the 2,439 miles on schedule.

Detroit Piston Ring Co. in New Home

DETROIT, MICH., June 4—The Detroit Piston Ring Co., has moved into a new one-story building 60 by 125 feet located at Richmond avenue and Custer. In this new home the company has over five times as much floorspace as in the old building and will increase at once its production facilities by adding considerable new machinery and employing about fifty men. The concern started in business about 2 1-2 years ago and is making piston rings exclusively. Since January business has been over 100 per cent. better than during the first 6 months of 1914.

Pennsylvania Tire Guaranteed Up to 6,000 Miles

NEW YORK CITY, June 4—The Pennsylvania Rubber Co., Jeannettte, Pa., has increased its guaranteed mileage from 4,500 to 6,000 miles on all its oil-proof vacuum cup tires. This will apply also to all vacuum cup tires at present in service. This announcement follows logically the result of The Automobile Club of America official test, in which nine tires on heavy cars averaged 6,760 miles, three of them exceeding 8,900.

Maxwell Finishes 10-Day Test

LOS ANGELES, CAL., June 3—The Maxwell 25 belonging to the Lord Motor Car Co., local dealers, which has made a round trip a day for 10 consecutive days between Los Angeles and San Diego, completed the run, a total of 2,764 miles, according to schedule. This car carried as passengers free on each trip, three outsiders. Most of the trips were made in less than 6 hours, four of the runs averaging more than 24 miles per hour for the 138 miles.

Young Blood in Goodyear

AKRON, OHIO—In carrying out the announced policy of distributing common stock to young partners in the company, the Goodyear Tire and Rubber Co., this city, has filed papers with the secretary of state increasing its authorized capital from $8,000,000 to $25,000,000. Only part of the increased capital will be distributed at this time, the remainder being kept in the treasury for future contingencies.

Detroit License Office Closed

DETROIT, MICH., June 8—Beginning July 1 the local office of the Secretary of State will be closed and all automobile licenses will again be issued and sent from the offices of the secretary in Lansing, Mich.

The announcement has caused quite a stir among manufacturers, dealers and owners, as it will cause much delay.

Monarch Buys 5,000 Advance Pumps

DETROIT, MICH., June 8—Harry H. Knipper, manufacturers' representative, has sold to the Monarch Motor Car Co., 5,000 Advance air pumps, made by the Advance Machinery Co., Toledo, O.

350-Mile Race for Sheepshead

Work on Track Progressing—Part of Concrete Foundation Finished

New York City, June 4—The inaugural meet at the Sheepshead Bay track on October 2 will be featured by a 350-mile race. It was the consensus of opinion of the officials that a race of 350 miles would be long enough to test to a reasonable and satisfactory limit the endurance of the cars.

Work on the track is fast progressing. A mile and a quarter of the concrete foundations has been finished and a 1-4 mile of the board surface has been laid. The portion completed shows as smooth as a bowling alley. The boards have been dipped in creosote so that the track presents a dark brown surface.

Foundations for the grandstand are being put in and the steel is on its way. With the working forces increased to 1,500 men, construction is progressing to such an extent that the management is confident that the speedway will be finished by September on schedule time.

Rayfield Offers $1,000 Prizes

Chicago, Ill., June 8—Findeisen & Kropf Mfg. Co., maker of Rayfield carbureters, has offered the following cash prizes to the winning cars in the 500-mile Chicago Speedway race if equipped with Rayfield carbureters. First, $500.00; second, $300.00; third, $200.00. In addition the company is offering a $1,000.00 solid silver punch bowl to the driver first winning the 500-mile race twice in a car fitted with a Rayfield carbureter.

Waterloo, Ia., to Have Speedway

Waterloo, Ia., June 3—The Waterloo Speedway Assn. of this city, has filed incorporation papers with a capitalization of $250,000, to build and maintain an automobile speedway at Elk Run.

The present officers of the association are: President and treasurer, W. H. Hanna; vice-president, F. W. Porterfield, and secretary, A. C. Savage.

These three with F. J. Dains and Otis Higdon, constitute the present board of directors.

Moross and Sloan Outlaws

New York City, June 7—The contest board of the American Automobile Association today stated that by reason of their participation in an unsanctioned mile track meeting at Detroit, Mich., May 30 and 31, the cars, drivers and mechanicians of the Moross and Sloan teams, the promoters and all officials connected with the meet, have automatically rendered themselves ineligible, under the provisions of Rule 58 of the contest rules, for participation in or connection with future events sanctioned by the American Automobile Assn. A definite period of suspension will be fixed at the next meeting of the contest board, to be held June 22.

Tacoma Has Sixteen Entries

Tacoma, Wash., June 3—To date sixteen entries have been received for the Tacoma speedway races July 4 and 5. The last four entries are:

Marmon	Harry Reynolds
Mercer	H. D. Stratton
Gordon-special	Frank Elliott
Schneider-special	S. Schneider

Des Moines to Build Speedway

Des Moines, Ia., June 4—A 10-year lease for the Des Moines mile board automobile speedway has been accepted. The speedway will be located on the old Bennett farm at Valley Junction and will be known as the Des Moines Speedway.

Six Franklins Average 32.55 M.P.G.

Brooklyn, N. Y., June 5—To demonstrate the mileage which could be secured by a Franklin car owner, A. G. Perretz and Gilbert B. Perkins, Franklin dealers, conducted an owners' 1-gallon test today. There were six entries. The course was 17 miles eastward on Long Island from the Long Island Automobile Club and return, after which any additional mileage was run off in Brooklyn.

The highest mileage was made by F. F. Koehler, Jr., who went 39.2 miles before the supply in his little auxiliary tank was exhausted. The other mileages were: F. H. Evans, 33.5; Dr. Nathan T. Beers, 33.2; Rufus T. Humphrey, 33; Peter B. Hanson, 29; Dr. W. Ross Martin, 27.3. The average was 32.55. The winner was awarded an engraved silver cup.

Wilson Truck on 30-Day Test Run

Detroit, Mich., June 5—The J. C. Wilson Co., which makes the Wilson truck, will start a 30-days' test run with a 2-ton model in a week or 10 days. The daily run will be of 100 miles, some days in Detroit and other days in the vicinity.

Secretary Stanley Wilson of the company started today on an extensive business tour in the interest of his concern. He will gather first-hand information as to the truck business in the Middle West, Northwest and California by calling on the principal truck dealers and distributors. Among the important cities Mr. Wilson will visit are Omaha, Neb., Minneapolis, Minn., Denver, Colo., Salt Lake City and Ogden, Utah.; Los Angeles, San Diego and San Francisco, Cal.; Seattle and Tacoma, Wash.

Free Emergency Tire Service

Straus System Sends Help to Stranded Motorists—Cost of Tire Only Charge

Indianapolis, Ind., June 4—The final word in tire service has been inaugurated here by the Straus service system, which in addition to maintaining a large store where stocks of casing and tubes are carried and where all kinds of repair work is done day or night, has a fleet of five free service cars, three Fords, an American and a Stoddard that cover a radius of 20 miles from the city and carry casings, tubes, gasoline and do tire changing as necessary. No charge is made for this service other than by way of new tubes or casings sold, or the price charged for repairs, and it is further claimed that all prices are on a par with those used in this city.

The working out of the system, which was only opened last week, is interesting. Should a tourist become stranded 18 miles out of the city for need of a casing he phones the Straus concern and immediately a man in a Ford starts out with the casing and perhaps an extra tube. This man makes the tire change, collecting only the cost of the casing. He carries in the car a large air tank capable of inflating five or six tires.

Chalmers Managers Meet

Detroit, Mich., June 7—Presided over by President Hugh Chalmers, the tri-monthly convention of the district managers of the Chalmers Motor Co. started this morning. All the officials of the company were present and during the next few days there will be morning and afternoon sittings of the convention at which matters pertaining to the 1916 season will be fully discussed.

Chalmers to Give 100 Hours' Service

New York City, June 7—A new service system has been inaugurated by the Chalmers Motor Co., Detroit, Mich. This system will give 100 hours' free service with the sale of every Chalmers car. The company is issuing a book of labor coupons that will be negotiable at any one of the 800 Chalmers service stations.

N. Y. Perfection Spring Service Branch

New York City, June 7—The New York Service Branch of the Perfection Spring Co., 243-245 West 64th street, which is the second service branch to be established by this concern, will within 30 days be prepared to take care of all forms of spring repairs, including tempering and resetting, and by that time will have a complete set of furnaces and equipment for such work. A. C. Bergmann, service branch manager, who was formerly connected with Simplex, Fiat and Mercer, has completed the installation of equipment to make it possible to change a spring in 1-2 hour and already the service department is completely stocked with springs for different makes of cars covering models as old as 1909 and in some cases older types. By the fall the new building will be occupied which will be a three-story structure 75 by 100 and located at 610 West 56th street. The first service branch of the Perfection Spring Co., was opened in Cleveland a year and a half ago and it is expected that others in addition to the New York one will be opened in the near future.

300 Hupp Dealers Discuss Business on Lake Trip

DETROIT, MICH., June 4—Three hundred dealers, subdealers, distributers and members of the organization of the Hupp Motor Car Co. disembarked from the steamer City of Alpena II today after having spent 4 days on Lake Huron as guests of the concern on the occasion of the annual dealers' convention, at which the new models for 1916 were shown and matters pertaining to selling were discussed.

The cruise began at 3 p.m. June 1 and the itinerary included stops at the Soo, Mackinac island and Alpena. Hupmobile dealers from all parts of the United States and Canada were in attendance.

Studebaker Gains 100 per Cent. in East

DETROIT, MICH., June 8—Sales Manager L. J. Ollier, of the Studebaker Corp., after an investigation trip through New York, Pennsylvania and New England reports conditions exceptionally good.

"I found everywhere a most optimistic condition," says Mr. Ollier, "not only in the automobile business, but in most all other lines of business. Compared with a year ago in those territories our business shows an increase of over 100 per cent., and in some instances, dealers and distributors have done 200 per cent. better. Sales have not only increased in the cities and towns, but out in the farming districts the demand has been and is stronger than ever. This increasing demand for motor cars applies as well to the commercial car as to the passenger vehicle."

Anderson Dines Hupp Men

DETROIT, MICH., June 5—The members of the sales force of the Hupp Motor Car Co., were entertained today at dinner at the Detroit Athletic Club by sales and advertising manager Lee Anderson.

Jitney a Public Utility

Illinois Puts It Under Utilities Commission Jurisdiction—Local Regulation

SPRINGFIELD, ILL., June 5—The jitney bus has been formally classified. It is now a public utility in Illinois. Henceforth in this state, its status is fixed and it must operate according to hard and fast rules, and regulations. No longer may it be a free agent, operating today and laying off tomorrow. It is now under the jurisdiction of the state public utilities commission. It must have fixed charges and fixed schedules for service. It must receive permission to operate and this permission can not be granted unless it is shown that its service is needed and that it promote the convenience of the public. The ruling of the commission was made following a petition filed by the Jacksonville street railway company, against the L. F. O'Donnell jitney bus company of that city, requiring the latter to comply with the utilities act. In line with the policy of the commission, certificates of convenience and necessity for jitney bus lines will not be granted where it is the intention to operate the lines parallel with the street car lines. The commission also holds that regulation by the utilities commission does not prevent additional regulation by city ordinance. It is maintained that this ruling gives the jitneys the worst jolt received in any state of the Union. In order to obtain a certificate of convenience and necessity the operators of jitney buses must incorporate under the state laws and must come to the commission with proper credentials showing that the city is willing to have them operate.

Jitneys Lose in Springfield, Mo.

SPRINGFIELD, MO., June 4—Jitney owners here this week lost their fight against the enforcement of an ordinance for the regulation of jitneys. The court refused to enjoin the city officials from enforcing the ordinance, with the exception of three minor clauses. As a result jitney owners here will be required to obtain liability insurance bonds for $2,000, to stop at all railroad crossings, and to limit their speed to 15 miles an hour in the residence district, a lower speed than allowed trolley cars.

Jitney Men Win in Savannah

SAVANNAH, GA., June 5—Holding that "some of the provisions in the ordinance under consideration are reasonable and beyond criticism, others are beyond reason and prohibitory," Judge Charlton, in a decision handed down to the supreme court, granted a temporary injunction restraining the city from enforcing the ordinance relating to the operating of jitney buses. Under this decision the jitneys may operate in Savannah free from municipal regulation except as provided in ordinances already in effect. The jitney ordinance is practically invalidated and rendered inoperative. The court order applies to all of the jitney injunction suits that have been filed.

Common Carriers in Georgia

ATLANTA, GA., June 8—*Special Telegram*—The Georgia Railroad Commission today handed down a decision holding that jitney buses are common carriers under the Georgia statute and as such, are subject to regulation by the Commission. The Commission issued a set of tentative regulations by which the operation of jitneys will be guided until July 13, when criticisms will be heard upon these rules for the purpose of arriving at just and reasonable regulations.

Pennsylvania Cities Can Regulate

PHILADELPHIA, PA., May 5—The cities in Pennsylvania are empowered to regulate jitney movements since the Patton bill has been approved. The bill provides that cities may regulate motor vehicles not operated on tracks and impose reasonable license fees and make regulations for the operations of the vehicles, as well as the rates to be charged.

$2,500 Bond in Fort Worth

FORT WORTH, TEX., June 4—The amended jitney ordinance requires an indemnity bond of $2,500, payable to the mayor to cover injuries to passengers or pedestrians. The costs of the bond will be $250 a year. The original requirement was a $10,000 insurance policy at a cost of $70 yearly. The jitney men will contest the amendment at Hornaday.

Washington Jitneers Abandon Fight

SEATTLE, WASH., June 4—Jitney bus operators have abandoned their fight against the state law which compels them to furnish a $2,500 bond before the state will issue a permit for their operation.

Jitneys Lower Hartford Trolley Earnings

HARTFORD, CONN., June 5—April of this year marked a big drop in the earnings of the Connecticut company, the trolley subsidiary of the New York, New Haven & Hartford railroad, and it was all due to the jitneys. A loss of $40,753 is reported for the month of April as compared with the same period a year ago.

Factory Miscellany

Auto Wheel to Add—The Auto Wheel Co., Lansing, Mich., is to build an addition 60 by 160 feet to its plant.

Autocar Co. to Add.—The Autocar Co. Ardmore, Pa., will add a three-story building to its factory. It will be of brick and concrete construction.

Locomobile Adding—The Locomobile Co. of America, Bridgeport, Conn., will erect a one-story building, 50 by 60 feet, for a case-hardening department.

Firestone Plant in Kansas City.—The Firestone Tire & Rubber Co., Akron, O., has purchased a site on Grand Ave., Kansas City, Mo., and will construct a plant.

Automobile Plant for Duluth—C. E. Kling is behind a project to construct a plant for the manufacture of automobiles at Duluth, Minn. The estimated cost is $250,000.

To Mfr. Tires.—The Standard Four Tire & Rubber Co. plans to construct a plant at Des Moines, Ia., for the manufacture of automobile tires. The estimated cost is $100,000.

To Mfr. Carbon Remover.—The Orolo Carbon Remover Co. is the name of a new concern located at 914 North High street, Columbus, O., for the manufacture of a carbon remover and engine cleaner.

Old Columbia Plant Being Reconstructed—Plans of the reconstruction of the Columbia Motor Car Co., Hartford, Conn., plant recently purchased by the Billings & Spencer Co. and which will eventually house all branches of that concern's business are are progressing. The old forge shop has been rebuilt and a similar new addition is now under construction.

Hamilton Lock Secures Plant.—The Hamilton Lock, Nut & Specialty Mfg. Co., Hamilton, Ont., has secured a factory on Gage Ave., Hamilton, and will manufacture a patented lock nut and an automobile wheel. W. J. Sutterby is superintendent.

Twentieth Century Packing Plant in Detroit—The Twentieth Century Metallic Packing Co., recently organized in Lexington, Ky., to manufacture automobile specialties, will locate its plant in Detroit, Mich., it is stated. E. J. Welch, of Detroit, is the head of the concern.

Faultless Contract for Addition Awarded.—The contract for the erection of two wings to the plant of the Faultless Rubber Co., Massillon, O., has been awarded. One of the wings will be 50 by 50 feet and the other 60 by 180 feet, both two stories high.

Beautifying Sheldon Plant Surroundings.—A large force of men is busily engaged in beautifying the grounds surrounding the plant of the Sheldon Axle & Spring Co., at Wilkes-Barre, Pa. The work is being done for the company under the direction of the Superintendent of Parks and Grounds of the City of Wilkes-Barre, and will be laid out along the same lines that the commissioners have adopted in the public grounds and parks throughout the city.

Goodyear Rewards Suggestions.—The Goodyear Tire & Rubber Co., Akron, O., in its efforts to attain the utmost efficiency, has inaugurated a "Suggestion System" whereby employees with ideas concerning possible improvements upon existing methods may bring them to the attention of the management, and, if adopted, receive suitable reward. There has been a general response to this offer and many employees have received the company's check for their ideas.

Republic Truck Stays in Alma—The Alma (Mich.) Board of Trade has voted to raise and spend $35,000 for a new building for the Republic Motor Truck Co., and as a result this concern will remain in that city instead of going to either Kalamazoo or to Saginaw. The company is employing 300 men at present and is working two shifts of 12 hours each in the machine shop and 3 hours overtime in other departments for 5 nights out of the 6. Last month the company turned out 242 trucks and shipped the entire amount. At present the concern is about 100 cars behind on orders.

St. Louis Co. Buys Plant.—The officers of the All-Steel Motor Car Co., St. Louis, Mo., and a committee representing the citizens of Macon, Mo., have closed a deal in the latter city by which the automobile concern acquires possession of the large Blees buggy plant for the manufacture of its cars. The company will install machinery and put a force to work at once. It is planned to make two types of cars. One is the roadster selling for $350 and the other will be a five-passenger touring car to sell for $410. The initial factory force will be about 800.

The Automobile Calendar

June 11-12	Effingham, Ill., Hillclimb and Fuel Economy Test, Salt Creek Hill, Effingham Automobile Club.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14	San Antonio, Texas, Jitney Convention.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 15	Peoria, Ill., Track Race, 100 Miles, National Implement and Vehicle Show.
June 15-17	Chambersburg, Pa., Run to Atlantic City.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Utica, N. Y., Hill Climb, Automobile Club of Utica.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
July 5	Visalia, Cal., Road Race, Tulare Co. Auto. Assn.
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug 20-21	Elgin, Ill., Road Races.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club
Sept. 8-11	Hamline, Minn., 2-Day Meet at State Fair Grounds between Minneapolis and St. Paul, State Fair.
Sept. 13	Oakland, Cal., Pan-American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct.	St. Louis, Mo., Show, Forest Park Highlands, St. Louis Automobile Manufacturers and Dealers' Assn.
Oct. 1	Minneapolis, Minn., Track Race, Twin City Motor Speedway Co.
Oct. 1-2	Trenton, N. J., Track Races, Inter-State Fair.
Oct. 2	New York City, Sheepshead Bay Motor Speedway Track Meet.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show, Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.
March 4-11	Boston, Mass., Truck Show, Mechanics Bldg.

The Week in the Industry

Reese Oakland Buick Manager—C. M. Reese has been named manager of the Buick branch in Oakland, Cal.

Kriedeman Superintendent — The Standard Motor Truck Co., Detroit, Mich., has appointed C. C. Kriedeman as superintendent.

Alvan Resigns—F. J. Alvan, who was general sales manager of the Sears-Cross Speedometer Co., Detroit, Mich., has resigned and will start in business for himself.

Hagerling Succeeds Dill.—L. H. Hagerling, former manager of the Packard agency at Harrisburg, Pa., has succeeded I. W. Dill of the Hudson Sales Agency.

Berry Now Sales Manager—P. A. Berry, for the past two years connected with the Pacific Car Co., Tacoma, Overland distributor, has been promoted to sales manager.

O'Neil Sales Mgr.—A. L. O'Neil, for about 7 years in the automobile business in St. Louis, has joined the forces of the Von Arx Automobile Co., Winton distributor, as sales manager.

Phillips Baltimore White Manager—T. C. Phillips has been made the Baltimore, Md., manager of the White branch. For six years Mr. Phillips was with the Pittsburgh branch of the concern.

Hallowell Resigns.—Montgomery Hallowell, publicity man for Briscoe Motor Co., Jackson, Mich., has resigned to accept a position in the advertising department of the *New York Times*.

Morarity Makes Change. — M. G. Morarity, of Des Moines, formerly manager of the C. F. Stewart Automobile Co., has become sales manager for the Miller Motor Car Co., of Waterloo.

Crumley Joins King—A. A. Crumley, late eastern district sales manager for the Hudson Motor Car Co., has joined the King Motor Car Co. in a similar capacity. His headquarters will be in New York City.

Gilbreath Resigns—W. S. Gilbreath has resigned as secretary of the Hoosier Motor Club at Indianapolis in order to go to Chattanooga, Tenn., where he is to become field secretary of the Dixie Highway Commission.

Cutting Heads Kissel Truck Dept.—Ned Cutting has been placed in charge of the commercial vehicle department of the Pacific coast branch of the Kissel Motor Car Co. His headquarters are in Los Angeles, Cal.

Moter Men in New Roles

Link Joins Standard Truck—Vincent Link, for several years truck engineer for the Packard Motor Car Co., has taken charge of the engineering and drafting departments of the Standard Motor Truck Co., Detroit, Mich.

Jones Heads New Co.—A. H. Jones, formerly manager for Ballou & Wright, accessory dealers in Seattle, Wash., is now at the head of the Pacific Auto Supply Co., and C. E. Barteau is vice-president and sales manager.

Dike Resigns—R. W. Dike, a locomotive engineer, who established a garage, agency and repair shop under the style of Osceola Motor Car Co., Osceola, Wis., last fall, has resigned his position to take personal charge of the business.

Wilkins Transferred.—F. W. Wilkins, formerly in charge of the Maxwell Service station in Winnipeg, Man., has been transferred to the sales department and given charge of the Saskatchewan branch, with headquarters at Regina.

Logan Empire Manager.—R. L. Logan has been appointed manager of the branch recently established in Pittsburgh by the Empire Rubber & Tire Co., Trenton, N. J. Formerly he was connected with the National Cash Register Co.

Moran Heads Tire Branch—The Southern Tire & Rubber Co., of Augusta, Ga., has announced the opening of a branch in Atlanta, under the charge of O. A. Moran. The branch is located at 225 Peachtree street, in the heart of what is known as "Automobile Row."

Strobridge Resigns. — George Strobridge has resigned from his position of chief examiner of chauffeurs in the office of the Secretary of State of New York State and will henceforth conduct the Strobridge Automobile School, at 1989 Broadway, New York City.

Maxson Heads New Overland Co.—A new corporation, known as the Overland-Hartford Co., Hartford, Conn., succeeds the Overland-Connecticut Co., throughout the state of Connecticut with the exception of most of Fairfield county. Irving F. Maxson, an Overland factory man, heads it.

Wing Heads Metz Branch—F. L. Wing has been appointed manager of the Southern California Metz branch, Los Angeles, succeeding E. H. Metz, son of C. H. Metz, president of the Metz company at Waltham, Mass. The former manager returns to Waltham to assume the duties of an appointment higher up in the company's service.

Savage Tire Changes — A recent change on the force of the Savage Tire Co. in California is the promotion of M. L. O'Brien, formerly sales manager at San Diego, Cal., to assistant to Claus Spreckles, secretary of the company. H. H. Eitzen, formerly assistant manager, has been made manager of the San Diego branch.

Bender Goes to Overland.—J. L. Bender, formerly of Timken-Detroit Axle Co., and American Ball Bearing Co., and recently sales manager of Grant-Lees Gear Co., Cleveland, has been appointed distributor of the Overland product in central Pennsylvania. Bender has acted as district manager in central Pennsylvania for the past year. He will take headquarters at Altoona.

Colver Heads Brooklyn Maxwell.—The New York City branch of the Maxwell Motor Sales Corp. has opened a Maxwell branch in Brooklyn at 1392 Bedford avenue, corner of St. Mark's avenue. Fred Colver has been appointed manager of the Brooklyn end of the business.

Franklin Appointed Mgr.—H. E. Franklin, who has been identified with the Chase truck line in Los Angeles for the past 4 years, has been appointed manager of the truck department of Hawley, King & Co., newly appointed Southern California and Arizona agents for the Chase line. The company also handles the National, Oakland and Saxon lines in the local field, covering the same territory. The Chase factory formerly operated a factory branch in this city under the management of C. J. Batcharie. The new agents have established a service station on Central avenue.

Ellwood Joins Nordyke & Marmon—A. L. Ellwood has been appointed manager of Kansas City branch of the Nordyke & Marmon Co. Mr. Ellwood has been with the Marmon company a short time as territorial representative, and before joining them was connected with the Locomobile Co. of America as St. Louis branch manager and later as Chicago branch sales manager. The territory controlled from Kansas City has been enlarged and will embrace the entire state of Kansas, Western Missouri, Oklahoma, Southern Nebraska, and Southwestern Iowa. Mr. Ellwood succeeds W. F. Seigmund.

Recent Incorporations in the Automobile Field

California

Los Angeles—Auto Truck & Drayage Co.; $75,000. T. W. Sims and others.

Canada

Edmonton, Alta.—The Jitney Bus Co., Ltd.; $30,000. The incorporators have not as yet been named.

Berlin, Ont.—Canadian Regal Motor Co., Ltd.; $100,000; to manufacture automobiles and parts, motor trucks, cycles, tricycles, motors, etc.

Guelph, Ont.—Guelph Tire & Rubber Co.; $350,000. A. H. Davidson, T. N. Dunn and A. Orr.

Colorado

Colorado Springs—Colorado Springs Auto Equipment Co., to handle motor cars accessories; $25,000. S. T. Mccollum and S. E. Howe, Jr.

Illinois

Blue Island—Blue Island Garage; $2,500; automobile business and accessories, repairing, storing and garage. Christian Krueger, Louis H. Johnson, Charles A. Voss.

Chicago—Automobile Engineering Co.; $2,500; manufacturing of improvements in gas engines, motor cars, etc. Charles S. Frank, Ed. H. Foster, James Fawkner.

Chicago—Continental Motor Truck Co.; $2,500; buy and sell automobiles, auto trucks, etc. H. K. Gilbert, George N. Sargent and E. G. Dunbar.

Chicago—Fort Dearborn Sales Co.; $250. Carl W. Kellman, E. E. Kellman and E. V. Culver.

Chicago—Monarch Motor Parts Co.; $2,000. John W. Follmer, Anna Brinkman and Clarence A. Samuels.

Chicago—Motor Aid Co.; $60,000; manufacturing and dealing in auto parts and accessories. F. B. Smith, G. K. Strong, A. W. Strong.

Chicago—Olsese Motor Car Co.; $2,500; manufacturing and dealing in automobiles, parts and accessories. C. W. Olsese, W. D. Bellon, A. R. Bales.

Chicago—Tempco Manufacturing Co.; $25,000; manufacture and sale of automobiles, accessories, etc. Frank Templeman, Carl J. Sharp.

Peoria—The Grand Auto Co.; $10,000; to deal in automobiles and automobile repairing. J. Shirley West, William J. Cook, Lois J. Schultz and Clarence A. Ullman. The office of the company is at 314-16 Fayette Street.

Mt. Vernon—The Mount Vernon Machine & Motor Co.; $15,000. R. P. Settlemire, L. E. Mayfield and Robert C. Smith.

Rockford—Eureka Ball Bearing Co.; $10,000; to manufacture and sell at wholesale, ball bearings and to manufacture other automobile accessories. Frank Vander Bogar, A. J. Christianson and William M. Rohn.

Indiana

Crawfordsville—Crawfordsville Rubber Co.; $5,000; to deal in rubber goods. C. A. Westfall, H. B. Coats and W. M. White.

Connorsville—The Lexington Kansas City Co.; $5,000. Arthur Dixon, Emery Huston and F. L. Barrows.

Indianapolis—The Franklin Auto Shoe Co.; $10,000; to manufacture emergency shoes for automobiles. William Featheringill, S. W. Featheringill and T. M. Hurdy.

Indianapolis—Martindale-Millikan Co.; $85,000; manufacturing automobiles. F. M. Millikan, F. N. Martindale and J. N. Staley.

Indianapolis—The Madison Motor Co.; $500,000; dealer. Cecil E. Gibson, William E. Moore and O. R. Ewing.

Indianapolis—Swan Motor Car Co.; $50,000; to manufacture and sell autos. Harry J. Herff, I. Porter Smith and H. Ralph Smith.

Iowa

Grinnell—A new auto company has been formed here; $10,000. E. H. Spaulding is president and C. C. Doran, general manager.

Sioux City—The Adams-Alexander Auto Co.; $35,000. No incorporators named.

Waterloo—The Moore Mfg. Co.; $10,000; to build tanks, culverts and portable garages. E. L. Moore and others.

Kentucky

Louisville—Calhoun Automobile Co.; $1,000. W. G. Houghland, Mrs. McGhee Houghland and Homer Puryear.

Louisville—Central Garage; $1,000. Carl J. Epping, Loretto Stagenberg and E. J. Cooney.

Louisville—The Robinson Mfg. Co.; $10,000; to manufacture automobile accessories. John C. Robinson and Robert F. Vaughan.

Paducah—Foreman Automobile Company; $50,000. S. E. Foreman, E. C. Phelps and T. A. Miller.

Maryland

Baltimore—The Annapolis Garage; $5,000. Ossin K. Mitchell and Clarence A. Beardmore.

Baltimore—Tire Sales Company; $5,000. Arthur P. Mosby, Carolyn B. Donnley and W. F. Kempel Jones.

Michigan

Detroit—Loveland Co.; $75,000; dealers. H. B. Loveland, Ralph N. Marlatt.

Detroit—Parkview Auto Garage & Repair Co.; $3,000. Edmund H. Jenks, Elverton F. Jenks and William A. Smith.

Detroit—Waco Schaffer Co.; $200,000; to manufacture an automobile engine invented by William Schaffer. Prominent Waco bankers are included among the stockholders.

Detroit—Wetzell-Hall Co.; $25,000; manufacturers' agents. Thomas W. Wetzell, Chas. M. Hall and Don M. Coffman.

Flint—Hamilton Radiator Co.; $10,000; to make radiators and other automobile parts.

Niles—State Motor Sales Co.; $300,000; to deal in automobiles and accessories; paid in $3,000. George Corell, J. M. Vann and Charles E. White.

Minnesota

St. Paul—Jitney Auto Transit Co.; $5,000. President, J. G. Wardell; vice-president, W. T. Kenny; secretary, D. D. Murphy; treasurer, J. D. Keough.

Missouri

Jefferson City—P. W. Hanicke Manufacturing Co.; $10,000. P. W. and Bertha Hanicke and August Cleale.

Jefferson City—Missouri and Texas Oil Co.; $100,000. William R. Affeldt, Emery Thompson and James A. Keinger.

Kansas City—The Byerley-Hoole Tire & Repair Co.; $15,000. C. T. Byerley, John C. Hoole and H. A. Bautiller.

Kansas City—The Four Wheel Drive Motor Co.; $500,00; to manufacture motor cars. Theodore Ditmars, H. A. Dougherty and S. B. Gatewood.

Kansas City—General Auto Service Co.; $6,000. W. F. Schrieber, E. S. Grinham and John W. Scott.

Kansas City—Kansas City Auto Parts Co.; $200,000. Gustave V. Nelson, Otto H. Nelson and Carl E. Kimpton.

Kansas City—Sweeny Tractor Co.; $15,000. George E. Ricker, F. J. Sweeny and George E. Ricker, Jr.

St. Joseph—The Herff-Brook Motor & Sales Co.; $15,000. C. E. Schwindler, John L. Keller and Howard A. Hall.

St. Louis—Ballman-Whitten Manufacturing Co.; $10,000; to manufacture and deal in piston rings and other automobile and engine appliances. Edwin C. Ballman, Stahl A. Whitten and Emil Doerr.

St. Louis—The Bee Tee Tire Co.; $12,000; to manufacture tires and repair automobiles. James D. Brennan, John P. Trader.

St. Louis—Hil-Ko Rim Lock Co., 2037 Railway Exchange Bldg.; $25,000; to manufacture rim lock for auto wheel, demountable rim type. Frank D. Hiller, Jr., Pres.; Maurice R. Kohn, Vice-Pres. and Treas.; Chas. L. Pyne, Secy.

St. Louis—The National Tire Co.; $18,000; to manufacture automobile tires, accessories, etc. William Geisl, George W. Mills and Adolph Schlesinger.

St. Louis—The Sterlin Transport & Auto Co.; $12,000. Jacob Hagelstein, Richard Mederacke and Gustave Koerner.

New Jersey

Haddon Heights—Mutual Tire & Rubber Co.; $125,000; to manufacture tires and other rubber goods. F. R. Platt.

Newark—Hassler Sales Co.; $5,000; to conduct a general auto business. Geo. A. Warren, Joseph H. Stienhardt, J. Milton Stienhardt, all of Newark.

Trenton—The Jitney Transportation Co.; $25,000. No incorporators have been named.

New York City

New York City—Auto Parts Co.; $5,000; to manufacture automobile parts. W. P. Kelly, M. M. Hirson, A. A. Bertini, both of 44 Cedar street.

New York City—Brown Tube Distributing Co.; $25,000; to market the Brown Perfection Tube, etc. F. L. Smith, L. F. Smith, C. S. Averill, Hotel Bancroft, Worcester, Mass.

New York City—Criterion Taxi Co.; $1,000; automobile livery, etc. E. C. Kiesow, A. Kiesow, I. Kiesow, 615 E. 179th street.

New York City—Cornfield Resilient Wheel Co.; $400,000; to manufacture spring wheels for trucks, automobiles and other vehicles. Stanislao Verusio, W. H. Byrne, Noah Cornfield, Hotel Anthorp.

New York City—East 73d Street Garage; $1,000. M. M. Hayward, F. B. Knowlton, E. M. Beyhn, 154 Nassau street.

New York City—Eggers-Knight Automobile Co.; $2,500; dealer. A. J. L. Knight, B. C. Eggers, B. C. Eggers, Jr., 1222 Spruce street, Richmond Hill.

New York City—Fay Motor Fabric Supply Co.; $20,000; to manufacture fabrics used on automobiles. E. M. Kimbark, G. M. Hessler, A. D. Moritz, all of 27 William street.

New York City—Federal Operating Corp.; $6,000; truck business. M. R. Herron, R. A. Hays, H. R. Ackland, all of 140 W. 52d street.

New York City—Fifth Avenue Auto School; $12,000. A. H. J. Heingaertner, Anna Heingaertner, C. H. Furlong, 190 Devoe street, Brooklyn.

New York City—A. W. Harris Co.; $25,000; lubricating oils and greases. D. F. Hiscock, Warren Bigelow, H. M. Simon, all of 44 Pine street.

New York City—Heindl & Rothvoss; $3,000; dealer. M. J. Heindl, Arnold Rothvoss, E. J. Atlin, 598 W. 191st street.

New York City—Hoffman Motor Car Co.; $10,000; dealer. A. L. Friedberg, H. H. Miller, M. J. Neumann, 140 Nassau street.

New York City—Lee Garage; $5,000. E. P. Roome, W. H. Roome, J. C. Rogers, 340 Madison avenue.

New York City—Motor Utilities Co.; $25,000; to manufacture devices for automobiles. L. E. Johnson, R. C. Lipman, R. E. McLear, 115 Broadway.

New York City—Multiple Worm Axle Corp.; $100,000; to manufacture driving gear for automobiles. A. W. Chase, J. R. Howland, A. L. Kull, 1790 Broadway.

New York City—Carl H. Page Motors Co.; $100,000. Carl H. Page, 1806 Broadway; H. B. Leary and A. J. Bryant, both of 55 Broadway.

New York City—Pneumatic Spring Equipment Co.; $30,000; to manufacture pneumatic springs. J. L. Wehrmann, C. J. Bensley, H. Seibel, 323 13th street, W. New York, N. J.

New York City—Republic Auto Painting Co.; $2,000. Morris Alper, L. Cohn, Sam Reisman, 765 Garden street, Bronx.

New York City—Second Avenue Taxi & Touring Car Co.; $3,000; renting. G. Perlmutter, P. Hartenstein, K. Hartenstein, 85 Second avenue.

New York City—Sheepshead Bay Velodrome Corp.; $5,000. T. J. Gillis, Richard Butler and Daniel Lang, all of Hupfel Bldg., 161st street and 3d avenue, Bronx.

New York City—R. B. Stanley Mfg. Co.; $10,000; to manufacture motors. R. B. Stanley, A. D. Stanley, G. B. Palmer, all of 11 E. 48th street.

New York City—Yours Truly Garage; $3,000. A. H. Tramer, Israel Efrus, Jacob Efrus, 8 E. 108th street.

New York

Addison—Addison Auto Bus Co.; $5,000; bus line from Corning to Hornell. C. A. Brewster, E. C. Smith, W. R. Park, all of Addison.

Binghamton—Taber Carburetor Co.; $100,000; to manufacture carburetors. G. H. Taber, W. L. Ford, A. W. Ford, all of Binghamton.

Brooklyn—The Famous Tire & Rubber Co.; $15,000. Emanuel Newman, William Jackson and R. A. Ihne, of Brooklyn.

Brooklyn—The Manroot Motor Co.; $100,000. A. W. Behrens, Henry Monroe, of Brooklyn, and Jacob Schefer, of Newark.

Brooklyn—Standard Motor Service; $10,000. A. P. Leibinger, O. P. Amend, H. M. Landgraff, 156 97th street.

Brooklyn—Watkins Street Garage; $5,000. Wm. Domroe, Abe. Bernstein, Solomon Morris, 464 Hamburg avenue.

Brooklyn—Wittenberg & Helmus; $2,000; dealer. B. Wittenberg, W. Wittenberg, Edw. Helmus, 103 Linwood street.

Buffalo—Detroit Electric Car Co.; $10,000; dealer. C. E. Sager, Helen Sager, G. B. Pratt, 331 Canterbury Road, Rochester.

Buffalo—S. & S. Delivery Co.; $2,000; renting, delivery, etc. Edw. Sperry, Ida Sperry, Chas. Schoenbut, 352 William street.

Kingston—Ulster Garage; $5,000. J. M. Barnhart, C. E. Snyder, M. H. Snyder, 77 Clinton avenue.

New Rochelle—Fortuna Operating Corp.; $6,000; to promote automobile racing. W. S. Viele, G. H. C. Lischke, E. P. Roehm, 2504 Bathgate avenue, Bronx.

New Rochelle—New Rochelle Autobus Corp.; $5,000. W. B. Gray, J. W. Gray, T. Gilleran, the latter of 48 E. Kingsbridge Road, Bronx.

Rochester—Beardsley-Gorsline; $10,000; to manufacture motors. N. A. Beardsley, D. E. Gorsline, T. C. Nixon.

Saratoga Springs—Saratoga Motor Carnival Assn.; $2,500; to promote automobile races. C. C. Van Deusen, E. D. Starbuck, W. W. Kelly.

Syracuse—Central City Taxi & Trucking Co.; $3,000. Wm. H. Draper, Fred. Martz, Michael Lemp, 205 Burnet avenue.

Syracuse—Mac Mfg. Co.; $50,000; automobile parts. F. F. MacLean, E. E. Tilton, Ben Wiles, 308 Maple street.

Syracuse—Syracuse Motor Transit Co.; $10,000; baggage, freight, transfer, transportation garage. Philip Manheim, George A. Smith, William H. Bissel, 498 South Salina street.

Nebraska

Lincoln—Glass-Evans Auto Co.; $25,000. V. R. Evans, J. R. Glass and others.

Omaha—The Consumers' Automobile Supply Co.; $5,000. Donald D. Troup, R. E. Smith and Wallace Troup.

Omaha—Moses S. Miller, Milton S. Livingston, George W. Coe and John W. Parkhurst have filed articles of incorporation for the Master Sales Co., to deal in automobiles in Omaha. $25,000.

Ohio

Akron—The Akron Livery Auto Co.; $40,000. C. F. Schnee.

Warren—The Park Garage Co.; $5,000; auto garage and livery. I. H. Price, John A. Hitchcock, E. Culver, P. W. Boyle and William J. Hyde.

Akron—H. A. Price Rubber Co.; $15,000; to make rubber articles. H. A. Price, E. F. McGalliard, John Rowley, Mary V. Price and Margaret McGalliard.

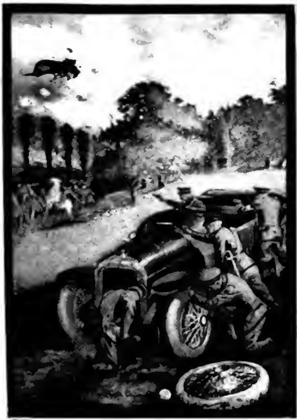
Akron—The Punctureless Auto Tire Co.; $100,000. D. W. Alexander, Charles Rempes, Samuel A. Messner, William Wotring and W. L. Keller.

Akron—The Summit Welding Garage & Machine Co.; $10,000; to operate a garage and a machine shop. H. G. Hann, J. G. Chatfant, Clarence Becker, Charles Firkles and V. M. Greer.

Open Until July 4th 1915

The Great Wheel Contest for a set of HOUK

DETACHABLE WIRE WHEELS



Have You Written Your Story About This Famous Picture

Your stories should contain about 100 words, may be written by anyone, are to be imagination not literature, and to be forwarded to the Houk Company before July 4th. The prize, one full set of five Houk wheels with hubs, will be awarded for the story which, in the opinion of the judges, best describes the incident the picture illustrates.

Here's a Sample Just Received

"The Lieutenant presents his respects and desires to report the orders delayed twenty-five seconds owing to a slight activity of the enemy near the river and to the consequent necessity for changing Houks."

MADE IN USA

Wood as a material for automobile construction has become obsolete and is retained in the wheels of some cars only because the car manufacturer has not been compelled by a discriminating public to demand a more expensive and safer type of wheel.

Write for an interesting booklet which contains the information you should have.

$325 Less Than Last Year

The newest Overland gives you all there was in the famous $1075 Model 80—and even more power. In detail, finish, mechanical fineness, comforts and conveniences it leaves nothing to be desired.

Specifications:

- 35 Horsepower Motor
- High-tension magneto ignition
- 5-Bearing crankshaft
- Thermo-syphon cooling
- Underslung rear springs.
- 33" x 4" tires; Non-skid in rear
- Demountable rims; with one extra.
- Electric starting and lighting system
- Headlight dimmers
- Rain-vision, ventilating type, built-in windshield
- Instrument board on cowl dash
- Left-hand drive, center control
- One-man top and top cover
- Magnetic speedometer

Deliveries Now

Write for 1916 Catalog. Please address Dept. 35

The Willys-Overland Company, Tole[illegible], Ohio

New Models Now on Display at the Panama Pacific Exposition

"Made in U. S. A."

Automotive Industries

HOUGH BRAN

Ho

MAGAZINE LOAN COLLECTION

The AUTOMOBILE

MAGAZINE LOAN COLLECTION

Vol. XXXII
No. 24

NEW YORK, JUNE 17, 1915

Ten cents a copy
Three dollars a year

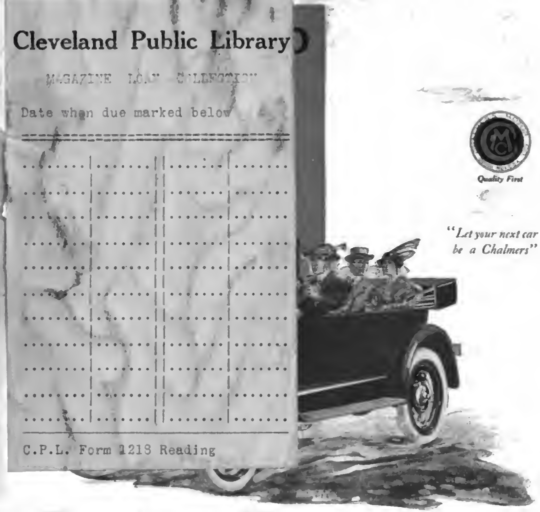
Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

Chalmers



Quality First

"Let your next car be a Chalmers"

"The New Thoroughbred"

We are changing dealers in one or two territories. Maybe in your locality. Write us.

Notice!!!

to 1915

Ford Owners

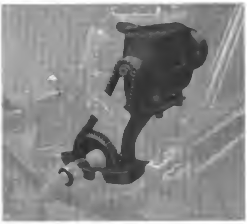
$15,000,000

will be distributed among you
on August 1st, 1915

How are you going to spend YOUR SHARE?

Why not the Comfort of a DISCO Ford Starting and Lighting System?

Disco simplest installation



Disco most reliable installation

$75 Complete
F. o. b. Detroit

Write today for this
FREE BOOKLET

Made in Detroit by

Disco Electric Starter Co.

Detroit, Michigan, U. S. A.

Vol. XXXII New York—Thursday, June 17, 1915—Chicago No. 24

The AUTOMOBILE

Engineers Off on Lake Trip

500 in S.A.E. Party Leaving Detroit for Summer Session—Committee Reports and Papers

Members of the S. A. E. party boarding the Steamship Noronic for their summer session trip to Georgian Bay

DETROIT, MICH., June 14—All morning the members of the Society of Automobile Engineers, their families and friends, have been entering the home town of the automobile industry and, with the lifting of the gangplank of the steamship *Noronic* at 3 o'clock, the party of 500 was put under way for their 4-day cruise on Lake Huron and Georgian Bay, where will be held the annual summer session of the Society.

Hotel Statler, convention headquarters, presented a busy scene all morning. At shortly after 8 o'clock the members of the party of the Metropolitan section, numbering fifty-seven, arrived on a special section of the Wolverine from New York. They were accompanied by many from the Philadelphia and New England territories and were met at the depot by the Detroit committee. Shortly after the Indiana delegation, numbering fifty, put in its appearance followed by numerous arrivals from scattered points. Detroit itself is well represented on the trip.

Among those taking the trip are President and Mrs. W. H. Van Dervoort, Mr. and Mrs. J. W. Zimmerschied, Mr. and Mrs. G. W. Dunham, Mr. and Mrs. Russell Huff, Mr. and Mrs. John J. Utz, Mr. and Mrs. E. E. Sweet, Mr. and Mrs. H. W. Alden, Mr. and Mrs. G. P. Dorris, Mr. and Mrs. J. S. Critchley (England), Mr. and Mrs. Alfred Reeves, Mr. and Mrs. C. B. McKinley, Mr. and Mrs. C. H. Foster. Among the former presidents who are on the trip are Howard Marmon, Howard Coffin, Henry Souther and H. W. Alden.

Important progress is looked forward to at this meeting and men of importance to the automobile industry are on board the *Noronic* to discuss the broad fields covered by the papers and the reports of the standards committee. The reports of eleven divisions of the latter are expected and the

A group of the Metropolitan section attired in their white coats which lent a picturesque touch to the embarcation

representation of members of the committee is sufficiently large to make it certain that a big advance will be made. The steps taken by the standards committee at the Spring meeting in this city will also be acted upon by the society as a whole.

500 in Party

Arrangements for handling the business of the trip have been so far shown to be complete. The Detroit committee provided automobiles for transporting the engineers from the incoming trains to the hotel headquarters. Those who had not made steamer reservations found a representative of the steamship company and all facilities for securing quarters on the boat. Registrations were made on the boat and at the time of sailing over 450 had signed with many still to come.

Even before the gangplank was lifted the engineers on board were preparing for the business meeting which is to start at 3 p.m. today. President W. H. Van Dervoort's party was among the early arrivals and the presidential address was about to be given as the *Noronic* gathered headway up the Detroit river.

The business for this afternoon calls for the reading of the presidential address, treasurer's report, report of the membership committee and the election of the nominating committee officers, together with any other business matters to be discussed before the professional session. The papers scheduled for this afternoon are three in number, covering automobile clutches, by W. F. Herst; a formula for comparing the performances of automobiles, by C. T. Myers, and a scientific method for testing electric vehicles, by T. H. Schoepf. This in connection with the business session gives a busy afternoon for the first day. The complete program as published in THE AUTOMOBILE for June 3, page 1,000, has not been altered, with the exception of an additional paper by A. P. Brush on scientific chassis design.

Specifications of Steels

Of premier importance is the report of the iron and steel division to be made by chairman K. W. Zimmerscheid, metallurgist of the General Motors Co. This contains the physical specifications of the S. A. E. carbon steels giving tensile strength, elastic limit reductions of area, elongation and hardness of S. A. E. steels No. 1020, 1025, 1035 and 1045 which are carbon steels of .20, .25, .35 and .45 average carbon content. In addition specifications are given for screw stock steel castings and some of the alloy steels with notes on their heat treatment and use. Along with the complete report on the physical characteristics of the steel, complete notes are given on the heat treatment. According to the S. A. E. Specifications, eight standard carbon steels are recognized, two of these being special, for screw stock and steel castings. In addition the report covers five nickel steels, fifteen chrome-nickel steels, seven chromium steels, two silico-manganese and two iron casting materials, one for the gray iron and another for malleable.

Tests of Automobile Steels

Results of physical tests given in the report are from standard S. A. E. test pieces and have been obtained on specimens prepared from sections common in automobile use. Taken altogether, the report furnishes highly desirable information on the use of steels for ordinary automobile purposes together with the proper heat treatments for these steels.

Electric Equipment Progress

Three topics for discussion are being submitted by chairman A. L. Riker, engineer of the Locomobile Co. of America, for the electrical equipment division. These cover the standard dimensions on bulb basis, sockets and plug ends for the single-wire system, standard tests for headlight limitation, and a progress report on the standard mounting of starting motors.

The proposed standard for lamp fittings will give full dimensions and tolerances and the headlight illumination subcommittee is proceeding in the direction of recommending standard tests for headlight illumination which will be suitable for use by police officials. No attempt is being made to develop or approve any particular device but the considerations are the distance at which the headlight should provide illumination, maximum height of beams from the ground and the control of the light from the seat.

Two Electric Motor Types

The electric vehicle division, through chairman Arthur J. Slade, is recommending two classes of motors for use on electric vehicles, one designed for 80 to 85-volt operation and the other of from 60 to 66 volts; a standard name plate has been arranged and definite numbers of cells as standard battery equipment. Progress reports are also being made by this division on a new speed and mileage rating and a schedule covering the size of car wiring and battery assembly.

Standards for Springs

In the nature of a review, is the report of the springs division through chairman C. W. McKinley, engineer of the Overland company. The results of the previous 1914 meetings are brought before the Society in considering standardization of master leaf lengths, nomenclature of cantilever springs, frame brackets nuts for spring clips, center bolt nuts, etc. It has been suggested that the master leaf length increase in even inches from 26 as a minimum up to 66 as a maximum, but the committee is not in favor of this. Cantilever nomenclature is the same as of previous reports but the division recommends that the tolerance on bush eyes of leaf springs, as adopted at the January, 1913, meeting of the Society, be changed.

Fan Belt Standards

Eleven subjects are touched upon by the miscellaneous division in the report made by Chairman, J. G. Utz, consulting engineer of the Perfection Spring Co. Two of these are matters for standardization and the remainder are progress reports. The two matters for standardization are fan belt and pulley width and a table of cotter pin sizes. Progress reports are made on the thickness of fan belt, width of piston rings and grooves, speedometer drive, radiator hose and clamp, screws for cowl board mountings, thickness of brake and clutch facing material, location of engine, chassis and car numbers, limits of tolerance on S. A. E. bolt thread and redrafting of standards for mechanically driven tire pumps. The division also reports that it has not been able to make progress upon standardizing license tags or upon standards for oil and gasoline.

Left—George W. Dunham, consulting engineer. Right—R. McA. Lloyd, consulting engineer, chairman meetings committee

A group on the pier—Henry Hess, president Hess Steel Co., Schwarz Spring Co. and Hess-Ives Corp., and Henry Souther, vice-president and general manager Ferro Machine & Foundry Co., a past president of the Society, and Walter C. Allen, sales manager Bijur Motor Lighting Co.

On the fan belt and pulley widths, four sizes are recommended as standard. Namely, 3-4, 1, 1 1-4 and 1 1-2 inches. A list of tolerances for each of these sizes is also given. On the cotter pin sizes, forty-one recommended sizes are given to take the place of 250 to 300 now in use.

Most important among the progress reports of this division, is a list of piston ring and groove widths for different sizes of pistons for 2 to 7 inches in diameter. There is also a suggested speedometer drive to screw into the side of the gearset.

New Carbureter Sizes

The carbureter fitting division under chairman Jerome J. Aull, mechanical engineer of the Lunkenheimer Co., in reporting on a number of suggestions brought up since the adoption of a standard side-outlet carbureter at the last summer meeting, is against the standardization of the dimension from carbureter centerline to face of flange as restricting carbureter design. It favors the two-bolt vertical flange for all sizes, up to and including 2 inches and the four-bolt flange for sizes above 2 inches. It recommends the standardization of the carbureter air heater which should be integral with the exhaust manifold casting. Besides this the division is in favor of standard 1-2-inch and 5-8-inch sizes.

Size and Inflation of Tires

T. W. Litchfield, factory manager of the Goodyear company, in his paper on Size and Inflation of Pneumatic Tires, declares that fully 33 per cent. of all automobiles are overloaded to such an extent that serious tire trouble and expense are inevitable, and that at the present time only a small percentage of American cars are properly tired from the economical standpoint of the car purchaser. Owing to too small tires which must be inflated to a high pressure, there is a relatively poor cushioning condition, and the source of motor troubles and general breaking down of car are traceable to this condition. Car owners are losing many millions of dollars per year because tires are too small to carry the loads placed on them. Practically 30 per cent. more tires are worn out each year than should be worn out if they were of the correct size and carrying the proper load.

In actual practice the size and inflation of tires should be settled by each individual car. Mr. Litchfield recommends carefully weighing cars in order to determine the proper tire size. To get the actual load on each tire the front of the car

Scene when the Noronic was just about to cast off with the S. A. E. party going on board

fully loaded must be weighed, then the rear similarly weighed and each weight should be divided by two, thus getting the load on each tire.

Both the car manufacturers and tire manufacturers are to blame for existing tire conditions. Mr. Litchfield does not favor too small a tire with too high an inflation but rather a larger tire with the proper inflation for the load. Distortion is one of the great causes of tire difficulties and there are two general aspects of this, first the flexing of the tire carcass and second the surface motion of the tread. It can be accepted as a law that the wear of a tire in cents per mile varies at least as the square of the load. In other words, if you increase the load on a tire 10 per cent., keeping inflation and other things the same, the average life of a tire will be at least 17 per cent. less for ordinary sizes. The wear on a tire is often found to vary more than as the square of the load but never less.

Mr. Litchfield lays down three laws governing tires:

1—Under given conditions of operation the total running expense for a given load is independent of the size of tire used providing the inflation pressure is so regulated as to keep the percentage of deflection a constant.
2—If the best conditions for carrying a given load are obtained at a certain percentage of deflection the best conditions for any load on the same tires will be obtained at the same deflection.
3—There is a certain fixed percentage of deflection corresponding to general best results which may be applied to all tires alike.

Military Truck Design

Four requirements for a satisfactory design of military truck, according to Jerry W. De Cou, factory manager for the Jeffery Co., are: 1, good clearance; 2, strong hook in front and rear for towing; 3, sprags and four quickly applied non-skid chains. These are the four essentials as determined by experience at the front and do not take into consideration the questions of chassis design. Mr. De Cou describes the Jeffery four-wheel design of truck, picking out many features that make it best suited for military uses, such as: There are front and rear steering connections which are alike; the four main springs are alike; driving and steering are through four wheels; every important adjustment can be made without disassembling; having the truck reversihle, with the same speed as forward, specially adapts it for use in the firing zone; and the automatic locking differentials which put the power into any wheel or wheels insures traction where such is not possible without these differentials. There are two of these differentials, one in the front power axle, and one in the rear. The axle is such that none of the road wheels of the truck can lag in speed behind the motor. The two outermost wheels can overrun the inner ones in turning a corner, but as soon as any wheel tends to lag behind the motor the differential locks automatically and the axle driving shaft is virtually solid from wheel to wheel.

Aluminum Alloy Pistons

Eugene Gruenewald, engineer of the Moline Co., in his paper on aluminum alloy pistons, reviews the situation as it stands at present, and points out that the addition of a small percentage of magnesium to the aluminum has resulted in the production of sounder piston castings, with better physical qualities. The tensile strength of the light-metal alloy is about the same as the average cast iron piston; that the head should be 1-32 to 1-16-inch heavier or else reinforced by ribs. The question of clearance is pointed out as particularly important due to the different co-efficient of expansion from cast iron, and according to the author, between .003 and .004 more clearance than in cast iron practice must be allowed. Among the advantages of aluminum are the freedom from carbon, less vibration, good wearing qualities and freedom from loose bearings. The disadvantages are great clearance necessary and the consequent light piston slap for the first few explosions. Commercially, aluminum alloy pistons are now produced at a cost slightly in excess of cast iron.

Factors in Spring Design

C. H. Gleason, designing engineer of the Kalamazoo Spring and Axle Co., in a paper on spring design mentions four points as basicly affecting spring design. These are, weight of car, load to be carried, speed at which the car is to run and wheelbase. The worst possible conditions under which the car will be operated must be considered and the spring suspension designed accordingly.

Speaking of the reaction of a spring, Mr. Gleason believes this will be determined largely by the length and the shape. The camber is of great effect in that an excessive camber gives a sharp reaction whereas a flat spring is lazy in its action. Friction between the plates and the proportions of the spring has its effect on the action.

Mr. Gleason holds that a semi-elliptic spring is at its greatest efficiency when the centerbolt is on center. Care must be given not to affect the bolts too much on front springs, for although road shocks are better endured the efficiency of the spring action is impaired. In three-quarter elliptics the front portion should have a deflection equal to that of the combined two rear parts. Some other aphorisms in the paper are:

A spring is at its best when it is horizontal and its master leaf is straight.

Nothing is gained by using a narrow spring.

When a spring is used as a driving member it is desirable to compromise a little in the deflection.

The spring should not be decided after the axle and frame have been determined, but should be selected first.

Spiral Type Bevel Gears

A. L. Stewart, of the Gleason company, large gear manufacturers, in speaking of the spiral-type bevel gears says they are more efficient than worm drive and equally as quiet. In a recent test of two electric cars, one with a worm-drive axle and the other with a spiral-type bevel, the worm-drive ran 72 miles on a charge, and the spiral-bevel type 95 miles. Both cars were alike. The essential feature of the spiral-type bevel is that the tooth is curved, whereas in the conventional bevel-gear it is straight. There are many advantages of the spiral-type bevel. One is that you can use a higher gear ratio than with a straight bevel. In straight-tooth bevels 4 1-2 to 1 ratios have been the dividing line between quiet and noisy rear axles, whereas with the spiral-type bevel, ratios of 5 or 6 to 1 give satisfactory service. The spiral-bevel is quiet, which is due to the overlapping of the teeth. A

great advantage of the spiral-type bevel is the endwise adjustment of the pinion, which is possible without reducing materially the amount of bearings or introducing noise. The spiral-bevel type is a stronger gear than the straight-bevel, notwithstanding the fact that the total load on the tooth of the spiral-bevel is 15 per cent. greater than on the straight tooth. To offset this extra load the spiral-type gear has more teeth in contact at all times than the straight tooth gear, and so the load is distributed with the net result that there is less load on each tooth of the spiral-bevel than there is on the conventional straight bevel.

Pressed Steel Wheels

According to Orrel A. Parker, manager of the Wheel Department of the Hydraulic Pressed Steel Co., in his paper on Pressed Steel Wheels for Passenger Cars, it is possible to make a pressed steel wheel weighing only 53 per cent. of the usual wood wheel and yet have the steel wheels slightly stronger. His paper is based on a series of sixty tests extending over 4 months and made by the Case School of Applied Science, Cleveland. In these tests the pressed steel wheel manufactured by Mr. Parker was tested against wood wheels of other makes. The following are some of the results: Tests of 36 by 4 1-2 inch steel and wood wheels showed a higher deflection of the wood wheels than the steel. The steel wheels are lighter than wood in that they are made without felloes, the rim of which carries the tire attaching direct to the wheel spoke.

Different Tractor Types

Frank H. Trego, Chief Engineer of the Knox company, in his paper on road tractors, divides this type of vehicle into three broad classes; first, the pure tractor vehicle designed primarily for pulling and used frequently for pulling ploughs, threshing machines and road building machinery. They are slow moving vehicles, and only for extremely heavy hauling. The second type, is a four-wheel, power-driven, vehicle of short wheelbase, constructed to support the front end of a two-wheel trailer. This may be called a semi-truck. The third is one in which the frame supporting the mechanism seats and steering devices is not extended to the rear for the support of the front of a two-wheel trailer, but has this trailer, supported on an independent axle with independent springs and fifth wheel.

It is with the third type of construction and its merit that Mr. Trego deals. The advantages for this are the possibilities of using light-weight springs, a firm support for the front end of the trailer, a shock absorbing device for starting and stopping loads, by the use of the cantilever springs for the support, and easy riding. Generally, Mr. Trego believes the truck tractor to have advantages over a truck because the bulk of the pay-load rolls on steel tires instead of rubber, the weight is spread over three axles, the radius of turning is shorter and it is possible to keep several varieties of bodies going at the same time. On going over figures, for draw-bar pull, Mr. Trego estimates that the limit to the pulling power of rubber for a given surface can be reached in actual practice and at the point which must be given consideration.

Clutches Save Tires

A bad clutch, carelessly operated, will reduce the life of the rear tires from 20 to 25 per cent. according to the paper by W. F. Herst, factory manager of the Brown-Lipe Gear Co., entitled Automobile Clutches. The clutch should not be of too great capacity, should release quickly and it is advisable to fit some type of clutch brake to facilitate gear changing.

Mr. Herst divides clutches broadly into two types, cone and disk. With the cone clutch the angle should be somewhere between 9 and 12.5 degrees, with the latter preferred, as it prevents trouble in releasing. The leather should be the best obtainable and should be frequently treated with neatsfoot oil to keep it soft. If asbestos fabric is used it should be soft and thoroughly carbonized.

In speaking of the disk type Mr. Herst believes the steel-to-steel type to be superior to the steel-against-phosphor-bronze ones as the former have been giving better satisfaction. Proper oiling is the greatest requirement with a clutch of this design to prevent it from overheating.

Earl Cooper, in Stutz, Makes 109.2 m.p.h. on Chicago Speedway

The three Stutz cars driven by Earl Cooper, Howard Wilcox and Gil Anderson on the new Chicago speedway. Besides covering a lap of 2 miles at an average of 109.2 m.p.h., Cooper averaged 106.19 m.p.h. for a 20-mile stretch. After this demonstration Cooper prophesied that the 500-mile race to be held on Saturday will be won in 5 hours.

$200,000,000 for Kansas Farmers—Car Sales Boom

Market Growing in Grain States of the Mississippi Valley—Registrations Gain Rapidly in Rural Districts—Kansas Gains 442 Per Cent. in 5 Years—Jitneys Are Flourishing

KANSAS CITY, MO., May 31—With the wheat harvest in Kansas almost ready to begin it looks as if the winter wheat states were going to repeat the performance of last year and roll up another tremendous ready money crop. The Turkish forts still hold at this writing and if they should fall, it is believed by grain men generally that the price of wheat would be very little affected by the opening of the Dardanelles to Russian grain. There might come a quick drop as was the case at the beginning of the attack but the grain men believe it would go back up again.

Cash wheat is worth today on the farms $1.30 to $1.40 and the farmers who are still supplying wheat to the mills of the western states are getting that for it. However, there is very little wheat left on the farms now. The mills have enough to run them until the new crop comes in. And if any farmer is worried about the price of wheat he can sell at from $1 to $1.10 a bushel on future delivery.

The first estimate of the new wheat crop which Kansas will begin to harvest the middle of June has just been made. There have been estimates on acreage before, but the estimate made May 24 from a close observation of the wheat in the fields shows Kansas will produce 136,000,000 bushels of wheat. This is 40 per cent. larger than any previous crop except last year when Kansas produced the greatest crop in its history and sold it at the greatest price, 180,000,000 bushels at from 90 cents to $1.48. The average wheat crop in Kansas is 70,000,000 bushels. With wheat at war prices, Kansas will get for the crop this year close to $200,000,000 in cash that will come in from Europe and the eastern states.

¶ This is the third of a series of monthly industrial reviews on conditions in the southwestern territory embracing such states as Kansas, Missouri, Nebraska and Oklahoma, which comprise an important section of the Mississippi Valley, one of the greatest grain-producing regions in the world.

¶ Higher grain prices and an unprecedented demand for horses and mules for the European armies render this region particularly important as an automobile and motor truck market at the present time.

¶ The author is one of the most widely recognized authorities in this territory, having watched the progress of these states for 25 years while in daily contact with their leading financial and industrial movements.

Just imagine $200,000,000 brought into a state to buy what the farmer likes. And there is Kansas with its $15,000,000 alfalfa crop coming fine and all its cattle and hogs. Of course, Kansas is the greatest of the winter wheat states. Nebraska will produce this year, however, close to 60,000,000 bushels of winter wheat and Missouri will produce 40,000,000 bushels. Oklahoma will produce the greatest crop of its history, estimated this year at 60,000,000 bushels. So, making a broad estimate, Kansas, Nebraska, Oklahoma and Missouri, the "big four" of the winter wheat states, should produce this summer close to 300,000,000 bushels of wheat—296,000,000 bushels to be exact. And at $1.50 prices, which may be expected if the war continues, it means that the Southwest will have cash money crops by July that will amount to $450,000,000, which ought to be good news to the motor manufacturers.

The rains the middle of May, which produced 4 inches of water in 3 days over all the grain states, insured the wheat crop. No more rains before the harvest will be necessary. The chinch bugs and the Hessian fly which have done considerable damage were killed by the deluge of water.

Reports from the spring wheat states are equally encouraging. The "big three," North Dakota, South Dakota and Minnesota, report good growth and while the crop, of course, will not mature until much later than the winter wheat, there is every reason to look for a big crop on account both of the acreage and the spring rains. Nebraska of late years has become almost entirely a winter wheat state, but this year it will have the usual amount of spring wheat. The outlook in the spring wheat states based on the acreage is:

	ESTIMATED ACREAGE	ESTIMATED BUSHELS
North Dakota ...	8,000,000	120,000,000
South Dakota ...	3,750,000	60,000,000
Minnesota	4,500,000	65,000,000
Nebraska	300,000	6,000,000
Total	16,550,000	251,000,000

This makes 251,000,000 bushels of wheat in the spring wheat states, worth at estimated war prices, $375,000,000. That gives, approximately, $825,000,000 in the spring and winter wheat states in cash for the 1915 crop and all cash to come from outside those states!

Corn in the corn belt of the western states is in good shape, the rains having given much moisture. Here is a brief table that gives an estimate of what may be expected from a normal corn crop in the big corn states of the West:

STATE	1914 SHORT CROP	NORMAL CROP
Iowa	389,000,000	400,000,000
Kansas	108,000,000	175,000,000
Missouri	158,000,000	200,000,000
Nebraska	175,000,000	200,000,000
Oklahoma	50,000,000	100,000,000
Total	880,000,000	1,075,000,000

A total of 1,000,000,000 bushels that will average in price anywhere from 50 to 75 cents, a total of from $500,000,000 to $750,000,000. Wars do not usually affect greatly the price of corn.

The other field crops in the Southwest and Central Western states are doing well. Oats and all other small grain have had plenty of moisture.

442 per Cent. Car Increase

The grain states of the Mississippi Valley may all be judged from the condition of Kansas, which raised nearly half of the winter wheat in the western states. It is of unusual interest to note the way in which automobile sales have increased in Kansas, which represents probably more than any other state, the farmer himself. Since 1910 the increase of motor cars in the state has been 442 per cent. The increase for the whole United States has been in the same period 240 per cent. Of the states that have 20,000 cars in use, Kansas's percentage of increase has been exceeded by only ohe state, Minnesota, great in spring wheat and dairy products.

This increase by years from 1910 shows:

March, 1910	9,301	gain
March, 1911	14,456	5,115
March, 1912	18,625	4,139
March, 1913	24,794	6,169
Jan. 1, 1914	34,945	10,151
Jan. 1, 1915	50,454	15,509

To these figures may be added an increase of 2,000 cars since that time. A list of cars in Kansas gathered from various counties on March 15 showed some interesting figures on the distribution of the various makes as follows:

Ford	19,411	Metz	311
Buick	5,430	Krit	281
Overland	3,987	I. H. C.	273
Studebaker	3,982	Brush	259
Reo	2,246	R. C. H.	207
Maxwell	2,180	Case	207
Cadillac	778	Paige	173
Chalmers	732	Cartercar	133
Mitchell	730	Saxon	131
Auburn	671	White	107
Hupmobile	663	Oldsmobile	106
Hudson	622	Everett	106
Oakland	613	Cole	105
Jackson	605	Lambert	103
Regal	517	Miscellaneous	4,568
Velie	388		
Rambler	385	Total	51,000

The figures given herewith represent the total of each different make except where the cars registered a total of less than 100 and they are included in miscellaneous. There are 353 different makes in the state and 320 have less than 100 in use.

The survey of the car users in Kansas serves as a lesson in what the farmer means to the motor car industry. Kansas has only one large city, Kansas City, and that city has less than 100,000 population. The other cities of the state are county seat towns mostly running from 1,000 to 5,000 population. There are two or three exceptions, Topeka, Leavenworth, Wichita, Atchison and Hutchinson, but with the exception of Topeka all represent the farmer and all live from the farmer's products. It is interesting to note that a survey of the industry in the state shows that where the towns are smallest the number of persons per car is likewise smallest.

Pawnee county in the central part of the state, where wheat rules, has 547 cars with an average of only fourteen persons per car. Almost as good a showing is made in Edwards and Lincoln counties with an average of fifteen persons per car each. Such thickly settled counties as Barton and Reno show averages of twenty-two persons per car each. And in Barton county are several small towns and in Reno the town of Hutchinson with a population of 16,000.

75,000 Cars for Kansas

The writer is able to give the figures of every county in the state with the number of cars and the number of persons per car, also showing the remarkable way in which the average of persons per car is going down. The moral, of course, is that where there are twenty-two persons per car in a county filled up with average sized farms, some small towns and a city the size of Hutchinson, every other county in the state, barring possibly the counties with towns of more than 50,000 can be made to have as low a percentage. This means that Kansas, with a population in 1914 of 1,672,106 could be showing the use of 75,000 cars without difficulty, and if the lowest percentage of any county in Kansas were reached over the entire state, the number of cars in used would be 111,474, more than twice as many as are in use at present.

And is there any reason why a rich Kansas county should not have as few persons per car as a county that is poorer in wealth, which is the case in a third of the 105 counties of the state?

Kansas City, third as a distributing center for motor cars, is sold out. Branch houses and agencies for territory extending over the Southwest have cleaned up 2 months before the 1916 product is expected. A committee of three managers of Kansas City motor houses went with the Kansas City Commercial Club a few days ago on a trade extension trip through Kansas and Oklahoma. They made diligent inquiry in every town they visited regarding the sale of 1915 cars and the outlook for the next year and when they had completed half of the trip they sent this telegram to E. E. Peake, secretary of the Kansas City Motor Car Dealers' Assn.:

> With the trade trip of the Commercial Club half over, the opinion is universally expressed that this will be a record year. Conditions all along the route back up the optimistic prophecy that automobile sales will be simply enormous and will tax the capacity of all the factories to supply the demand.
>
> J. F. MARTIN, Kansas City Buick Branch Manager.
> A. F. NORTON, J. I. Case T. M. Co.
> C. W. SCARRITT, Bond Motor Co.

Ford Delivers 1,000—Turns Down 2,000

And this expresses the opinion of all the representatives of the automobile manufacturers in Kansas City. If one wanted to buy a new car in Kansas City today he would have to go to half the dealers in town before he could find a car. Probably there are not to exceed a dozen new machines in town. The Ford company, which has an assembling plant in Kansas City, delivered 1,000 cars in Kansas and western Missouri last month, and had to turn down 2,000 orders for delivery within that time. The Ford plant, as a result of the heavy demand from the grain states territory, has announced the immediate beginning of work on an addition to the plant here in Sheffield, a suburb of Kansas City, that will more than double the output. The new plant will have a capacity of 2,000 cars a day.

Buick Working on 1916 Allotment

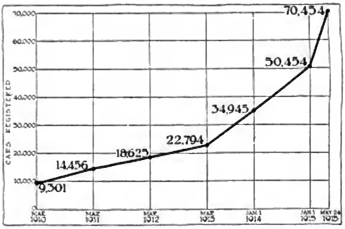
The Buick company sold the last of its 1915 cars May 5 and since that time has been taking orders for the 1916 cars. Right along this line is found comment by representatives of automobile manufacturers that the industry has become so thoroughly established that buyers, especially those that have driven a certain make of car, are placing orders before they even see the specifications of the model of the car they expect to purchase.

The Overland company, like the Buick, is sold out and the same is true of the Studebaker. The latter company has been bringing cars from other points to supply the remarkable demand in the Kansas City district.

The manufacturers of the eights, as well as the sixes and fours, all report the same heavy sales. The increase for the year to date shows approximately 70 per cent. over last year in the popular-priced models and somewhat less in the higher-priced cars.

The jitney continues to flourish in Kansas City which has been pronounced the jitney center of the United States. For

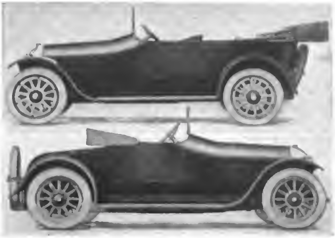
(*Continued on page* 1084)



The gain in number of cars registered in Kansas

Pathfinder Twelve and Six for 1916

Twelve-Cylinder Continental Valve-in-the-Head Motor 3 by 4 Inches Is Interchangeable with Six-Cylinder in New Chassis



Above—Fremont model Pathfinder six-cylinder touring car for 1916, with complete equipment selling for $1,695. Below—Roadster body mounted on the same chassis and selling at the same price

THE plans of the Pathfinder Co., Indianapolis, Ind., for 1916 contain some surprising developments, these including a twelve-cylinder car in three-, four-, five- and seven-passenger form at $1,975 as well as a new six-cylinder model at $1,695 as against $2,222 for the 1915 six, the twelve-cylinder and six-cylinder motors being interchangeable in the one chassis. The Pathfinder twelve will use a Continental valve-in-the-head motor, a startling addition to the Continental factories' product as this concern has been adhering to the L-head type for many years. This makes the third twelve-cylinder announcement in the history of the world's automobile industry, Packard and National having brought out twelves almost simultaneously about 3 weeks ago.

Chassis Is New

The chassis in which the new twelve and six motors will be mounted is entirely new and differs in many respects from the former one, the wheelbase being 122 inches, as compared with 124 on the previous model, the propeller shaft hollow and open instead of solid and inclosed and the propulsion being taken through flat cantilever rear springs of new design instead of through the propeller shaft tube. The torque is absorbed by a V-shaped member on the rear of the car which uses a three-speed gearset instead of a four-speed type, 35 by 4 1-2-inch tires instead of 34 by 4 1-2 and a new braking system is employed in which only the service set is equalized. Spiral bevel axle gears are used instead of straight bevel.

Twelve Is 3 by 4 Inches

Details of the twelve are meager indeed at this time but some of the important facts concerning it are known. It is a 3 by 4-inch motor with its cylinders set at 60 degrees, each set being a block casting mounted on an aluminum crankcase. The valves are set vertically in a removable head and operated by vertical rods and rocker arms, the tappet adjustment being at the top. The mechanism at the cylinder tops is inclosed in a cast-iron housing. No valve cages are used.

Between the cylinder blocks is the carbureter with special manifolding to each block and the other motor accessories such as generator, cranking motor, etc., are carried on the right side where they are easy to inspect.

In order not to make the motor appear complicated the various parts have been separated as much as possible, thus avoiding apparent disorder and hence ease of understanding by the owner. One point which has been worked out to this end is the exhaust manifold location. In most of the multi-cylinder designs these manifolds are carried in the V and extended backward to two mufflers by means of flexible piping. In the Pathfinder installation, the manifolds are on the outside of the blocks and extend rearward to flexible tubing. This construction is somewhat like the Sunbeam twelve, although the latter has inlet manifolds on the outside and uses two carbureters.

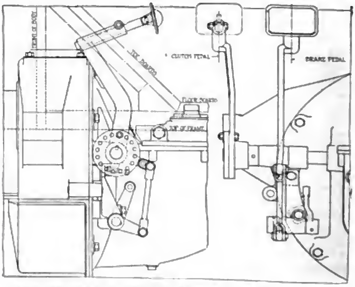
Crankshaft Like Six

Within the motor is a crankshaft which is just like that of a six-cylinder motor. The rods are said to be extremely light and the pistons of an aluminum alloy. Above the crankshaft and in the apex of the V is a single camshaft which operates the vertical valve rods.

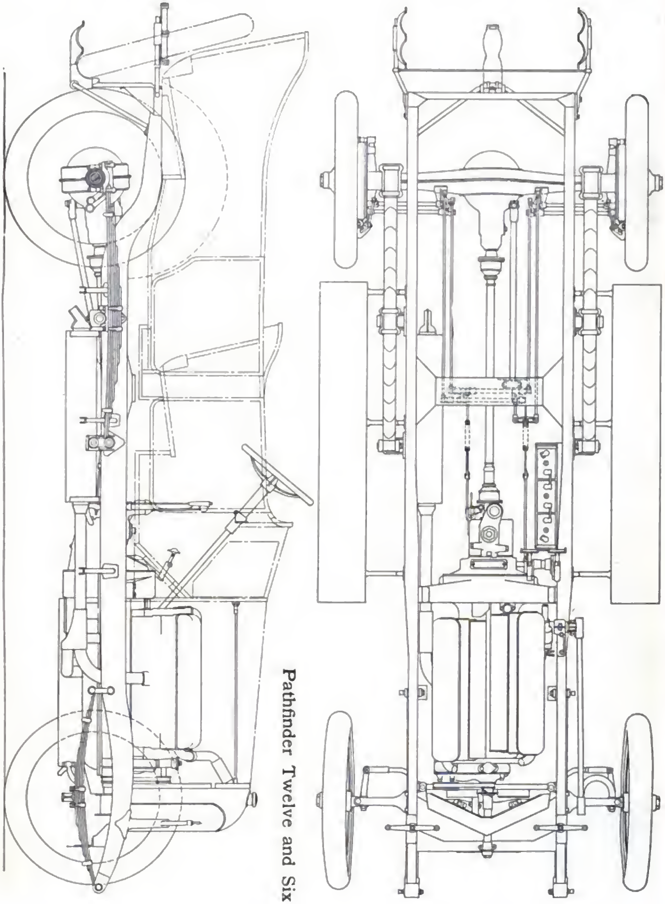
In the cooling there is a single centrifugal pump mounted on the right side of the motor and driven from an auxiliary shaft. This pump supplies each cylinder block. The oiling is said to be the same as that of other large Continental motors, there being direct leads for the main bearings and a trough system of feed for the splash, the pump, of course, taking its oil from a sump which catches the overflow from the troughs.

Special Westinghouse System

A special Westinghouse cranking and lighting system is installed and the details of this, which make it especially applicable to twelve-cylinder design, have not been made known. The starting motor, however, uses a Bendix drive and the



Pedal adjustment on the 1916 Pathfinder. Brake and clutch pedals as well as brake rocker shafts are fitted with bronze bushings



Pathfinder Twelve and Six

generator has a combination interrupter and distributer in unit, the current source being a Willard 6-120 battery mounted under the front seat.

The twelve-cylinder motor uses the same clutch and gearset in unit as that employed on the new six which makes the cars identical in every respect except cylinder number.

The Six-Cylinder Model

The new six, which as roadster, four-, five- or seven-passenger, lists at $1,695 as against $2,222 for the 1915 six, uses a Continental type 6N motor instead of the 6P. One familiar with these designs knows that the new one has 3 1-2 by 5 block cast cylinders, while the 6P has 3 3-4 by 5 1-4 cylinders cast in threes. It is stated that this engine develops 50 horsepower at 1,600 r.p.m. but this appears a little high and apparently is the rating for an unusually good motor of this type. Four-point suspension is used instead of three as last season.

The oiling and cooling systems are the same as in other large Continentals, the former being of the constant-level splash type in which a gear pump within the crankcase forces oil to the main bearings through leads and also supplies troughs under the connecting-rods. The overflow from the troughs drops to a sump from which it is picked up by the pump for re-circulation. There is nothing unconventional in the interior parts of the motor, the cast-iron pistons with three diagonally split rings, I-beam rods and three-bearing crankshaft and camshaft. The former has babbit bearings of new composition, their dimensions being as follows: front, 2 3-16 by 3 1-8; center, 2 1-4 by 2 1-2; rear 2 1-4 by 3 1-4. The valves are 1 17-32 in the clear and have nickel-steel heads welded to cambon-steel stems.

The carbureter is a 1 1-4-inch model T Schebler, a new design brought out recently and described in THE AUTOMOBILE for March 25. It is fed from a 16-gallon cowl tank. Ignition is by a battery system using a Westinghouse combination interrupter and distributer driven by worm gears from the generator shaft. The latter is an improved Westinghouse design. The cranking motor now uses a Bendix drive, the final reduction being about 10 to 1.

The new series Pathfinder chassis uses a Brown-Lipe disk clutch and three-speed gearset in unit with the motor and there is nothing of uncommon design in this installation. The clutch is a dry-disk type with fifteen plates 8 1-2 inches in diameter, the spider plates being fabric faced and the driving plates, high-carbon steel. The gearset affords the following ratios: First 13.55 to 1; second 6.83 to 1 and high 4.06 to 1.

The gearset drives a hollow Spicer propeller shaft fitted with two joints. The rear axle is a new design for Pathfinder, being a Salisbury floating type with spiral bevel gears. The differential uses Hyatt bearings, the driving pinion Gurney and the axle shafts Bower rollers.

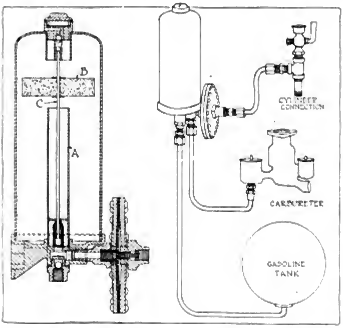
In order to make the change from torsion tube propulsion to that using the cantilever springs, the Pathfinder engineers have had to use a new frame strengthened considerably to take care of the twist at the points of spring attachment. The illustration of the chassis, page 1065, shows how this has been done. A channel cross-member 5 inches wide and with heavy gusset plates at the ends is used for bracing purposes. It also affords a means of housing the brake cross shaft, the channel portion pointing downward.

The cantilever springs are a new design and are almost

(*Continued on page* 1077)

A New Fuel System—The Carter Tank

NEW YORK CITY, June 12—A new gasoline feed device called the Carter Automatic Gravity Tank, operated by compression and suction of one engine cylinder, has been added to the automobile accessory line of the H. W. Johns-Manville Co. this city. This tank has only three moving parts with no complicated mechanism to get out of order. It consists of a container with a capacity of about 1 quart which is mounted on the engine as high as the hood will allow in the most convenient position but away from the exhaust manifold, and connected to the main gasoline tank and also to the carbureter, as illustrated. A diaphragm pump which is secured to the base of the container and also to the petcock of the nearest cylinder acts on each downward stroke of the piston in that cylinder, lifting fuel from the main gasoline tank to the Carter tank from which it flows to the carbureter intake by gravity. The Carter system may be readily attached to any car, either old or new.

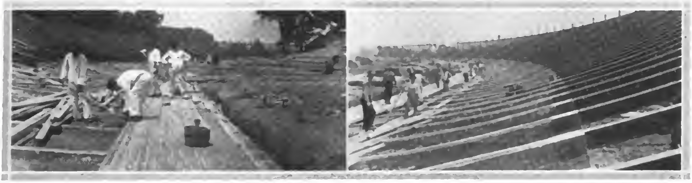


Left—Section through Carter automatic gravity tank. Right—Diagram of Carter fuel feed system

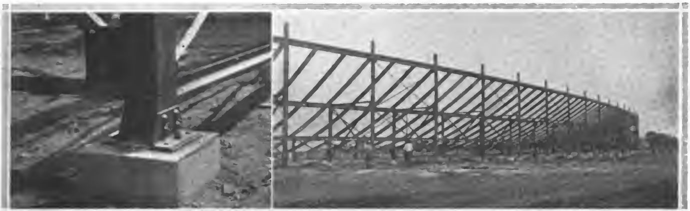
The action of the Carter system is progressive and its capacity unlimited, the fuel supply being increased directly in proportion as the engine speed is accelerated. The delivery of fuel is increased from 6 gallons per hour at 300 r.p.m. to 22 gallons per hour at 1,500 r.p.m. A sufficient difference in height between the fuel level and the carbureter inlet is maintained to insure a uniform gravity feed under all conditions, this method of mounting permitting the carbureter to be placed in its most advantageous position as close to the inlet valve as possible and also allowing it to be mounted so high as to be readily accessible and to receive the benefit of the warmth from the engine, giving the least possible area on which the mixture could condense.

Referring to the accompanying sectional illustration it will be seen that the tank is fitted with a standpipe A which insures the constant level of the fuel. A float B is mounted on the rod C having a spring check valve at the bottom and a steel breather ball at the top in the breather inlet and priming cup. The diaphragm pump is also illustrated in section. The Carter system sells for $10 complete with all necessary fittings for attachment.

Rush Construction at Sheepshead Bay



Left—The 12-foot 2 by 4 planks are laid on edge in the direction of car travel and are fitted closely by iron rods while being nailed. Right—General view of the speedway, looking from east to west



Left—Each supporting girder is on a concrete foundation. Right—The steel construction from the south end of the bank

NEW YORK CITY, June 14—Before the end of the present week nearly 3,000 men will be at work on the 2-mile Sheepshead Bay motor speedway, on which a 350-mile race is scheduled for October 2. Up to date the steel framework being used for the track on the curves at each end is up for one end, and the laying of the 2 by 4 timbers for the track proper has begun. On the straightaways the board surface is being laid on cement cross girders, and all of these are in place on one straightaway and will soon be completed for the other. The laying of the track surface on the back stretch is at present under way. Slower progress is being made on the steel framework at the other end of the track, the work on which has not yet started, due to a heavy fill having to be completed. The cement piers for the grandstand and bleachers are being poured and the steel work for the grandstand is on the ground.

The banking on the curves is most impressive, the steel girders being hollowed so that the curve from the inside of the track to the outside is a paraboloid rather than a straight line as in the Chicago track. The width of the track on these curves is 78 feet, the inner third being supported on cement girders which are continued into the steel girders. The steel construction is particularly rigid, every alternate tier being in the form of a steel tower braced transversely and diagonally. The track is 70 feet wide on the straightaways and an inside safety apron of solid turf approximately 30 feet wide runs all the way round. Inside this comes the cement safety retaining wall.

The grandstand will be a covered two-story steel construction seating 28,000. On the opposite side of the track is an uncovered bleacher stand for 30,000 spectators, which brings the total seating capacity up to 58,000.

To Cost $710,000

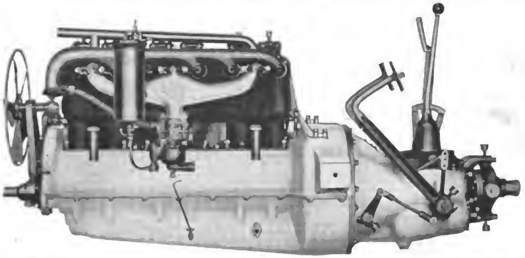
According to present estimates, the total cost will approximate $710,000, divided as follows: Grandstand, $260,000; track, $250,000; buildings, fences and other improvements, $200,000. Over 5,000,000 feet of lumber is being used in the track surface.

There are 1,000 grandstand boxes. On the inside of the track opposite the grandstand are forty repair pits, each 20 feet long. There is a neutral apron 40 feet wide in front of these, paved with brick.

Concrete foundation on the straightaways of the course

1916 Buicks Are Both Sixes

Improved Clutch and Carbureter on Both Chassis—Small Six at $985 To Be Principal Product—Main Features Retained



Left—New small six Buick motor with block cylinders. The water pump and the Delco combined generator and motor are the only fittings on the other side

SEEING that the Buick Motor Co. introduced its first six-cylinder model only 2 years ago and that the popularity of the four-cylinder has been so great, it comes as somewhat of a surprise to learn that only sixes will be built in the great factory at Flint, Mich., for the coming season. There will be two chassis with roadster, touring, coupé and sedan bodies as a choice on the smaller, but the larger chassis will be offered with only roadster or touring body. There is not much difference in size of chassis, but the touring body on the smaller chassis seats five only while that on the larger holds seven.

Improved Manufacturing Processes

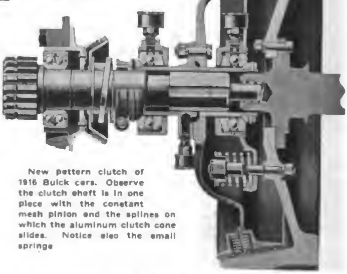
When a well known firm comes out with a new program that shows a reduction of price or which apparently offers much more for the same price there at once occurs the thought that the quality may have been cut to make this possible. Sometimes this has happened, but far more often, as in the present case of the Buick schedule, the greater value for money is rendered possible by the elimination of redundancy of parts and by better processes of manufacture.

For instance, the new Buick six with its little 3.25 by 5-inch motor has block cast cylinders that can be made more cheaply than the pair castings now that the necessary machinery has been installed, and cutting out the four-cylinder enables the whole attention of the entire force to be turned upon sixes, so establishing an efficiency-producing unity of purpose.

The rigid bodywork, the first class leather upholstery, the highly finished fittings and the good chassis materials which have hitherto given the Buick character are just as obvious in the 1916 cars as ever before.

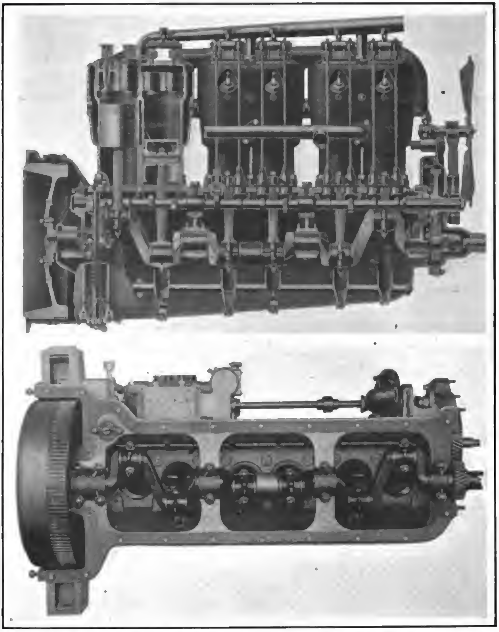
Two Motors Similar

To the casual glance there is a good deal of difference between the small six 3.25 by 5 and the larger motor 3.75 by 5 but a closer look will disclose that the principal thing which accounts for the altered appearance is the use of a block casting for the cylinders of the smaller chassis and pair cast cylinders for the big one. Really the block casting of the small motor is three pairs joined together, as both motors have crankshafts with four bearings and a point which should be appreciated is the way in which the lower caps of the two middle bearings are held up by bolts which pass up through the aluminum of the crankcase and have the heads outside. In the cylinder casting there are holes to clear these heads so removing the cylinders does not disturb the bearings while the support given to the latter is much greater than is readily obtainable from studs. To further enhance the rigidity of the crankshaft support the bearings, which are die cast, have bronze backings or shells though plain die castings are employed for the lower end connecting-rod bearings. A new feature is the use of bronze bushings in the pistons so as to increase the useful life of the wristpins and the pistons themselves, and the latter have been reduced in weight somewhat. A stepped type of cast iron piston ring is used.



New pattern clutch of 1916 Buick cars. Observe the clutch shaft is in one piece with the constant mesh pinion and the splines on which the aluminum clutch cone slides. Notice also the small springs

The Buick company has, of course, always been a protagonist of the overhead valve system, which it carries out simply and efficiently. The valves are not very large, but the small size is offset to a considerable extent by the directness of the route for gas which they afford; and by the absence of any complicated cored passages in the cylinder cast-



Upper—Section through large Buick six showing the lubrication system, the spring drive for the oil pump and the setting of the valves in the cylinder head. The small six is precisely similar except for the block cylinder casting

Lower—Four-bearing crankshafts are used on both the large and small Buick sixes. This view, taken from below, shows the water pump and the Delco outfit

ing. Cams are flat sided and quick lift is obtained by using an extra large roller. Since the valves are held in detachable cages their proper grinding and inspection is rendered ideally easy, and the proper cooling of the cages is guaranteed by the large body of water carried in the jacket space surrounding them. The whole success or otherwise of an overhead valve motor can be traced to proper precaution for keeping the valves cool, a point which the Buick engineers discovered a long while ago.

Since the push rod adjustment is at the upper end of the rod, it also is very accessible, and it is even possible to set the adjustment while the motor is running although this procedure is not advised owing to the possible risk of setting an adjustment too tight, so preventing the proper closing of the valve.

Simple Lubrication System

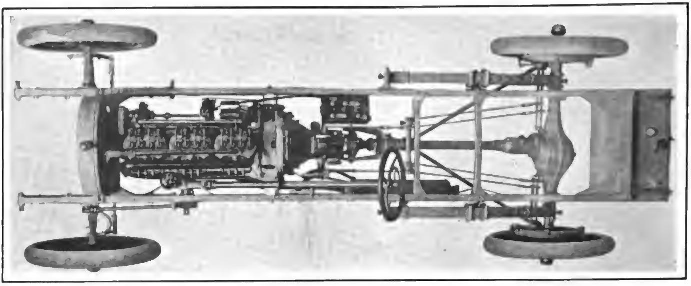
There is no pressure on any part of the oil feed save that necessary to drive the lubricant from the crankcase, up a sight glass on the cowlboard and then down to a branched internal pipe which looks after the distribution to the troughs into which the connecting-rod scoops dip. This internal pipe has six holes drilled in it and it is through these that the oil reaches the troughs. Since the supply from the pump is at one end of the pipe, it has been found worth while to drill these six little holes of different diameters, that furthest from the source of supply being the largest. This is said to ensure a perfectly even supply to each trough. To serve as connection between the gear at the rear end of the camshaft and the pump spindle a coil spring is used, this forming the drive shaft. The idea has been used a good deal, but hardly so much, perhaps, as it deserves, since it is the simplest imaginable way of allowing for a little disalignment and yet preventing any noise such as may be created by almost any sort of universal coupling.

Single-Unit Electricity

For starting and lighting the system used is the latest design of Delco single unit apparatus. In principle this follows the same system of third brush regulation which has been used previously, but a slight internal change enables the full lamp load to be taken at a lower motor speed, so that the battery is idle at any speed above 12 miles an hour. To the switch rack, which has been simplified a little, a small ammeter has been added to show the driver whether his battery is charging or discharging, and this is a distinctly comforting accessory to any man who understands his car. It is easy to argue that if the apparatus is not behaving as it should the motorist can seldom do anything to it, but this is a trite argument when it is remembered that any unusual behavior on the part of the ammeter may show a trouble much more quickly than anything else and may save a more serious derangement. There is a double reduction gear used in conjunction with the Delco apparatus, so that the machine runs much faster when in use as a motor than it does when in action as a dynamo. Ignition is combined with the same Delco machine and has the new pattern of simplified automatic advance.

Ingenious Motor Details

There is a variety of detail work about the motor which indicates the experienced hand and mind. For instance, the lubrication of the timing gears is quite separate from that of the motor proper so that a thicker oil may be used and the steel and cast iron gears kept quiet. A felt gland is used to prevent admixture of the oils and there is a filling plug for the timing gear case at such a level that it is not

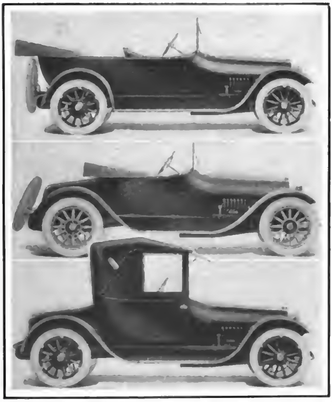


Chassis of Buick big six showing the cantilever rear suspension. The small six is similar except for the motor

possible to overfill the gear very much. Then again there is a small ring oiler that looks after the pump spindle and this has a small separate reservoir accessible through a plug on the right side of the motor.

New Clutch Aids Gear Shifting

The clutch used on both the large and small six is an entirely new design with a very light aluminum center cone and three small springs arranged in a circle instead of the usual heavy single spring, this facilitating adjustment. The old clutch coupling which was a little liable to rattle has been abolished and the clutch shaft is now a single piece of steel integral with the constant mesh pinion of the gearset and located at the front end in a flywheel spigot. Here there is a small bronze bush filled with the patented self-lubricating compound, which renders any other sort of oiling or greasing needless.



Three of the 1916 Buick six models, mounted on the smaller chassis. Top—Five-passenger touring car listing at $985. Middle—Roadster, $950. Bottom—$1,350 coupé. The wheelbase of this chassis is 115 inches and tires are 32 by 4

The cone slides on splines on the clutch shaft, it being bolted to a steel sleeve containing two large ball thrust bearings. Against the rearmost of these the withdrawal fork presses, and the front bearing carries the spider through the medium of which the spring pressure is transferred to the cone. It should be noticed that these ball thrusts have spherically faced rings that allow the spider to take up a slightly angular position in the event of the springs being adjusted unevenly, and this equalizes the pressure all over the cone. When the clutch pedal is depressed to the fullest extent possible the small cone brake seen just in front of the gear pinion is brought into action and quickly stops clutch spinning; thus the lightness of the cone and the brake effect in addition make the art of changing up extremely simple. For changing down the lightness of the cone allows a very quick shift, which is a great advantage, for the second speed is so seldom needed that few drivers have a great deal of opportunity for learning the easiest method if there be any sort of kink. With a light revolving member the lever can be just pulled through without risk of damage to the gears.

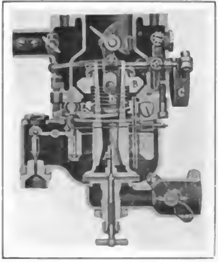
Improved Type of Carbureter

This year an improved model of Marvel carbureter is used in conjunction with an aluminum manifold branched so as to insure an even supply to each cylinder. Immediately above the carbureter is a fairly large gas chamber as shown in the side view of the complete motor. The middle of this chamber is filled by a diamond-shaped block of aluminum so that no gas can go directly from the carbureter to the outlet above it, but is forced to divide into two streams and to pass round the obstruction. This directs the streams toward the extreme ends of the manifold which might otherwise not be filled so well as the middle portion and it is said that the effect upon the running of the motor is most marked.

The action of the carbureter is as follows: There is but one jet, shown at A, and this is adjustable by an internal needle. Thus the air for idling all passes up the venturi tube around this main jet. To control the admission of additional air there is the large cone valve B which is held down against its seat, so closing the orifices, by the weight C on the end of a short lever. This is said to be better than a spring because it cannot vary in strength.

Suction raises the cone and lifts the weight the amount of air admitted being in proportion to the height the cone is lifted. Now, there is a light spring D which tries to lift the air cone against the weight—in effect it reduces the mass of the weight—and this spring is backed by a collar supported by the forked lever E. This is attached to the lever F and thence to a wire control that ends in a knob on the cowl board. There is a stop screw limiting the return travel of this lever.

Now, if the lever is set so that there is a minimum of spring pressure it will need a maximum of suction to raise the valve and a rich mixture is obtained while putting more spring pressure on enables the valve to rise more readily. Finally, when the knob is operated to its outer limit of travel the spring overcomes the weight and keeps the cone off its seat, thus giving a passage large enough to let in practically pure air for coasting down a long grade. The total effect is to provide a means for altering mixture strength that is available for any changes of weather or altitude without the need for opening the hood.



Section through the improved Marvel carbureter used on the 1916 Buicks

Gears Are Interlocked

The gearset which completes the power plant is a simple sort of transmission with the main shaft on New Departure double row bearings and the countershaft on bronze bushings. It may be observed that a square shaft is used and, since this is often considered as inferior to splines, the maker explains that the square is used on account of the ease of grinding it quite true. A special machine grinds out the square holes inside the sliding gears, so insuring their accuracy of fit on the shaft, preventing any lost motion which might cause rattle, a good engineering point.

In the lever assembly there are two plungers that move toward the center by reason of springs behind them and, when the lever is in the neutral position these plungers enter and lock absolutely, the gear shifting arms. If the lever is pulled over to bring its lower end into mesh with one or other of the shifting arms, it has first to push back the spring plunger, and the striker can be moved only when the end of the lever has completely expelled the locking pin. This, however, leaves the other shifting arm securely locked by the second plunger, so it is impossible to confuse the gears by careless lever handling.

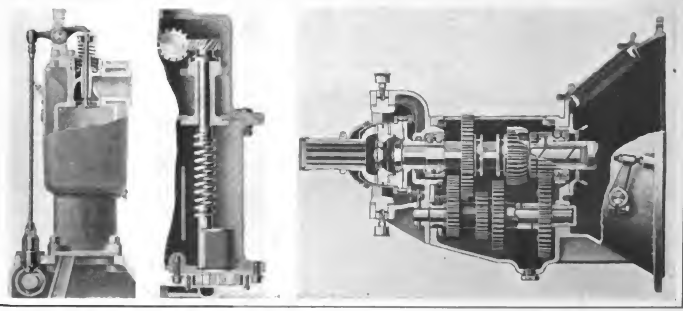
Though it is not new the Buick method for supporting the front end of the torque stay is worthy of study since it is the same in effect as a ball and socket, but much simpler and cheaper to make. The torque tube is forked like many others, but instead of linking the fork end to solid pins on the chassis, it is attached to a ring that swivels upon vertical pivots. This gives a perfect universality of movement to the torque tube and so to the axle to which it is attached.

Tried out on one model last season, the new Buicks have both cantilever rear suspension, the springs being diamond-pointed and of good length.

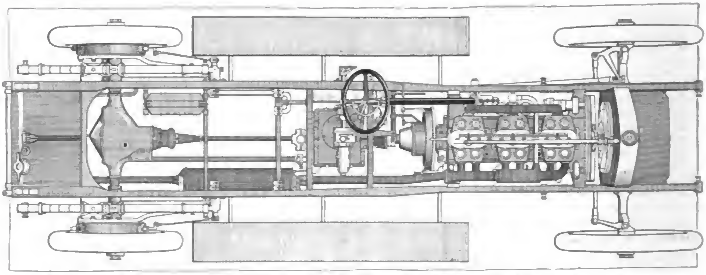
As mentioned at the commencement, there are roadster, touring five-seater, sedan and coupé bodies supplied for the smoll chassis, the prices being $950, $985, $1,875 and $1,350, respectively. For the large chassis the roadster and seven-seated touring bodies only are made, the prices being $1,450 and $1,485. The equipment includes everything from one-man mohair top and ventilating windshield to the smallest spanner necessary. Tires are 32 by 4 inch on the small car and 36 by 4 1-2 inch on the large. A spare rim goes with each car, this being held on a patented rear support which holds the rim from the inside on a sort of false bonding rim.

Battery Capacity Increased

There are no side lamps, but the headlamps contain small bulbs as well as large and so give two intensities of light at will. The capacity, but not the size, of the battery has been increased, so that the current available for town work is increased. It may be mentioned, in conclusion, that the roadster body on the small chassis is wide enough to hold the spare rim and tire inside the tail which adds greatly to the smart appearance of the car. Wheelbases are 115 and 130 inches for the two chassis, and the treads 56 inches, though a 60-inch tread can be had if desired on either car.



Left—Detail view of valve operating mechanism of Buick six. Center—Oil pump, with spring drive, and oil screen. Right—Buick gearset and universal and detail of interlocking device which absolutely prevents the simultaneous engagement of two gears



Plan view of chassis showing location of the control and driving members and arrangement of frame construction

Locomobile Refines Both Sixes

Bodies 3 Inches Lower and Clutch of Unique Multiple-Disk Design—Refinements Make for Luxury and Silence

FOR 1916 the Locomobile models are quieter, easier riding and lower than their predecessors. In addition many small detail changes go to make these new products the most luxurious yet turned out by the Bridgeport factory.

Quietness has been a feature of the Locomobile chassis for some time, but a step further in the direction of absolute silence has been made by the inclosing of the valve mechanism in metal housings, in the refinement of the timing gears at the front of the motor and the driving gears at the rear of the car. In addition to these, rattle is guarded against by the use of pressed steel, one-piece fenders of great strength which keep their shape and which cannot rattle after wear. Throughout the entire chassis anti-rattling protection has been given maximum attention.

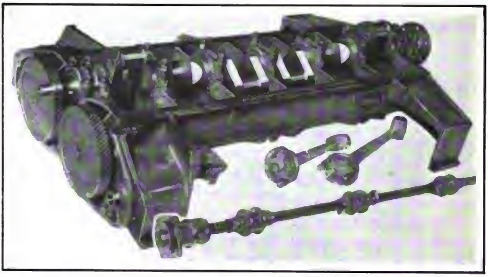
Easy riding has been secured in the new model by the use of an entirely new clutch which gives softer engagement, the use of improved 10-inch upholstery and softer cushion springs designed and patented by the Locomobile company. The thickness of the upholstery on the extra seats has been increased by 1 1-2 inches, and this, in connection with the new springs and an improved flatter spring suspension for the vehicle itself, combine to work an important improvement in the ease of suspension.

Bodies 3 Inches Lower

The body has been lowered 3 inches and the running boards 1 1-4 inches. In addition, the wheelbases have been increased in the two sixes which make up the line for this season and which are in fact, refined continuations of the 1915 models. The two sixes are known as the 38 and 48 and the increases of wheelbase have been 8 inches for the smaller model and 3 inches for the larger, making their lengths respectively 140 and 143 inches. This lengthening and lowering at the same time has produced a car which has a distinctive appearance and readily marks the new design. Other changes in the appearance are noted in the motor bonnet which now has no louvres but plain panels, an increased slope and a softened cowl line. The running boards are low and wide and are free from all incumbrances. The doors are wider and while the body itself is 3 inches lower along the sides than in the 1915 model, the distance from the top of the body to the top of the cushion remains practically unaltered, thereby allowing the passengers to sit lower than in last season's model.

Improvements have been made in the fittings and equipment, the dash instruments being rearranged to allow foot operation of many of the switches, a step light has been fitted which is lit automatically when the door is opened, illuminating the step and the ground near it and

Double-drum brakes on 1916 Locomobiles with space between for cooling



Seven-bearing crankshaft and the chrome-nickel steel, forged camshaft

a tonneau light which may be adjusted to throw the light either upward or downward is also part of the standard equipment. Improved material is used for the top which is a one-man design, but instead of having the side curtains fold up into the top itself they now fold into the back of the front seat. The top is covered with Pantasote. Another new feature is the combination speedometer, odometer and clock sunk flush into the center of the dash and so arranged as to make the reading of these instruments easy at night by an electric lamp.

Difference in Dimensions

Both Locomobiles 38 and 48 are similar in design and differ only in dimensions. The motors are T-head, the 38 being a 4.25 by 5 and the 48 a 4.5 by 5.5. According to the horsepower curve furnished by the factory, and illustrated herewith, the maximum horsepower developed by the 38 is 65.5 and by the 48 is 82.5. The S. A. E. rating of these motors are respectively 43.4 and 48.6. The cylinders are cast in pairs with the tungsten valves carried on opposite sides. A feature of the cylinder manufacture is to have the compression space in each cylinder the same, and all are calibrated to have this space 26 per cent. of the total volume of the cylinder when the piston is at the bottom of its stroke. The pistons are gray iron castings ground to size and fitted with four compression rings at the top with an extra oil ring at the bottom. The wristpins are case-hardened alloy-steel ground to a finish and are a drive fit into the piston bosses. The bearing is contained in the upper end of the connecting-rod, being a bronze bushing and the pins are held by two studs.

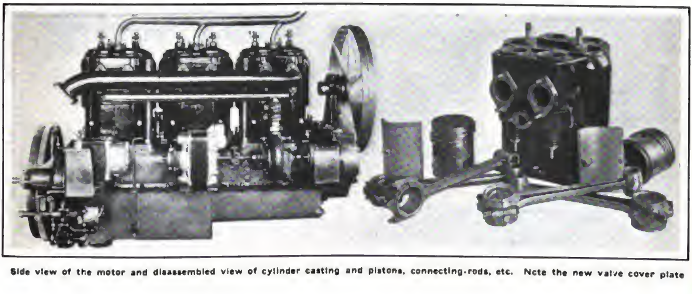
The connecting-rods are drop-forgings of chrome-nickel steel and carry at the lower extremity bearings which are made up of bronze boxes lined with babbitt-metal. Adjustment can be made on these bearings by removing steel shims beneath the upper and lower halves of the bearing boxes.

Nickel-steel is used for the crankshaft which is carried upon seven main bearings used by the Locomobile engineers for the purpose of eliminating any chance of a whipping action. Particular attention has been paid to the balancing of the entire crankshaft, connecting-rod and piston assembly, the crankshaft being given a running balance while the reciprocating and oscillating parts have been balanced in the original design of the motor and in manufacture by selecting the pistons and connecting-rods in sets of six, all weighing the same and in the case of the connecting-rods, each having its center of mass in the same location. The weight limit of all the reciprocating parts has not been cut down to the lowest possible point, but has been designed with a view to provide an ample factor of safety under the stresses of heavy duty work such as hard pulling with a wide open throttle.

Crankshaft Bearings Accessible

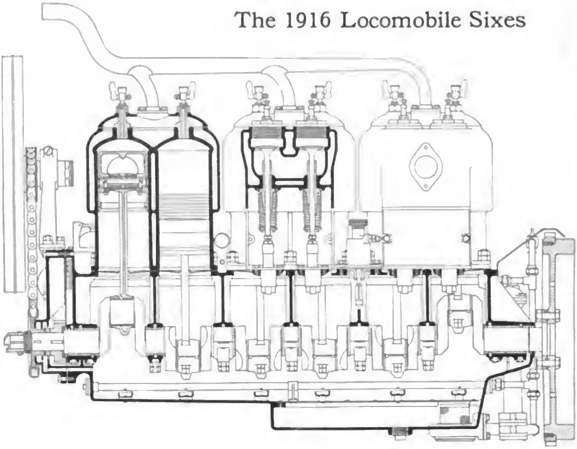
The bearings for the crankshaft are hand-scraped, and are carried in the upper part of the crankcase being accessible by dropping the lower part of the crankcase. The crankcase itself is manufactured in two parts, the upper part of government bronze testing 80,000 pounds to the square inch tensile, and the lower half of cast aluminum. The four arms for the motor support are a part of the bronze casting forming the upper half of the crankcase.

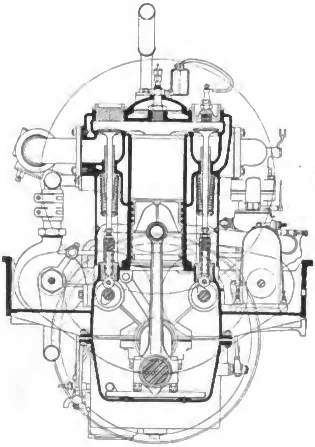
Camshafts are chrome-nickel steel forgings with the cams integral with the shaft. The exhaust camshaft is 1 1-16 inches in diameter and the intake camshaft is 7-8 inch. They are supported by five bronze bearings. The cams are hardened by a process which renders the surface glass hard and the inner structure of the cam of sufficient toughness to withstand the thrusts of valve drive. The camshaft gears are

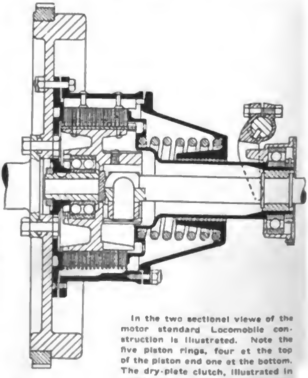


Side view of the motor and disassembled view of cylinder casting and pistons, connecting-rods, etc. Note the new valve cover plate

The 1916 Locomobile Sixes







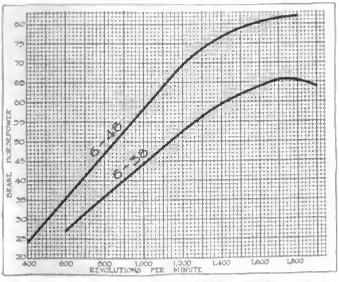
In the two sectional views of the motor standard Locomobile construction is illustrated. Note the five piston rings, four at the top of the piston and one at the bottom. The dry-plate clutch, illustrated in section above, is redesigned for 1916 and employs sixteen fabric disks in conjunction with nine driving and eight driven disks of saw steel ut helically and are driven by an alloy teel pinion on the crankshaft. The water ump shaft and magneto shaft chrome-ickel steel gears are driven off the camhaft gears. The tungsten valves are ground to a true seat at the factory and with this material should not warp or pit under any usage. The tappets are also f alloy-steel and operate in bronze guides while the rollers are case-hardened and operate on hardened pins. The proper clearance between the tappet end and valve-stem is .008 inch on the exhaust side and .004 inch on the ignition side. The entire mechanism including tappets, stems and springs are inclosed in aluminum housings for protection against mud and sand and also to minimize noise.

Seven-passenger touring body fitted on 1916 Locomobile chassis

Lubrication is by a combined low-pressure feed and splash. All the oil along with the pump splash troughs and sumps is contained in the aluminum oil pan at the bottom of the crankcase. On the 48, 7 quarts of oil fill the reservoir and on the 38, 6 quarts. The pump is a gear design operating at a lower level than the sump and hence is self-primed. At the intake of the pump there is a strainer through which all the oil is drawn and forced into a series of leads, one of which passes along the bottom of the crankcase and supplies the six troughs for splash lubrication and another which passes along the upper half of the crankcase, from which branches are led to each of the main bearings. This same main lead also carries oil to the magneto and pump shaft bearings. The connecting-rod scoops dip .125 inch into the troughs, throwing a spray of oil over the entire interior of the motor and all the surplus oil drains back to the oil sump. The pressure on the oiling system can be controlled by regulating a by-pass valve and baffle plates prevent the motor from becoming flooded when descending a steep grade.

Air pressure feed is used on the gasoline. The tank holds 30 gallons and is hung from the rear of the chassis frame, being made of galvanized sheet steel and fitted with a calibrated gauge denoting the amount of fuel in the tank. The tank is sealed by a heavy forged filler cap with a leather gasket to prevent air leaks. Air pressure is obtained by a reciprocating pump driven by an eccentric on the camshaft. It is a single acting design and is lubricated from the crankcase. An adjustable regulator is set on the air line to hold the pressure in the tank to 2 pounds.

Locomobile continues to be one of the few companies which manufactures its own carbureter. Briefly, this is an eccentric float design with an automatic air valve, the latter having three springs in series for low, intermediate and high-speed air. In the center of the intake passage is a venturi with a needle valve. The gasoline passes to the atomizer nozzle which is a double-jet design, the low-speed holes being drilled at the throat of the venturi and the high speed at the top of the nozzle which is located some distance above the venturi. The main air enters the base of the carbureter and is supplemented by the auxiliary which enters the secondary valve controlled by the calibrated springs. The mixture may be made richer or leaner by changing the position of a lever which adjusts the tension on the springs. The throttle is a butterfly type and hot-air facilities are provided.



Horsepower curves of the two Locomobile sixes for 1916. They are known as the 6-38 and 6-48

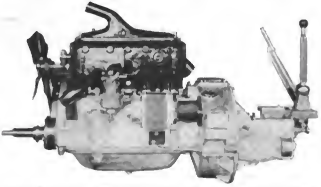
Special Westinghouse Electric System

The electric equipment of the cars consists of a Westinghouse electric lighting and starting system and a Bosch high-tension dual ignition system. The Westinghouse installation is a special design for Locomobile cars, so arranged as to provide push-button starting and automatic control. The regulation of the generator is accomplished by a differential winding of the field which provides a constant output curve as shown in the accompanying illustration. A feature of the generator material is that when the generator becomes warm, the output is tapered down so that in summer, when the high charging rate is not needed, the output is lower than in winter when it is required. The wiring is on a single system, the return being grounded. The exterior winding is carried in flexible metal conduits.

The starting motor is engaged by a solenoid series coil which brings the pinion into mesh with the teeth on the flywheel and is held in position and mesh by a shunt coil. When the series coil becomes energized it pulls a soft iron core into the magnet winding, thus shifting the starting gear into mesh with the flywheel. Just before the gear meshes, a small amount of current is allowed to flow through a resistance in the switch, causing the starting motor to spin slowly to facilitate the mesh of the gear and when final contact is made the hold-in or shunt coil comes into action and the full starting current cranks the motor. When the engine commences to fire the voltage of the generator builds up and the cutout switch closes. This grounds the positive side of the generator and opens the relay switch, allowing the pinion to become disengaged by means of a powerful spring. Two new features are involved in this device, one being a brake which brings the starting motor gears to rest quickly and thereby eliminates any chance of a clash in case of a too-hurried re-engagement and another is the forged steel rim on the flywheel for the starting gear. This is driven on as a very tight fit and held in place by headless set screws. Some of the main facts regarding the starting motor are that it is

(*Continued on page* 1084)

Imperial Four Has Large Motor



Intake side of 3 3-4 by 5-inch Continental power plant used in Imperial four for 1916. Note mounting of Westinghouse starter unit

Good Chassis Detail and Very Large Five-Passenger Body Characterize New Model for 1916—Hotchkiss Drive Through Long Underslung Rear Springs

ON first seeing the 1916 Imperial made by Mutual Motors Co., Jackson, Mich., the immediate impression is that the car is very large for the price—$995. Closer examination of the chassis also shows that size is not the only thing about the car by any means for the main components are good and the detail work in keeping with the character of the essentials. The motor is a four-cylinder Continental 3 3-4 by 5, piston displacement 221 cubic inches, and, since the only cast iron part is the cylinder block, the engine should be light for its power. It is stated by the manufacturers that the weight of the complete car is 2,450 pounds and, on the road, it is easy to feel that the power-to-weight ratio is large. The high gear ability is quite exceptional for a four-cylinder car and the flywheel has sufficient mass to prevent any unpleasant pounding when the motor is running at a very low speed indeed.

In construction the motor follows usual Continental practice the lubrication being constant-level splash combined with pump, the valves inclosed and provided with cylinder head plugs so that they are accessible without removing more than one valve at a time. A very large crankshaft is used with the idea of eliminating vibration and there are three main bearings of ample proportions. Though the conditions of our road trial on this car did not make possible any high speed we were able to observe that there is practically no vibration at any pace up to 35 miles an hour and the engine did not then suggest by sound or otherwise that it was revolving at a great rate. It is geared 4 to 1 in the rear axle and the tires are 33 by 4.

Westinghouse Electrical Equipment

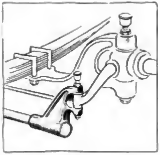
The electrical outfit is Westinghouse, with a unit generator and ignition and a separate starting motor, the latter meshing with the flywheel through the medium of a Bendix drive. The generator is driven by a shaft on the right side and there is a substantial leather coupling while, as is shown in the illustration, the ignition part of the machine is set vertically, containing an automatic advancing governor. All details of the distributor are magneto type. The valves are all extremely accessible as the generator platform is placed low enough to prevent the generator obscuring the tappets when the valve cover plates are removed.

Located on the opposite side to the valves is the Stromberg carbureter, this having a short intake pipe only, as the manifolding is carried out within the cylinder casting. Right alongside the carbureter comes the oil filling cap in a place where lubricant can be poured in without difficulty, and a gauge is used to register the amount of oil in the motor. There is no oil indicator on the cowl board.

Disk Clutch Has Easy Action

The inclosed disk clutch has alternate Raybestos faced and steel plates and is proportioned to the torque to be transmitted so that the pedal action is not so heavy as usual. It is, in fact, a very easy clutch to operate. Similarly the gear shift is smooth and free so that it is easy to control the gears quietly and quickly. The gearset is a Muncie and provides three speeds, but a point is that annular ball bearings of the best quality are employed in it.

Very long underhung rear springs are used, designed especially to give a Hotchkiss drive, so the propeller shaft is fitted with two universals. The speedometer drive being taken by gearing off the forward end joint casing. Sometimes vibrations in the drive arise from the practice of taking the drive through the springs, and to guard against the possibility of such a happening the Imperial rear springs have a particularly wide bracket for the attachment of the front ends of the springs to the frame. This, like other frame fittings, is hot riveted in position. The two spring hangers are employed as plummer blocks for the brake shafts which cross the frame at this point.



Detail of unusual tie rod construction used in Imperial four

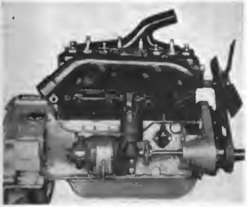
Ball-Bearing Axle

The rear axle is a Salisbury with straight-tooth bevel gearing and for the support of the pinion and the differential large ball bearings are used.

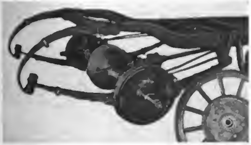
The axle sleeves are carried through, inside the road wheel hubs so that the weight is borne directly by a pair of Hyatt, heavy-duty roller bearings located in the plane of the wheel and the drive shaft secures the wheel in place. The upper half of the center case of the axle is detachable for inspection of the bevel drive or differential it being pointed out that this way of splitting an axle case leaves the lower portion a solid oil container that cannot leak lubricant by reason of failure properly to tighten a few bolts.

Front springs and steering gear layout is normal, but executed with an eye to the accessibility of the grease cups which is everywhere excellent. A detail of the steering gear which though not unique is worthy of special mention is the way in which the tie rod is lowered to clear the underside of the motor without putting a bend in the tube. A bent tube is less easy to set to a definite length and is more liable to distort than a straight one, so the Imperial uses a straight tube and drops it by means of forged hangers at each end. These small drop forgings are extremely strong and rigid and are also neat in appearance. The chassis frame is of heavy gauge steel, designed for rigidity so as to eliminate body squeaks and further to guard against noises of this character the running board aprons have a felt packing strip both beneath them, against the frame, and above them against the body.

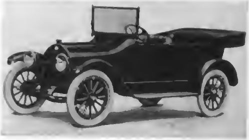
In assembling the fenders and the aprons a large number of bolts is used to secure rigidity and permanent freedom from rattle.



Exhaust side of Continental motor used in Imperial four, showing mounting of lighting and ignition unit and fan belt drive



Imperial rear axle, showing long underslung springs with brackets at the front ends which transmit the drive to the frame. The fitting of the road wheel on a high-duty roller bearing is also a feature



Imperial four-cylinder touring car which sells for $995 with complete equipment

It has become so usual to say that a body is of streamline form and that it is roomy that the phrases are losing their true meaning, but it is impossible to forego the remark that the Imperial body will hold five people of greater individual bulk than the majority of cars having the same passenger rating. As to its lines they suggest space and it is a car to catch the eye, though it might be hard to say quite why this is.

Completing the specificatory details: Wheelbase 115 inches, Detroit rims, a spare rim included in equipment. The headlights have two bulbs for full and diminished illumination, and the switch gear is placed conveniently on the cowl board. In the cowl is the gasoline tank, which has a gauge the driver can read while at the wheel. Good upholstery with deep padding, a leather covered back to the front seat, and a good carpet make for comfort in the rear compartment.

Pathfinder Twelve and Six for 1916

(*Continued from page 1066*)

flat when the car is unloaded. These springs are 52 inches long and have leaves 2 1-2 inches wide, the main leaf being of alloy steel and the shackle extra strong to care for the drive. The spring mounting brackets are of bronze and made unusually heavy. The rear spring seat, of course, oscillates, the front end being shackled.

Bushing at Every Bearing Point

There is one feature of Pathfinder design which might be brought out here in conection with the braking system, but which holds true of the whole chassis design. Wherever there is a bearing surface a bushing of some type is used. Brake rocker shafts are bronze bushed, the brake and clutch pedals likewise. The cantilever spring trunnion has a heavy bronze bushing and the steering connections are steel bushed.

In the Pathfinder bodies there is little noticeable change, the low-hanging, characteristic V-shaped radiator, curved fenders, etc., being retained. The battery box, formerly on the left running board, has been removed, leaving both boards clear. The back of the front seat does not extend upwards as much as it did on the former model and the tonneau has been made a bit larger. The two-tire carrier still is in the rear. The three-passenger roadster design also has been improved in detail. Tire sizes for this year are 35 by 4 1-2, straight side, non-skids in the rear. The standard colorings are as follows: Blue-black with white or gray running gear, wine or dark green with the same color of running gear. Other colors are $50 additional for the body and $10 for the running gear.

Body types for the coming year are the same as they were for the past season, there being roadster, four-, five- and seven-passenger touring cars at the same price and inclosed cars on special order.

Has High Mica Commutator Trouble

EDITOR THE AUTOMOBILE:—Have been working on a Wagner one-unit starter and generator on a Studebaker 35 and have it so that it will charge at 7 amperes if I press the contact point on the cut-out at the start. I can slow down the motor so that it will cut out and then speed up and will cut in by itself, but if I stop the motor and start again, it will not cut in without help. I have cleaned both commutators with fine sandpaper, and soldered all connections. What is the cause for it not cutting in when starting the motor after it has been idle for some time?

2—The starter will pull the motor with priming cups open, but is very sluggish with a new battery charged to 12.75 specific gravity and all connections tight.

3—I have been told to groove the insulation between the brass segments on commutator. Is this proper? If so, please give reason. I have seen on a 1915 Overland, equipped with an Auto-Lite starter and generator that the generator commutator had a sort of groove between the segments. I should imagine that dirt and bits of metal would accumulate in these grooves and short circuit the armature coil.

Melvin, Ia. H. EHLBERG.

—From the information contained in your letter it would seem that the mica between the commutator bars is a little too high. It is entirely proper that this should be scraped out so as to be below the surface of the commutator. In other words it is necessary that there be grooves between the segments of the commutator, first because of the high speed of instruments of this type, and second, the copper being softer than the mica, which is used as an insulator separating these segments, that should the mica protrude above or through, expanding from contact with oil or dampness, prevent the brushes from making constant contact with the segments, the efficiency will be greatly impaired. It is therefore, advisable to keep the mica slightly below the surface of the commutator and hence the groove between the segments.

Keep Commutators and Brushes Clean

The commutators and brushes of these instruments should be examined at least every week or 10 days to find out their condition. If the commutators are dirty, or the mica protrudes above the surface, the condition can be detected from the action of the generator as follows:

The relay will not close and the generator will not charge even though the engine is speeded up to a very high r.p.m. If, however, the engine is speeded up until it corresponds to a car speed of 18 to 20 miles per hour, and then the contact points of the relay are closed with the finger, the generator will start to charge and the contact will remain closed. If the engine is now slowed down, the contacts will open and they will close properly upon speeding the engine up. However, if the engine is stopped for a few moments, and then started it will be necessary to close the contact points of the relay with the finger before the starter will charge the battery.

In order to eliminate this condition it is necessary to scrape out the mica from between the commutator bars until it is below the surface by about 3-64th inch. No mica should be left above the commutator surface.

Before attempting to remove the mica it is advisable to remove the starter generator from the car and then withdraw the armature. A special jig A can be made for large shops for doing this work or a special tool B as shown in Fig. 1, can be used for small shops or individual repairmen. This tool can be made of a hacksaw blade about 8 inches in length, one end being ground sharp like a parting tool on a lathe or planer to the thickness of the mica between the copper bars. The other end should be shaped like a hook, having the same kind of a point as on the other end. Around the center of this tool should be folded a piece of heavy tin wrapped with electric tape making it easy to handle and less likely to break. The mica is removed by forcing the sharp edges of the tool from the outer edge of the commutator surface to the inner edge. It can be finished with the hooked edge being drawn back in the opposite direction. Do not cut away the copper as this will increase the width of the slots and give very poor results. It will be found convenient to place the armature in a vise while undercutting the mica in this manner. Do not use a sharp needle-pointed tool, as this will not give good results. A tool of this shape will simply make a V-shaped crevice in the mica and the pieces nearer the commutator bars will not be removed. A small magnifying glass can be employed to great advantage in detecting whether or not all the mica has been taken from the grooves to the proper depth. It is of great importance that the tool which does this work be very sharp.

Maxwell Electric System Outlined

Editor THE AUTOMOBILE:—Kindly outline the lighting and starting system used on the Maxwell car. Would appreciate your tracing the current.

Isanti, Minn. A SUBSCRIBER.

—The starting and lighting system used on the 1915 Maxwell is the Gray & Davis two-unit outfit. The apparatus is composed of a dynamo, starting motor, battery, a regulator cut-out for controlling the output of the dynamo, switch for operating the cranking motor and lighting switches, fuses, wiring, etc., to make up the various circuits and protect them against injury.

Briefly, the operation of the system is as follows: When the car is in normal condition the motor is stopped, the battery charged and nothing whatever about the car has any motion. By pressing the starting switch, the potential energy contained in the storage battery is drawn upon and starts to operate the cranking motor by first throwing into engagement the drive pinion P with the flywheel bevel B in Fig. 2, and then by spinning the cranking motor when these two gears are in engagement the motor is started. As soon as the motor starts, the starting pedal is released, disengaging the flywheel pinion and electrically disconnecting the motor from the battery.

As the motor speed increases, the generator or dynamo which is driven by it produces a current of electricity which passes through the regulator and then on to the storage battery, charging this with electricity which is drawn for the purpose of lighting the lamps or for again cranking the motor. An ammeter on the dash shows the discharge and charging current in amperes. The current can be traced from the accompanying wiring diagram Fig. 3.

Moon Co. Makes Its Own Bodies

Editor THE AUTOMOBILE:—Kindly advise through the Rostrum the name of the maker of the bodies used on the 1915 Moon cars.

Homestead, Pa. H. N. M.

—The Moon Motor Car Co., St. Louis, Mo., makes its own bodies, having a fully equipped plant to do this work.

Tire Diameter Affects Speedometer

Editor THE AUTOMOBILE:—I have changed the 30 by 3 front wheels and tires on my car to 30 by 3 1-2 in order to have the same size all around. How much more than a mile will I have to travel before the speedometer registers 1 mile?

2—Is there any inexpensive way of changing the speedometer to make it accurate? It is a Stewart on a 1915 Ford.

Gladstone, N. J. J. M. HARPER.

—Unless you have replaced the entire wheels you should not have changed your 30 by 3 for 30 by 3 1-2 as the rim profile for a 30 by 3 tire is different from that of a 30 by 3 1-2. In changing your equipment from 30 by 3 to 30 by 3 1-2 on the same wheel it would be necessary to cut the felloe of the wheel 1-2 inch all the way around and buy a new rim of different profile. Without changing either the wheel or the rim you can use a 31 by 3 1-2 tire in which case the distance traveled by the car would be 3.33 per cent. greater than the speedometer reading would show. If you change the wheels and rims and use the 30 by 3 1-2 size in place of the 30 by 3 your speedometer reading would not be affected.

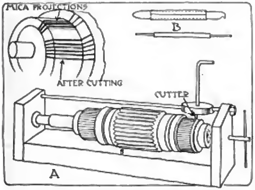


Fig. 1—Special shop jig A and hand tool B for trimming commutator micas and also sketch showing commutator partly trimmed

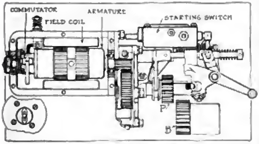


Fig. 2—Part sectional view, showing operation of Gray & Davis electric starting motor on the 1915 Maxwell. P is the drive pinion and B the teeth on the periphery of the flywheel

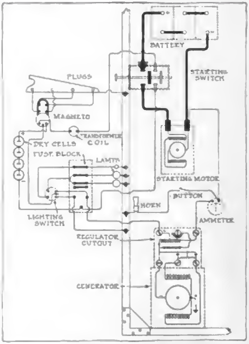


Fig. 3—Wiring diagram of electric system on the 1915 Maxwell

2—The method of changing the speedometer to make it accurate is simply to put a new gear on the speedometer drive. This is not expensive, the cost being $1 for the new gear. It must be remembered that unless you use the 31-inch size it will not be necessary to change.

Defective Hose Causes Overheating

Editor THE AUTOMOBILE:—The writer has a 1913 six-cylinder Chalmers car which heats up considerably; in fact on a warm day it gets so hot that it is torture instead of a pleasure to drive the car, and on moderate driving it will boil.

This, in my opinion, is due to the car being driven without any water in the radiator a distance of 6 miles by another party, part of this 6 miles having two very steep hills and 1 mile up a mountain with a maximum grade of 8 per cent. Before this party drove the car without water it worked fine and never heated to any extent. I would like to know whether there is anything that I could do to stop the heating up?

Leckrone, Pa. J. A. R.

—THE AUTOMOBILE has no record of any heating troubles with the Chalmers 18, and in instances where trouble has occurred, it has been brought about through some local condition. As you explained in your letter that the trouble had not developed in your car until the car had been run a considerable time without any water and in running the car in

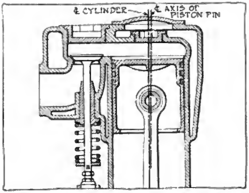


Fig. 4—Section through cylinder of internal-combustion motor illustrating the principle of the Packard patented offset wristpin

this condition, the only trouble that could develop would be to injure the rubber hose connections, radiator to water pump and cylinder block to radiator. In this instance, the motor and parts undoubtedly became so hot that the inside surface of the radiator hose collapsed and this undoubtedly is obstructing the passage of water on this particular car.

It is suggested, therefore, that you remove the radiator hose and examine it and if necessary install new hose, being sure that they are not kinked.

There is also a possibility of the radiator cells having become partially clogged on account of the sediment which was undoubtedly distributed to the cells by the steam generated. This might have clogged the cells. If this is the case the radiator should be filled with water; then draw off about 1 quart and dissolve in this the maximum of concentrated lye which the water will carry. This should be poured into the radiator and the motor run for several moments until the cooling system has become thoroughly heated. The water is then drained off and thoroughly flushed out with several fillings of fresh water, care being taken not to get any of the water in which the lye is dissolved on external parts.

Packard Patented Offset Wristpin

Editor The Automobile:—I would like to see the offset wristpin discussed in your magazine. I understand the Packard company is using this style in the new cars for more quiet. How might this be accomplished?

2—How will it affect speed?

3—How will it affect wear on the cylinder walls?

Providence, R. I. H. C. Orndorff.

—The Packard company has been manufacturing motors for some time with the piston pin offset approximately 3-32 inch from dead center in order to allow the use of a fairly free piston to prevent sticking and at the same time get away from the troubles of piston slap. The Packard company, in fact, took out a patent No. 1,138,892 issued to Edward F. Roberts and assigned to the Packard Motor Car Co., covering this construction. In presenting the reasons for this device, the patent application states:

"It is well known in hydrocarbon motors, and particularly in upright, or vertical motors, that on the compression and exhaust or up or outward strokes of the piston, the latter tends, by reason of the angularity of the connecting-rod and the pressure on top of the piston, to press closely against one side of the cylinder, causing all the clearance to be between the opposite side of the piston and the cylinder. On the intake or first down or inward stroke there is probably little change in this respect as the piston is being pulled down by the connecting-rod, unless perhaps the top of the piston may be rocked across to the opposite side by reason of the change in angularity of the connecting-rod at the top of the stroke. But on the firing or second down stroke, that is, the stroke following the compression stroke, as soon as the crankpin passes dead center and the explosion occurs, the side pressure on the piston is immediately transferred from one side of the cylinder to the other, and if there is a small amount of play or looseness between the piston and cylinder, that is appreciable clearance as when the motor is cold, what is termed a "piston slap" results. In other words, this "flopping" of the piston from one side of the cylinder directly to the other at the moment of explosion causes a sharp click which is objectionable in motors for use in motor vehicles where quietness is very desirable. The piston of a hydrocarbon motor is usually connected to the motor crankshaft through a connecting-rod which is journeled at its big end on the crankpin and is pivotally connected at its smaller end to the piston centrally of the latter.

"One of the objects of the present invention is to provide means for opposing the rocking action of the piston on its support, usually the piston pin, at the top of the stroke.

"Another object of the invention is to oppose or prevent the piston from rocking suddenly on its pin at the top of the stroke, thus eliminating a slap at that time.

"Another object of the invention is to arrange the piston pin of a motor such as hereinafter described in offset relation with the center of the piston or cylinder, and preferably only slightly offset, to thereby retain the position of the piston at or near the top of its stroke, and prevent its sudden rocking.

"Another object of the invention is to produce a motor in which the piston will not rock or slap suddenly from one side of the cylinder to the other.

"These and other objects of the invention are obtained in the motor illustrated in the drawing forming a part of this specification, and in which the figure is a vertical transverse section of a motor embodying one form of this invention.

"In the drawing, Fig. 4 the invention is illustrated in a strictly vertical hydrocarbon motor of the four-cycle type. It is particularly applicable to this and other upright motors such as multiple cylinder motors of the V-type, as distinguished from horizontal motors."

The Packard company states that exhaustive tests were run and these showed to the satisfaction of the Packard engineers that there was no difference in the wear of the piston walls and the motor was not slowed down in any respect while there was a gain in power, due to the ability to use a freer fitting piston.

A Good Remedy for Blow-Outs

Editor The Automobile:—All motorists know that among the many forms of tire trouble the blow-out, which nine times out of ten occurs near the bead, is the most serious; the inner patch or the inner lining does not help the trouble a very long time; only a costly vulcanizing job can make the injured casing again fairly serviceable and many people discard the tire rather than go to the expense.

A rapid and very economical way to repair a blow-out consists in simply lacing up the injured part with ordinary wire belt lacing. A good repair job can easily be done in about 15 or 20 minutes, proceeding as follows: First, cut away the loose rubber around the blow-out so you can extend the lacing one inch or so beyond each extremity of the "wound." Second, with a stout hat pin or a sharp nail, punch a sufficient number of holes around the edges of the cut, being careful to get them equidistant, yet not too close together. Next, lace up the cut, with the wire lacing, just as you would lace an ordinary belt, but in this case allow only one strand through each hole; be also very careful to equalize as much as possible the tension of the wire strands. A double row of wire lacing (one over the other) will be much stronger than a single one. Finally, place a piece of canvas or cardboard or leather, inside of the casing, over the laced part, so the inner tube cannot be injured. You have then a repaired tire that you can again depend upon for a good many miles. The writer got recently 1,200 additional miles, with a repair as explained above, out of a blown-out 36 by 4 1-2 casing that had already 9,500 miles to its credit.

It stands to reason that wire belt lacing that is capable of lacing up a 100-horsepower belt should equally as well answer the purpose of lacing up tire fabric. The scheme favors greatly the cars equipped with demountable rims or wheels; the last ounce of possible use can be handily extracted out of an injured tire, whether the blow-out is premature or not.

It is essential that the wire lacing employed should be of the best wire lacing obtainable, which has not only an enormous tensile strength but which possesses also a remarkable amount of resistance to torsion and flexion. These qualities make it admirably suitable for repairing a blow-out in a prompt and economical manner. An ordinary coil of belt lacing costs but 35 cents and is amply sufficient to repair from ten to fifteen blow-outs, according to the size of the tire.

Arcadia, Cal. C. V.

Ford Engine Suitable for Light Boat

Editor THE AUTOMOBILE:—There has been quite a discussion in this district regarding the placing of a Ford engine in a boat. I would like to have you express your opinion on this. If it can be worked please state how, or why, if it cannot be used to advantage.

Ensley, Ala. E. C. GODFRY.

—There have been several examples where the Ford motor has been successfully mounted in a boat. The exact propeller to use with the engine however, depends upon the weight of the boat. The motor can only be satisfactorily installed in a light, high-speed launch and is not satisfactory for slow, heavy-duty work. Another point which should be observed in installing it is that it should not be put in salt water but in fresh on account of the iron water jackets. The fresh water would not harm the motor but the deposits on the iron water jackets due to salt water would rapidly accumulate to such an extent that the cooling efficiency would be cut down.

Wants Practical Dressing for Tops

Editor THE AUTOMOBILE:—Will you kindly tell me what is a good, practical preservative dressing for automobile tops? Something that will not in the end do more harm than good? I have my machine re-varnished each year, but have not yet found anything good for tops. Perhaps you or some of THE AUTOMOBILE readers can solve the problem for me.

Topeka, Kan. A. H. BENNET.

—The material which you use in your top has everything to do with what is most desirable in keeping it in good condition. If it is mohair, castile soap and luke-warm water are best. The other tops, which are patented fabrics or imitation leathers, etc., will have to be taken care of according to the substance of which they are composed. None of them, however, will be harmed and most of them benefited by the castile soap and water treatment.

Misaligned Wheels Will Affect Steering

Editor THE AUTOMOBILE:—We have for some time been trying to locate a peculiarity in the steering gear used on a 1915 Empire roadster.

The difficulty seems to be in lost motion or side play in some of the parts which is made apparent on traveling over a stretch of rough pavement, for instance, granite blocks, by a continuous hammer jar communicated up through the column. Originally, this gear was apparently right, that is, did not give this jar in passing over rough roads. We have examined all the connections and have taken up play in all the knuckles. What adjustments or remedy would you suggest in order to take out this lost motion and thus eliminate the latter?

Dayton, O. M. G. KOPP.

—Adjustments are provided on the steering gear of the Empire for putting the proper spring tension in the reach rod and also to take up the slack or backlash in the gear by moving the eccentric bushing on the worm gear shaft. This is done by removing the steering arm from the end of the worm gear, loosening the clamping screw on the steering body or chuck, and making the proper adjustment of gears, then tightening the clamping screw holding same in position.

It might be that your car has experienced some jar which has bent the axle, knocking the wheels out of alignment, which would give the trouble you mention.

Two-Throw Crankshaft Disturbs Balance

Editor THE AUTOMOBILE:—What are the objections, if any, to a crankshaft such as illustrated in Fig. 5.

With a firing order of 1, 3, 2, 4, and proper counterpoise, would this scheme cause any unusual vibration of the motor?

Princeton, N. J. A. K. CHAPMAN.

—The great objection to this method of manufacturing the crankshaft is that it would be detrimental to effecting a proper balance of the reciprocating parts. The counterpoise which you mention as illustrated would only effect the rotative balance and by having its weight properly arranged no doubt the rotating parts could be brought into proper balance. The reciprocating parts, however, would be arranged in pairs with all of the parts in the forward two cylinders, going upwards, at the time that the parts in the rear two cylinders were going down. This would set up a longitudinal rocking motion due to the couple PP1 as shown in Fig. 6. At high speed this would cause considerable vibration and besides would be a considerable strain on the bolts connecting the cylinders to the crankcase.

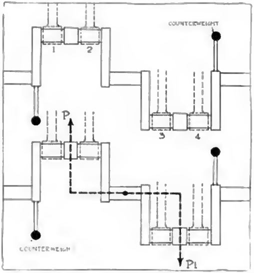


Fig. 5—Upper—Two-throw crankshaft diagram submitted by A. K. Chapman for information

Fig. 6—Lower—Why the two-throw crankshaft is impractical. The couple PP1 would set up a longitudinal rocking motion which would injure the motor, besides destroying the balance

Definite New Unit for Motor Speeds to Avoid Vague "High" and "Low"

1 Motor Speed =1 Turn Per Second. Proposed by M. C. K.

As everybody knows, 400 revolutions per minute is fairly high speed for a stationary gasoline or oil engine; 600 revolutions was considered high speed for a boat motor until motor boat racing had become well advanced; 1,200 revolutions was the perfectly giddy speed of a Mercedes automobile motor in 1901, and nowadays an automobile motor giving its maximum power at 1,800 revolutions per minute is termed a low-speed motor or a high-speed motor accordingly as the speaker's precious experience has been with aeroplane or automobile motors running at 4,000 revolutions or with the average American automobile motor whose torque begins to drop at 1,000 revolutions and whose maximum power is obtained at 1,200 to 1,500 revolutions. In blithe disregard of the uncertain sense of the term "high-speed," laymen and engineers alike continue, however, to employ this expression with the expectation that the hearer or reader will understand the same by it as the speaker or writer. As in all similar cases, there is a reason. The more accurate and comprehensible terms are inconvenient for common parlance as well as for formal writings. The abbreviation r.p.m. for revolutions per minute refuses stubbornly to be assimilated by the public; it cannot be used outside of technical disquisitions, and with a big numeral in front it makes a very poor descriptive adjective, even in an S. A. E. Bulletin. With the present tendency toward changes in motor design which increase the motor speed and the need of speaking of the subject both informally and formally, there is occasion for a little effort to make it easier to refer to the speed properties of a motor without breaking the flow of language, upsetting the structure of a sentence or making the layman feel that now he can quit listening or turn to another page.

When electrical engineers pass resolutions that hereafter a 12-horsepower motor must be called a 9-kilowatt motor, they have all exact reasons in their favor but popular parlance against them, and the change is not readily accepted. But in looking around for a term for motor speeds by which "high-speed," "medium-speed" and "low-speed" can be relegated to oblivion, the chance for reconciling technical and popular requirements very acceptably seems better.

"25-Speed" a Speakable Adjective

If 1 revolution per second is termed a "speed," a motor giving maximum power at 600 revolutions per minute becomes a 10-speed motor, one giving maximum power at 1,800 revolutions per minute becomes a 30-speed motor, one of 1,200 revolutions per minute becomes a 20-speed motor, and so on. In all cases the expression appeals to the intuition, because a 20-speed motor, for example, is one which makes 20 turns in 1 second, and the mind can grasp what that speed means, while it is quite unable to grasp what 1,200 revolutions per minute means in the way of rapidity of rotation, without first dividing by 60 to find out how many turns per second it stands for. The revolution counter on the testing stand also works by the second, and the second is in all respects a more standard unit than the minute for all other measurements excepting horsepower. The system gives no real difficulties for intermediate motor speeds. A 1,400 r.p.m. motor becomes a 23-speed motor, with sufficient accuracy; a 2,500 r.p.m. motor becomes a 42-speed motor. This is more likely to correspond with reality than the large figure in round hundreds per minute, which is nearly always roughly approximated.

The relation to piston speed is simplified. All one has to do, to find the piston speed in feet per minute, is to multiply the speed figure by the stroke in inches and the product by 10. The piston speed of a 42-speed motor with 4 inch stroke, for example, is $42 \times 4 \times 10 = 1,680$ feet per minute.

In practice, if this system of parlance is adopted, the mileposts of motor speed—the divisions in which people think—will of course quickly be moved from the figures corresponding exactly to the round hundreds of the present method, and the even figures with the new system will take their place. Or, in other words, nobody will think of 1,320 revolutions per minute when a 22-speed motor is mentioned but will know directly whether a 22-speed motor is what he would call high-speed or low-speed in comparison with other motors he has known.

Obviously, by taking 1/100 minute instead of 1 second as the period for "a speed," a motor of 600 r.p.m. would become a 6-speed motor, one of 1200 r.p.m. a 12-speed motor, and so on. There would be a little less friction at first in adopting this unit than the other. Also, a motor making, say, 1560 r.p.m. could be known as a 15.60-speed motor, with a sop to accuracy. But, with a view to permanent advantages, the simple relation to 1 second is probably preferable, because, with it, fractions can be avoided with smaller average error. The motor with 1,560 r.p.m., for example, is, with the 1 second unit, simply a 26-speed motor. The S. A. E. could at all events decide which unit should be adopted.

The Public Is Willing

Only a little persistency is probably required to introduce a new term which has practical advantages. Some years ago, for example, the proponent in this case had frequent occasion for mentioning the carbon contents and alloy contents of steels and found it troublesome to refer to the quantities of small admixtures as multiples of one-hundredth of one per cent. By adopting the term "a point" for this percentage he was enabled to speak about a steel having 15 points of carbon and 65 points of manganese or of a 4-point phosphorus steel instead of using the awkward decimal and sub-decimal notations, and after he had done so for some time others began to adopt that way of speaking, which is convenient and does not clash with the use of percentage, being only the use of a 100-times lower unit in addition.

If the few writers on metallurgical subjects who took favorable notice of the little innovation—for which no argument was offered—had continued the practice independently, it would, judging from indications, have been generally accepted today as a convenience in terminology.

Another example, showing how readily a practicable change in terminology can be accepted if it is only resolutely employed in print and speech during the psychological period, is given in the term "denatured alcohol." Up to 1905 "denaturized" and "denaturated" were the accepted forms, but the writer employed "denatured" instead, with a brief argument for the preference, and this shorter and better form was silently adopted by experts and congressional debaters and was employed throughout the subsequent legislative enactments on the manufacture and use of ethyl alcohol for industrial purposes. "Denaturized" or "denaturated" has seldom been heard or seen in print since.

The Engineering Digest

Sizes Required of Wheels and Tires in Heavy Traffic, for Road Protection

WIDTH of tires for tractors and trailers must sooner or later become a subject on which legislation will be demanded, in view of the need of protecting road surfaces against damage from excessive loads and speeds. Activity in road building and the incipient agitation for the use of trailers in connection with motor trucks are now adding a touch of actuality to this matter which has troubled vehicle builders and road authorities in England for a number of years. W. W. Beaumont's formula for tire widths may in this respect be of interest, as it is intended to afford an improved basis for the regulation of construction and traffic, as compared with the rules laid down in the Heavy Motor Car Order of 1904. These rules, Mr. Beaumont points out, are involved and difficult to follow, mainly because the wording of the enactment refers to axle loads instead of wheel loads, but they also fail to encourage the use of large diameters for wheels, although experience has shown that the large wheels save the road considerably, and they prescribe a maximum speed of five miles per hour which cannot be enforced.

The formula designed to take their place refers to hard tires only and reads:

$$W = B\,D\,21$$

in which W = the load or weight permitted on a wheel in pounds, while B = the width of the tire in inches and D = the diameter of the wheel in inches. By applying this formula the values given in the appended table are obtained. The figures therein may thus be taken as embodying the experience of Great Britain in this matter for the period 1904-1915, as interpreted by a well-known authority. He explains:

"These figures do not, of course, relate to vehicle loads on rubber tires. . . . It is, however, more generally recognized than it was even a year ago, that the wear of roads by the ordinary motor omnibus and the motor lorry on rubber tires was only noticeable on roads with a friable surface."

TRACTOR AND TRAILER TIRE DIMENSIONS FOR PERMISSIBLE WEIGHT ON A WHEEL IN POUNDS

Dia. of wheels in in.	Width of tire, in inches	5	6	7	8	9	10	12	14
	30	3,150	3,780	4,410	5,040	5,670	6,300	7,570	8,800
	32	3,360	4,030	4,710	5,374	6,037	6,720	8,300	9,400
	36	3,780	4,530	5,270	6,048	6,804	7,560	9,100	10,600
	42	4,400	5,290	6,170	7,056	7,938	8,820	10,600	12,370
	46	4,830	5,800	6,750	7,728	8,694	9,655	11,600	13,520
	48	5,040	6,050	7,050	8,064	9,072	10,080	12,100	14,100
	54	5,670	6,800	7,940	9,070	10,180	11,330	13,600	....
	60	6,300	7,570	8,830	10,080	11,300	12,600	15,100	....

Single and Dual Sparks in T-Motors and L-Motors—Castor Oil Facts

SOME tests conducted at the F. N. works of Herstal, Belgium, before the German army took possession, gave results which neatly summarize the answers to questions frequently asked by motor vehicle owners.

Lubricating with castor oil.—Although castor oil (specific gravity .962) has higher flash and ignition points (255 degrees and 315 degrees, respectively) than ordinary cylinder oils (210 and 265 deg.), and though it leaves no trace of corrosion and less of it is required for good lubrication than of any other oil, ordinary oil should still be given the preference for use in automobile motors for the following reasons: The use of castor oil reduces motor power about 1 per cent.; it leaves on the top of pistons a coating 50 per cent. heavier and more adherent, resulting in a more nauseating exhaust odor. Being more nearly colorless, castor oil is not easily observed in sight glasses, and it is not soluble in gasoline but only in alcohol.

Ignition by single or dual spark.—When a single camshaft is used and the combustion chamber is compact in shape, the double spark gives no advantage.

With two camshafts and two spark plugs placed over the inlet and exhaust valves, respectively, the following results were recorded: With two sparks the angle of spark advance is twice as small as with one; the efficiency of the motor is improved; timing can be omitted without reduction of the power, but the motor knocks when slowed down. The knocking is avoided by using magnetos with spark advance.

Location of spark plugs.—In a motor with single camshaft the spark was produced, successively, over the inlet valves, in the cylinder axes and over the exhaust valves. The location over the inlet valves, which agrees with common practice, was found to produce a very small power increase. No appreciable difference was noted, whether the terminals were projecting or recessed.

In a motor with two camshafts the location of the spark over the inlet valves gave a marked increase of power, as compared with the location over the exhaust valves. The latter method produced slower inflammation, as shown by backfiring when the motor speed exceeded 1,800 turns per minute. To have the plug project into the combustion chamber produced, with this construction, a 1.7 per cent. increase of power at 1,700 turns per minute.—*From Génie Civil.*

Drop-Forging Art Held Back by Too Many Specifications

ACCORDING to a paper by Arthur Stubbs which was read before the Institution of Automobile Engineers last month the wider adoption of drop forgings for automobile parts is hindered in England not only by the relatively small output of the average British manufacturer, which makes the cost of dies high, but also by an unsettled condition with regard to the question of who should decide the grade of material to be used for a given design. It is usual for the motor car manufacturer not only to specify the material but also the tests to which it is to conform. The steel maker and the forger can then both retort, in the case of failure, that the steel was not suited for the design. Mr. Stubbs recommends that the whole responsibility be placed upon the forger and that he be held to produce forgings which will stand specified physical tests. This would compel closer cooperation with the designer before work is undertaken and would lead to a more widespread understanding of the different flowing-properties of alloy steels. He mentions that for drop forge work nickel steels show a tendency to develop fissures and surface defects, that chrome-nickel steels are liable to be spoiled by the re-heating which becomes necessary on account of their toughness, and that chrome-vanadium steels generally give better results, being easier to forge and machine while having high shock resistance.

$200,000,000 for Kansas Farmers—Car Sales Boom

(Continued from page 1063)

2 months there has been no word from the city hall nor the Metropolitan Street Railway company regarding the jitney business. There are nearly 500 small cars and buses operating in this city while from several small towns just outside Kansas City regular service has been established.

There are now forty-two jitney buses operating, all of them except ten, on regular touring car chassis with bodies made at home or in Kansas City carriage company plants. The ten cars that are not on regular touring car chassis, were made by the Studebaker company for regular jitney bus trade and involve special axles and tires. They are pay-as-you-enter cars. They are operating over one route about 3 miles long and maintain a 4-minute schedule during the busy part of the day and a 7-minute schedule the rest of the time.

They are operated by the Kansas City Jitney Bus Transportation Co. They have been in operation almost a month and W. F. Miller, the president of the company, says the average earnings of each bus per day is $20. From this Mr. Miller figures that he can junk each bus at the end of a year and buy a new bus of the same kind at a cost of $1,200 and show a good profit. This company expects to have forty buses operating inside of 2 months.

Co-operative Co. of Bus Owners

Another innovation in the jitney business here is the formation of a co-operative company of bus owners. Ten have banded themselves under the name of the White Star Line and are establishing a service that closely resembles the Kansas City Jitney Transportation Co. line.

Locomobile Refines Both Sixes for 1916

(Continued from page 1075)

series wound, weighs 21 pounds and develops about .7 horsepower at 5.25 volts. It revolves the 38 at about 125 r.p.m. and the 48 at about 115 r.p.m.

A feature of the lighting system is the lock switch which has a night and day arrangement. There is also an On position which renders all the lights, horns and ignition switches operative. In the day position all the lights are disconnected, the magneto grounded and the starter disconnected so that it cannot be used. Thus if the car is left anywhere in the day time it cannot be tampered with. In the night position the lights are connected, the tail and side lamps being on and cannot be turned off while the starter cannot be used.

With the ignition system, the magneto is set so that with the spark fully advanced the spark occurs while the piston is still 7-16 inch from the top of the cylinder on the 48 and 5-16 on the 38. On the battery system, the breaker is set to make the spark a little later than with the magneto when the spark control is set to full retard. This is done to make cranking safe in case of failure of the cranking system. The firing order is 1-5-3-6-2-4.

Clutch Entirely Redesigned

The clutch, which is entirely new for this season, is a dry-plate design with a cast steel housing bolted to the flywheel and driven with it. The housing contains six hard steel keys riveted to it and equally spaced about its periphery. Meshing with the keys are nine thin saw steel disks, each 1-16 inch thick. The clutch disk retainer also has steel slots and eight saw steel disks which mesh with it. These disks are free to move in a lateral direction along the axis of the clutch and forming the driven member. Between each pair of driving and driven disks is a heavy woven fabric disk of material much resembling brake lining. These fabric disks are floating and neither driven nor are driven but serve merely as a medium for transmitting the driving torque from the driving to the driven disks. This new clutch design provides a smooth engagement.

Four speeds are provided in the gearset, the first having a ratio of 14.152 to 1, the second 6.793 to 1, the third 4.950 to 1 and the fourth 3.538 to 1. The reverse is 20 to 1. The drive is taken through a chrome-nickel steel shaft with a full universal at the gearset end and a block and pin type at the rear axle end.

A floating rear axle is used, the Locomobile design of seamless steel tubes forced into the rear axle housing under heavy pressure and then riveted being continued. The axle shafts are chrome-nickel steel. The gears are spiral bevels of 4-pitch, manufactured from chrome-nickel steel, and the floating construction is carried out to permit the entire dismounting of the bevel gear differential and live axles without even jacking the car. A torque rod is anchored to the rear axle housing and engages with the rear gearbox cross member by means of a shackle.

The front springs are 38 by 2-inch semi-elliptics and the rear 50 by 2.5 3-4 elliptics. The eyes are bronze-bushed and the shackles are drop-forged with steel shackle bolts. The springs are fastened with alloyed steel clips. The frame is made up of pressed steel channels, the side members being 6 inches deep with 1.75 inch flanges and made from 5-32 stock. The material used is chrome-nickel steel and all members are hot riveted together, the holes being drilled and reamed.

Two Concentric Brake Drums

Brakes are carried on the distance rods which absorb all braking torque. There are two concentric drums, spaced apart, allowing air space for cooling. The body straddles the chassis and is supported on three bronze brackets on each side and also by the two top leaves of the rear spring which are extended beyond the spring perch to permit fastening the body to it. Both stock and custom bodies may be furnished with the cars, but the feature of construction is the sheet aluminum paneling over wood frames, securing lightness and strength. The rear doors on the open bodies are 25 inches wide and on the closed bodies, 26 inches. The front doors on the touring cars can be opened forward for ventilation and the entire body is fitted out for great luxury. A special feature of the windshield is that the lower half is independent of the upper and either may be swung into any desired position. The upper glass overlaps the lower so that no rain can enter. Left drive and center control are used with emergency lever on the left. Tires for the 38 are 36 by 4.5 front and 37 by 5 rear. For the 48 they are 37 by 5 all around.

The prices are: for the 38 for six-passenger touring cars and seven-passenger touring cars, $4,400; limousine, $5,400; landaulet, $5,500, and Berline, $5,700. For the same bodies on the 48 the prices are, respectively, $5,100, $6,200, $6,300 and $6,500, with full equipment.

THE AUTOMOBILE

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, June 17, 1915 No. 24

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Ave., Phone Harrison 7707
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - - - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - - One Year, $3.00
Canada - - - - - - - - - - - - - - - - - One Year, 5.00
Foreign Countries - - - - - - - - - - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

S. A. E. Still Growing

TO talk of the remarkable progress of the S. A. E. has become platitudinous and there is no longer any need to argue that it is a powerful society which is doing a power of good work. But when a person or a concern is making great headway, when he or it is making a great success; right then is the time to beware of the rocks.

The S. A. E. has been fortunate in the possession of officers who appreciated this truism at the full, with the result that a success once scored by the society has always been taken as simply a stepping stone to the next accomplishment. The meeting at Detroit last week was chosen as an opportunity for several of the men who have made the S. A. E. what it is to express their conviction that now is the time for redoubled effort on the work of standardization, that the usefulness of the few standards already adopted must not be regarded so much as proof of work *done* as proof of the work needed *to be* done.

The cry for more members from the executive side of the automobile industry is one which every engineering member should heed, for it is up to executives to use what the engineer provides and, if he makes standards with an eye to their money saving value, the fact must be brought home in the proper quarter. Far the best way to do this is to get the executive men to the meetings and on the membership roll and this is to be the great endeavor of the coming year.

110 Miles an Hour

THE completion of the Chicago 2-mile board speedway with its scientifically-banked board surface has already opened a new régime in motor racing and the average speed for a lap on American speedways has within a week jumped from less than 100 miles an hour to over 110 miles per hour. Since the conception of the Indianapolis speedway, the American public has been inclined to think that averages between 80 and 100 miles per hour were the limits of racing cars today, but this delusion has been dispelled. Chicago's track has already proven that the high-speed car is valueless without a scientific track for it to run upon. For years Brooklands has held top figures in speed performances, first because the track was properly constructed and second, due to the English makers building cars that were capable of speeds as high as 125 miles per hour.

Now that tracks are being built in America which will contain speeds it is hoped, up to 140 miles an hour, it remains for our manufacturers to build cars that will have speeds up to the limit of the track, a nice engineering problem.

The May-June Dilemma

THE sentiment is growing that automobile manufacturers are erring in disturbing what should be the best selling period of the year, namely, the months of May and June by the announcement of new models during these months and thereby not only disorganizing the entire selling forces of the country during this period, but also upsetting the mind of the prospective buyer.

There has been a strong sentiment against this annual May-June program, but manufacturers seem insane on getting their announcement before the public at the earliest moment, in some cases irrespective of the best interests of their dealers. The present work of the National Automobile Chamber of Commerce to change this condition will not meet with very early success because manufacturing concerns will continue to use those policies which they think best suited for their particular needs, consequently, it would seem that the spring disturbance is scheduled to continue for some time to come.

The most unfortunate aspect of this spring disturbance is that hundreds of dealers are brought out of their territories to the factories during this period. May and June would seem to be months when these dealers should be at home, pushing the sales and perhaps lending every aid in clearing up the last cars. These dealers would find it more convenient to visit the factories at other seasons when home needs are not so urgent.

Some manufacturers are making an error in announcing their new models before they are ready to make deliveries to customers. It is a good plan to start your selling campaign well in advance of when you hope to make deliveries, but it is questionable business to put on a selling campaign for prospective buyers and not have the goods on the counter that these buyers want.

Buick Plans 400 Cars Per Day

Factory Additions Make 60,000 Cars for 1916 Possible—50 Per Cent. Sold

FLINT, MICH., June 12—When the additions to the Buick Motor Co. are completed and the new machinery installed, which will be within the next 3 weeks, production will average 400 cars a day. With an output of 60,000 cars planned for 1916 or 15,000 more than this year, it is stated that since the announcement of the new sixes was made less than 2 weeks ago, more than 50 per cent. of the total scheduled production has been contracted for, by those dealers and distributors who have thus far visited the plant this month.

From Monday June 7 to this day, more than 800 dealers, distributors and sub-dealers have been or still are at the plant.

Timken to Add Cold Drawing Steel Plant in Canton

CANTON, O., June 10—Provided proper switching facilities and the vacation of part of an alley can be obtained, a new department, a cold drawing steel plant, will be added to the Timken Roller Bearing Co. in Canton, O.

The new plant which will produce a new product will employ 150 men at the outset. It will be in a building 300 feet long and 100 feet in width and will be located adjacent to the roller bearing factory off Deuber avenue. At first there was some discussion of locating the new plant in Detroit where most of the output will eventually be sold, but the Chamber of Commerce induced the Timken company in connection with the Detroit plant officials to locate the factory in Canton.

U. S. Rubber Output Gains 30%

NEW YORK CITY, June 15—The United States Rubber Co.'s tire output is running 30 per cent ahead of last year. The company is now stocked up with crude rubber costing about 8 cents a pound below the present market quotations. The average output, including both the Detroit and Harford works, is now slightly over 9,000 automobile tires a day. With a little more machinery, the Detroit plant alone will be in a position to manufacture 10,000 tires a day. Officials of the company expect a production of approximately 1,500,000 tires this year.

Fisher Buys Universal Plant

DETROIT, MICH., June 11—The Fisher Body Co. has purchased the four-story plant of the Universal Motor Truck Co., Theodore street, and 3 acres of ground property of the truck company. The deal involves $120,000 it is claimed. This is the second big purchase made by the Fisher Body Co., within a few weeks, the first being that of the bankrupt Detroit Body Co., for a consideration of $170,000.

Business of the Fisher company has been increasing so rapidly that even with these additional plants it is possible that further additions will be necessary. The added business comes from the regular customers who have ordered from 50 to over 100 per cent. more bodies for their 1916 business than for 1915.

New Velie Six Reduced $530

MOLINE, ILL., June 11—The Velie Motor Vehicle Co., Moline, Ill., has made public the first details of a new six-cylinder Biltwel model which is to sell for $1,065, a reduction of $530. The car is slightly smaller than its $1,595 companion, and is equipped with a 3 1-4 by 4 1-2 Continental motor with removable cylinder head. Drive is through a dry multiple-disk clutch, three-speed selective gearset and floating axle. Remy electric lighting and starting apparatus is standard equipment. Tires are 32 by 4 inch with non-skids in the rear.

Buys Zephyr Carburetor

DETROIT, MICH., June 12—The P. R. Mfg. Co., 621 Bellevue avenue, which for 20 years has been a manufacturer of electrical and metal specialties, has purchased from G. A. Breeze the patents and rights to manufacture and sell the Zephyr carburetor, which the company has already started the marketing of.

$50,000 Bldg. for Republic Truck

ALMA, MICH., June 14—After considerable bickering the plant of the Republic Motor Truck Co. has been assured to Alma, Mich., through the raising of $10,000 by the board of trade of that city as first payment on the building being used by the company. The building will cost $50,000. The plant has been forced to work a night shift in order to catch up on its orders, and the company expects to turn out more than 300 trucks during the present month.

Saxon Triples May Shipments

DETROIT, MICH., June 12—Three times as many cars were shipped by the Saxon Motor Co., in May, 1915, as during that month in 1914. It was at the same time the biggest month the company had since in business. More than 3,500 orders for fours and sixes were on the books when June started, and in all probabilities this will be a still bigger month than May. Since the first day of June the daily average has been 120 cars. This is at the rate of 3,120 for the whole month on a basis of 26 working days.

Ship 1,282 Chandlers in May

To Build Over 10,000 This Year—103 Shipped in 1 Day Is Record

CLEVELAND, O., June 12—During May the Chandler Motor Car Co. shipped 1,282 cars valued at $1,666,190, an increase of 493 per cent. as compared with May, 1914. The biggest day's production was May 29 when 103 cars were shipped. President F. C. Chandler states that before the end of 1915 more than 10,000 cars will be built and shipped by the company. Although the plant has been enlarged the increasing production will probably require further additions. Several of the final test departments are housed at the present time in two large circus tents.

The daily production average has steadily progressed since early in April. By April 1 the company was shipping forty cars per day; by May 5, fifty cars per day; by May 20, sixty cars per day, while an average of ninety per day was maintained for the last week in May.

Franklin ½-Year Business 64% Better Than 1914

SYRACUSE, N. Y., June 10—The Franklin Automobile Co., this city, shows a 64 per cent. increase in business for the first 6 months of 1915 over the same period last year. Sales are 39 per cent. greater. The business increase represents shipments only, the factory not having been able to keep up with the demand, actual orders received being 90 per cent. over last year.

Holders of the company's preferred stock have been notified that the company will take advantage of its option and retire all the stock on July 1, paying thereafter $110 per share and accrued dividends. The stock was sold in 1913 at par.

A large addition to the Franklin plant is about to be erected on Geddes street. The building will be of fireproof construction. Plans are being worked out for a still larger addition, the construction of which will probably be started in the early fall.

Goodyear Managers Meet in St. Louis

ST. LOUIS, MO., June 12—A conference of the Goodyear Tire & Rubber Company's branch managers was held here today. District Manager M. H. Parsons and St. Louis Branch Manager W. E. Finney, entertained the managers from Kansas City, Oklahoma City, Dallas, Houston, and San Antonio. Business conditions generally and the company's business in particular were discussed.

Artemas Ward, Jr., Heads King

Succeeds J. G. Bayerline—F. A. Vollbrecht Is Vice-President and General Manager

DETROIT, MICH., June 14—Following the resignation by J. G. Bayerline as president of the King Motor Car Co., comes the announcement that the board of directors has elected vice-president and advertising manager Artemas Ward, Jr., as president, and secretary and treasurer F. A. Vollbrecht as vice-president and general manager. Mr. Vollbrecht will also continue as treasurer of the company.

The announcement of the changes was made at a dinner given by officials of the King company to Mr. Bayerline at the Statler Hotel tonight. It was with regret that Mr. Bayerline announced that other plans which he had been formulating caused him to sever his connections with the King company to devote his undivided attention to the new proposition. At the present he is unable to announce his plans.

As a result of the changes, J. B. Seigfried, factory production manager and purchasing agent, takes the position of assistant general manager in charge of the factory. J. R. Emerson is purchasing agent, W. L. Daly continues as sales manager, while H. C. Bradfield resumes his duties of sales promotion and advertising manager at the factory.

Car Exports to Argentina

WASHINGTON, D. C., June 12—American-made cars imported into Argentina increased from 10 1-2 per cent of the total automobile imports into that country in 1912 to 19 per cent in 1913, though they dropped 30 per cent in 1914, owing to the depression in trade, according to the latest official returns which reached the Bureau of Foreign and Domestic Commerce.

Total automobile imports into Argentina in 1913 were valued at $5,194,200, the countries of origin being France, the United States, Germany, Italy, the United Kingdom and Belgium in the order given. Thus the United States jumped from fourth place in 1912 to second place in 1913, its actual and relative gain being greater than in the case of the other nations.

In 1914 the world-wide business depression affected all automobile exports into Argentina, those of the United States dropping to but a little over a third of the total for 1913 and the other countries' shipments falling in proportion.

The following table, from the official Argentine publications, gives the number and value of automobiles imported into that country in 1911, 1912, 1913 and 1914:

Imports of Automobiles Into Argentina, 1911 to 1914

Year	Number	Value
1911	2,461	$2,346,800
1912	4,281	5,149,000
1913	5,115	5,194,200
1914	2,185	1,305,200

Imported from	Number 1912	Number 1913	Value 1912	Value 1913
France	1,651	2,939	$2,252,500	$1,914,900
United States	708	1,294	544,000	1,003,600
Germany	627	761	822,200	848,800
Italy	622	425	547,200	692,500
United Kingdom	451	412	430,500	471,800
Belgium	295	302	433,900	351,200
Other countries	122	69	124,300	111,400

Government Awards Motor Truck Contracts

WASHINGTON, D. C., June 11—The general supply committee has awarded the following contracts for furnishing the executive departments here with motor vehicles during the fiscal year beginning July 1, 1915:

The Waverley Co., Indianapolis, electric truck, 1,000 pounds capacity, $1,660; with screen side express body, $1,920; with standard full panel body, $1,925.

Fifteen hundred pound electric truck, no award.

The Waverley Co., 2,000-pound truck, $2,095; $2,385; $2,425; $2,450.

Kentucky Wagon Co., 2-ton electric truck, $2,650; $2,985; $2,010.

Baker Motor Vehicle Co., Cleveland, O., 3-ton electric truck, $2,975; $3,360; $3,435.

Eight hundred to 1,000-pound gasoline truck, no award.

Commercial Automobile & Supply Co., Washington, D. C., 1,500-pound Studebaker truck, $1,025; $1,125; $1,125.

The White Co., Cleveland, O., 2,000-pound truck, $1,835; $1,950; $2,150.

Velie Motor Vehicle Co., 3,000-pound truck, $2,025; $2,155; $2,159; $2,169; 2-ton Velie truck, $2,280; $2,324; $2,470; $2,490; 3-ton Velie truck, $2,680; $2,882.-70; $2,908; $2,940.

Stearns Building 5-Story Plant

CLEVELAND, O., June 9—The F. B. Stearns Co., this city, has broken ground for immediate erection of a five-story concrete factory building. The new building is being erected on the 6-acre site owned and now partly occupied by the company's plant. It will have a frontage of 175 feet on Euclid avenue, extending back 75 feet toward the Nickel Plate railroad which marks the northern line of the company's property. It will be completed about October 1.

The Stearns company has promoted T. A. Boyle to the position of advertising manager and manager of the service department. G. W. Vaughan has been appointed special sales representative.

New Canadian Ford Plant

Six-Story Building Adds 145,000 Square Feet—Roof and One Side of Glass

FORD CITY, ONT., June 12—An addition, 700 by 45 feet, will be started by the Ford Motor Co., of Canada, Ltd., in a few days. It will be a six-story structure and might almost be called a glass house, as the side facing the river and the entire roof will be of glass. It will be erected upon a site which was formerly part of the river but which the company started to have filled 2 years ago. From 300 to 500 piles, 35 to 40 feet long, will be used to support the new building which will cost about $85,000.

Second Addition in 14 Months

This is the second big addition to the Canadian Ford plant within about 14 months. The other addition, a six-story building, 210 by 194 feet, is now almost completed and with the two additions the total floor space of the plant will be increased by 145,000 square feet.

The Ford business has been growing rapidly during the last 2 years and this year especially it has been very good. From an output of 100 cars a day the average has passed to near 200 a day and it is planned to increase this to 300 or more this year.

40,888 Fords in May

DETROIT, MICH., June 12—Production of Ford cars during May totaled 40,888 or 5,630 less than in April. Nevertheless there need be no fear that the scheduled 300,000 Ford cars will not be made and sold, as predicted by the Ford company, by the end of the fiscal year, July 31. Including the May output there have been made and shipped 251,321 Fords, thus leaving 48,679 to be made in June and July or 24,339 each of these 2 months.

Crescent Bond Issue Attacked

CINCINNATI, O., June 10—In the matter of the Crescent Motor Co., of Carthage, bankrupt, petitions were filed in the United States district court by Thomas L. and J. Lloyd Wayne, setting up claim of ownership of 100 shares of common and 100 shares of the preferred stock of the Crescent Motor Co. and attacking the validity of the company's bond issue of $100,000 on the ground that the preferred stock held by them contained the provision that no mortgage should be given on the property without the consent of the holders. They ask the court to decree the bonds null and void as to them and that their rights be protected.

Engineers in Session on Georgian Bay

Noronic Delayed 5 Hours by Fog—Program Goes by Schedule—President VanDervoort Asks for High-Grade Members—Society Must Grow and Broaden—Many Papers Read and Discussions Good—Compare Eights and Twelves

MIDLAND, ONT., June 15—*Special Telegram from steamer Noronic*—Carrying out the announcement made by President W. H. VanDervoort, the business of the Society of Automobile Engineers, on their summer cruise through the Great Lakes, is proceeding strictly according to schedule, although the cruise itself has been delayed by fog and the trip through the 30,000 islands will be made Wednesday morning.

The meeting started at 4 o'clock yesterday when President VanDervoort made his address of welcome, the keynote of which was the advancement of the Society through the most rigid scrutiny of the quality of applicants for membership and an application to the tasks at hand.

The report of A. B. Cumner, treasurer, showed the affairs of the Society covering the last fiscal year to be in excellent condition. The cash balance on hand at the close of the fiscal year, May 31, 1915, amounted to $13,309. One hundred and five new members have been added to the Society besides which there are a large number still to be approved by the Council. Of these added twenty-seven are full members, twenty-three associates, twelve juniors, five affiliates and thirty-eight students' enrollment.

New Nominating Committee

Election of the nominating committee resulted in the appointment to this committee of H. G. McComb, from the Metropolitan section; K. W. Zimmerschied, from the Detroit section; Howard Marmon from the Indiana section and at the general election, B. B. Bachman, Henry Souther, David Ferguson and J. G. Perrin.

A vote of thanks was passed by the members to the Detroit factories who had furnished cars and entertainment to the members while in Detroit. Besides this there was no new business and the professional part of the meeting was immediately begun.

President VanDervoort opened the meeting by a few words of welcome, stating that he hoped that this would be made the most enjoyable meeting ever held by the Society both as a real respite and in the way of benefits which would be brought to the members. Speaking of the development of the industry, he stated that it had figuratively in 1 day grown to marvelous proportions. He said that it had developed so rapidly that it cannot be compared to what it was 15 years ago. The prophecy, carriages without horses shall go, has been a true one. It has produced changes in the mode of life. The countryman is no longer isolated and the business man finds that the increased efficiency in being carried at about the speed possible with automobile, that he has more time to devote to his business. The Society of Automobile Engineers will advance to great prominence among engineering society circles. It should aim to have a strong engineering membership and should have good quality of membership so that a membership in the Society will be a real asset. This can be reached by a careful scrutiny of the applicants. The requirements for all membership in the Society must be raised and before it can be attained the applicant should have the proper experience and training. Care must be used to guard against commercialism, and there is disaster in the tolerating of commercialism. The Society must be broad in its treatment of ideas. Years ago, conditions in the industry were such that the membership of the Society suffered a loss. For inability to pay dues and for other reasons eighty were dropped in February, but at the present time the loss is only four more than the gain and there are still a number of names to be passed upon by the council. At the present time the Society has a student enrollment of fifty-one.

The treasurer's report is excellent The Standards committee has been going steadily forward and while the development of the standards is necessarily slow as it takes time to mould the opinion. Progress is being made rapidly while the cars produced by different manufacturers will always differ in a large number of details. Still, there are many parts which can be made alike in all cars and the committee is striking these vulnerable spots.

President VanDervoort recommended the taking of a letter vote in the adoption of a new standard rather than in a vote at the open meeting because in that way a number of these who could not vote otherwise would be able to put in their votes. Another point mentioned was that the National Automobile Chamber of Commerce had again pledged $3,500 to be given to the S. A. E. for the furtherance of its work.

In contrasting former methods with those of today, President VanDervoort stated that the idea at first was to produce the greatest reliability and cost considerations were secondary. Now the cost considerations are paramount without any of the reliability being sacrificed. The highly systematized work of today is what has enabled the manufacturer to bring the costs of the cars down. Consider the stationary engine, which operating on its fixed base, need give the engineer no concern on weight but only on rigidity. Also consider the locomotive which operates on rails, and which is always in the care of an expert mechanic. How different is the automobile with its highly developed mechanism and with its weight per horsepower reduced to the lowest possible point. The owner is always expecting too much from his car and getting less than the machine is capable of.

Car Not Competing with Horse

The passenger car is not competing with the horse. Its great speed and reliability have rendered it above that, yet the problem of the commercial vehicle on short hauls has not as yet been solved successfully. The long-distance haul for the commercial vehicles is a success but in this good roads are essential. The commercial car has successfully competed with many other types of transportation, even in certain instances with the railroad. A car can deliver goods from the shipper to the purchaser without necessity for transporting to and from stations. Good roads will help, however, in the further development of the commercial car.

Farmers have now accepted the automobile in spite of their former prejudice and we may soon expect to see trucks for hauling farmer's products. During the past year we have seen the results of trucks in warfare, and in our maneuvres the same facts have been demonstrated in hauling troops and provisions.

The automobile parts maker has come to hold a unique position; practically all the car makers go to him for parts at the present time. He can produce the parts cheaper than the car maker and it is only a few of the largest of concerns that can hope to make successfully their own carburetors, magnetos, etc.

We must work in close harmony with the commercial side of the business. At one time during the last year the supply had caught up to the demand but at the present time the demand is ahead of the supply. However, with the big production schemes now under way this condition will not last long and the engineer must set himself to work to meet the keen competition. The automobile business will not get into a rut quickly. Progress is being made too rapidly for that and we cannot predict what the universal car will be in the future. It might be a four or a twenty-four. Dare we predict what we will be able to give to the public in 1925?

Clutch Field Waiting

Introducing his paper on clutches which was the first on the program, W. F. Herst said that the subject was so little thought about and yet so important that he had ventured to open discussion with a very brief paper. He remarked that the subject was brought especially to his notice by some work done by the miscellaneous division of the standards committee, in which the fact came out that nearly 200 different sizes of clutch facings were used on disk clutches of dry-plate types. This fact in itself showed that the clutch was a part of automobile make-up that the Standards committee might consider.

D. Landau asked whether the triple-cone clutch described in the paper was not an old Panhard invention, and Mr. Herst replied that he had no information on this point, but that the clutch as he mentioned it was now in course of development by a Cleveland man. N. B. Pope suggested clutch action ought to be expressed in terms of slip and that the ideal clutch, according to many engineers, ought to have a degree of slip under the driver's control, so that he could make it grip slowly or quickly at will.

J. D. Waite asked the coefficient of friction upon which Mr. Herst figured, the reply being that it varied very greatly with different asbestos materials, so greatly, indeed, that some of these fabrics were compounds that could not be used for clutches while they were good for brakes.

F. E. Moskovics raised the question of desirable pedal pressure, saying that it varied greatly, and Mr. Herst replied that his tests showed a variation of from 70 pounds down to 12 pounds needed to release the clutch. It was his opinion that a good average would be about 40 pounds.

C. T. Myers' paper on a formula for the comparison of automobile performance was not prepared in time for printing previous to the meeting, and as it is largely mathematical, discussion proved difficult, the members having no reference in their hands. The main theme of Mr. Myers' proposal was that the ultimate thing which determines road performance of an automobile is the effort at the tire which the motor is able to exert. Taking V. C. as the coefficient of the vehicle

$$VC = \frac{8.4\,NB^2SR}{DW}$$

Where N is number of cylinders, B the bore of motor, S the stroke, R the gear ratio, D the diameters of road wheel in inches, and W the weight of car and load. This when multiplied by two constants representing the mechanical efficiency of the engine and chassis, gives, in the author's opinion, a ready method for calculating the respective road ability of different cars.

He said the formula could be used to show the ability of the car to ascend a grade on high gear and gave some interesting examples, in tabular form, that showed the effect of altering gear ratio or motor size.

Professor F. R. Hutton questioned the character of the formula as depending upon the A. L. A. M. horsepower formula, but Mr. Myers covered this point by saying that it was intended for comparative and not absolute results.

C. W. MrKinley, Overland engineer, spoke in favor of accelerometer testing, saying that he found a little practice with the instrument enabled quick determination of a car's condition to be made, which would come as near as 3 per cent. to the laboratory determination on the dynamometers.

Testing Electric Vehicles

The next subject was the determining of a standard electric vehicle test with much the same aim in view as that in mind by the author of the last paper regarding gasoline cars. In the absence of T. H. Schoepf, of the Westinghouse company, the paper was read. W. Conant enlarged on the importance of a standard method for testing, because at present two manufacturers might claim the same performance in 10 miles and yet the capacity of the vehicles be different, solely because of difference in the test details.

R. McA. Lloyd, New York, said that he considered the method of testing suggested was no better than the old method, because the rest given the battery during stops and braking increased its capacity to a great enough extent to compensate for accelerations. The old style non-stop run was easiest to make at prescribed speed, and therefore more reliable.

Commercial Tractors

Recognizing the increasing importance of the tractor as a special field of the automobile industry, two important papers were devoted to phases of it in the Monday evening session. Philip R. Rose presented a valuable discourse upon farm tractors and their motors, while Frank Trego's (Knox company) paper was referred to in the absence of the author. In amplification of his written ideas Mr. Rose said that the tractor holds out great possibilities for the future of agriculture. He cited some interesting statistics to show the enormous expenditure now necessary for what he termed animate power. It takes 5 acres of land to raise enough to feed a horse or mule and when there are 255,000,000 horses with a value of $2,842,000,000, the magnitude of the farm power problem is evident; in fact, the farm power problem is the biggest in any industry in the country. One reason tractors have not progressed farther is that they are not used by a class that is up on mechanics, as a rule, and there are no garages or repair shops where they may be intelligently cared for. At first tractors sold as high as $3,000, but now they are available for as low as $600 or $1,000. At these prices there is room for 2,500,000 of them, there being that many farms of 100 or more acres, and these being of the minimum size on which they can be worked efficiently. Farms must be laid out and other operative conditions considered in order to make them paying in any case.

Construction Must Be Rigid

Mr. Rose called attention to the fact that the construction must be rigid to take care of the excessive vibrations to which such vehicles are naturally subjected, and also pointed out that cooling is a problem, large tanks of water being carried in most designs. When asked regarding reference which he had made to the use of rough-cast gears rather than hardened and ground ones, Mr. Rose pointed out that for the large amount of grit and dirt which they catch such gears are just as efficient and cost less than the machined ones. A tractor in farm service travels at the rate of from 2 to 2.25 miles an hour, and hence it stays right in the dirt and dust and does not have a chance to get away as do the faster-moving trucks. For this reason air filters were often employed to keep the dust out of the engine. J. P. Fitzpatrick inquired regarding the feasibility of using worm drive, and Mr. Rose was encouraging on this point. One at least having appeared and looking very attractive it can be worked out undoubtedly.

Henry Souther, ex-president S. A. E. brought up the point as to whether or not a single tractor is likely to be used in a community or by several farmers. Mr. Rose said that it had been mentioned, but that farmers as a rule, are not easy to organize in that way. In a community the farmers are all apt to have the same crop and thus the work all comes at the same time, then the farmers all want the tractor at once and they cannot agree as to who is to get it first. It is the same condition as with the threshing machine, every man wants it at the same time.

Herbert Chase, A. C. A., New York, wanted comparative figures as to the total fuel used by the agricultural interests and the automobile industry, and it was thought that there was about as much consumed by automobiles as by agriculture outside of motor vehicles. Regarding air filter and just how serious the dust factor is, Mr. Rose cited one locality in Washington where there is a volcano ash land, and here one concern had to abandon tractor selling due to the dust getting into the cylinders and cutting them out. Rings were worn to mere slivers in another case. Filters usually consist of a disk on the end of the inlet pipe with muslin on either side of it. In another form a special muslin is used with strikers on one side.

Two-wheeled tractors were mentioned and the special advantage of getting into corners with them was cited. They usually are constructed with two large wheels and the motor in between with the plows in the rear.

C. T. Myers also mentioned the light and cheap type of tractors now undergoing development, they drawing considerably upon automobile practice. The vibration trouble he said is similar to that in the early days of the truck, but now the designers make them less rigid so that they will conform to the road.

In the absence of A. R. Miller, of Detroit, K. W. Zimmerschied read the main points of his paper on increasing truck efficiency with trailers. Mr. Zimmerschied also read two dissenting opinions by absentees from the trip. H. D. Church, Packard company, was one of these and he believed that a truck is designed to carry a certain load and not pull several times its capacity. Continual use of its pulling powers brings about many losses and there is not sufficient cooling capacity to pull in hot weather. Traffic conditions and the inadequacy of brakes to handle trailers are also points against their use, according to Mr. Church.

John Younger, Pierce-Arrow, is also against the use of trailers as it increases depreciation, according to his view. He disapproves of rear members of truck frames being standardized in order to make use of trailers.

Automobile Lubrication

Oil was refined in a model refinery by G. W. Stratford, of Pratt & Washburn, refiners, who gave the paper on Automobile Lubrication, as the result of a long and painstaking investigation. H. L. Connell asked regarding oil filters on motors. Mr. Stratford said he has had no experience with oil regeneration, but it is surprising how the color may be brought back by passing the oil through waste. He approves of a settling basin rather than a filtration within the engine.

Henry Souther spoke for the co-operation between the refiners and the users as typified by Mr. Stratford, telling of his experience, he being a refiner. In the old days all was mystery, now we are getting something worth while. He cautioned against laying everything to lubricating oils as being the cause of all ills. There must be some give and take.

Mr. Myers questioned as to what had been learned as to the effects of good and bad mixtures on carbonization. Mr. Stratford said that it is very difficult to determine the amount of carbonization from a poor mixture. Rich mixtures show big increase in carbon deposit and it may vary from less than 1 per cent. to as high as 75 per cent., depending upon how much of the time the explosions are on full throttle opening.

At the start of proceedings on Tuesday morning, President VanDervoort announced that the paper on Tire Inflation would be postponed till tomorrow, the author being absent and expected to come aboard later. Thus the first paper taken was on Spiral Bevel Gears. A. L. Stewart, of the Gleason Works, expounded this very lucidly, using some sketches, and the discussion following was extremely vigorous, centering mainly around the question of durability of tooth form. It was maintained that the permanent pitch line contact in bevel gearing caused wear over face of tooth at an even rate, while in other gear forms, except worm, the pitch line wear is slower than wear at other portions of the tooth face.

A. P. Brush's paper on engine design covered the reasons for many phases of engine design and brought to a head discussion on the merits of the eights and twelves. Discussion on that point has been called for by President VanDervoort and no doubt later in the meeting some valuable discussion will ensue. Mr. Brush's paper brought out much discussion on the merits of eights and twelves and the discussion was handled by such engineers as Huff, Coffin, Donham, Ferguson and White. It broadly indicated that the question of piston displacement per cylinder is the fundamental factor.

Resta Goes 110.1 M.P.H. on Chicago's 2-Mile Board Speedway

500-Mile Race Postponed to June 26 Because of Strike and Rains—Stutz Cars Average High—All Cars Qualify to Date

CHICAGO, ILL., June 15—*Special Telegram*—The 500-mile race to be held Saturday, June 19, on the new 2-mile wood speedway in this city has been postponed 1 week and will be run Saturday, June 26. Continual rains have placed the infield in such a condition that it is impossible to park cars and the street car strike in the city has made the running of the race practically impossible. Some of the elimination trials have already been made but they will not be completed until June 17.

This was the decision reached late tonight at a conference of the speedway promotors and the race officials, the majority of whom are members of the Chicago Automobile Club and pioneers in the promotion of speed events.

It is believed that the postponement will make for a better race and will increase the attendance. Although the spectators could reach the speedway from the loop district without depending upon the street cars, the traction strike might have an untoward effect on the attendance since the fans would be partially dependent upon the surface and elevated roads to carry them from the residence sections to the terminals of the steam and interurban lines that run to the track. The postponement also will give the infield, now soft and muddy as a result of recent rains, a chance to dry out and thus permit easy parking of cars.

The drivers welcome the postponement as it gives them more time to prepare their cars and allows for more practice. Practice is a profitable proposition here, the pilots receiving 40 per cent. of the gate receipts. Last Sunday, each of the nineteen drivers that appeared on the track received $90 from the management and if this Sunday is fair, the speed stars expect to harvest a greater crop.

CHICAGO, ILL., June 15—*Special Telegram*—With the throttle of his Peugeot wide open and sweeping around the banked turns without decreasing his astounding speed, Dario Resta, winner of the 1915 Vanderbilt and Grand Prize races and second to Ralph De Palma at Indianapolis, May 31, established a world's speedway record for cars of 300 cubic inches piston displacement of 110.1 miles per hour this afternoon in the elimination trials for the inaugural race to be run on the Chicago board oval Saturday.

Resta's time for the 2-mile lap was 1 minute 5.4 seconds and shatters all existing records for the distance irrespective of piston displacement classification except the 2-mile mark of Jean Chassagne, who last year covered 2 miles on the Brooklands track in 60.51 seconds at the wheel of the twelve-cylinder Sunbeam. Resta's speed today was far greater than that ever reached by a 300-inch car, being 3 miles an hour faster than the world's 1-mile record of 107 miles per hour made by Georges Boillot in a 300-inch Peugeot at Boulogne-Sur-Mer last year.

Before Resta covered his record lap today, Earl Cooper was king of the new wooden track by virtue of a 2-mile drive at a speed of 109.09 miles per hour in practice last Friday.

Stutz Average High

Just as phenomenal as Resta's record lap was the showing of the three Stutz cars in today's elimination trials. All three entries qualified at a speed of 104 miles an hour or better. Cooper turned the fastest lap, his time being 1 minute 8.8 seconds. Gil Anderson's time was 1 minute 8.6 seconds and Howdy Wilcox made the circuit of the bowl in 1 minute 8.7 seconds. Such consistency is truly remarkable, there being but 2-10 second difference in the time of the fastest and the slowest car.

Fifteen Qualify

Fifteen of the twenty-nine entries for the Chicago race qualified today. None of the cars that reported for the tests failed to make a lap at less than an 85-mile an hour average, the speed necessary to start. Besides the Stutz, two other three-car teams qualified all three of their entries, Duesenberg and Maxwell. Two of the Knight-motored F. R. P. cars made their first appearance and escaped elimination.

The cars that have yet to qualify in the elimination trials to be held to-morrow and Thursday are the two Sunbeams driven by Von Raalte and Porporato; Chevrolet's Delage, Babcock's Peugeot, Brown's Du Chesneau, the two Mulford Specials, Henning's Mercer Special, Zucker's Berwyn Baby, Hughes' F. R. P., Joe Cooper's Sebring and Johnny Mais' Mais Special.

The cars that qualified today are:

Car	Driver	Time	M.P.H.
Sunbeam...	Harry Grant	1.16	94.73
Peugeot ..	Bob Burman ..	1.11.1	101.01
Maxwell...	Eddie Rickenbacher	1.14.6	96.55
Peugeot ..	Dario Resta	1.05.4	110.1
Duesenberg	Willie Haupt	1.17.6	92.65
Duesenberg	Tom Alley	1.15.9	95.00
Duesenberg.	Eddie O'Donnell....	1.17.6	92.65
F. R. P....	Earl Devore	1.21.3	88.56
Stutz	Howdy Wilcox ...	1.08.7	104.75
Stutz. ...	Earl Cooper	1.08.8	104.58
F. R. P. ...	Charles Keene	1.14.3	96.9
Stutz .	Gil Anderson ...	1:08.6	104.4
Maxwell	Tom Orr	1.22.2	87.4
Maxwell .	Billy Carlson ...	1.14.3	96.9
Sunbeam ..	Limberg	1:19.3	90.5

Motor Troubles Sure, Say Drivers

Chicago, Ill., June 15—Drivers in the 500-mile race Saturday prophesy a paradox from their experience on the new track. It seems to be the consensus of opinion that the race on the one hand will be the fastest long distance ever run in America, and on the other that there will be more motor trouble than ever has been experienced in a 500-mile race before.

Ralph DePalma thinks the track is too fast for the cars and that no car in America today will be able to test its possibilities. He expects an unusual amount of engine trouble because there will be no opportunity to close the throttle during the 500 miles. At Indianapolis it has been necessary to close the throttle to take the turns, which temporary rest adds to the life and staying power of the motor, allowing more oil to work up, allowing the engine to cool slightly and also relieving parts from the constant strain of the uninterrupted succession of explosions.

Porporato says that the race will be the easiest on drivers that ever has been run. He finds that the car goes into the turn and holds the turn at whatever level it enters the turn and holds this level clear around the turn, practically without aid of the driver; that little or no steering is necessary to keep the car on its course.

After Cooper had made his record speed of 109 miles an hour, he stated that at no time during the two miles was the throttle closed and added that the sensation of the turns which has been a feature of Indianapolis is eliminated at Chicago. Harry Stutz said it is possible for a car to make 140 miles per hour on the track and Bob Burman believes that were he to put his 200 horsepower Benz on the speedway he easily could make a lap in one minute, which is equal to 120 miles per hour.

A rather unusual prophecy was made by DePalma who said he expected to see a great deal of trouble with wheel bearings. On other courses which are not banked to the degree that the Chicago speedway is sent the pressure on the wheels which is made up of the weight of the car plus the centrifugal force on the turns is divided into two components—one in the direction of the vertical axle of the car; that is, a radial load on the bearings, and the other a side thrust which tends to cause the car to skid. With the banking as it is on the Chicago track, this side thrust is eliminated; that is, there is no skidding tendency.

Gasoline Price War in West

Standard Cuts 1 Cent, but Independents Refuse to Follow —Crenshaw Heads Latter

Kansas City, Mo., June 15—What looks like the opening shot in gasoline price warfare, between the Standard Oil interests and the independent operators and refiners, has started here by the Standard Oil Co. reducing price of gasoline 1 cent per gallon, from 9.8 to 8.8 cents, which is the only cut since February 22. Up to the present, local independent refiners have refused to follow this cut and are appealing to their customers to oppose the old rates. Twenty-four refiners representing Western petroleum interests in Kansas and Oklahoma fields, have met in Tulsa, Okla., and have refused to follow the present cut saying that such prices are profitless and that the Standard company would probably advance crude oil and further reduce gasoline. The claim is made in this section that the independent refineries which control much of the mid-continent and Cushing pools are gaining control of the market and that it may be such a condition has prompted the present apparent price war of the Standard company. The independents declare that the present European consumption of gasoline warrants an increase rather than a decrease in the price and that before the end of the year an increase of perhaps 1 cent or a little more may be expected.

The independent refiners are now better organized than previously, due to P. C. Crenshaw, who for 17 years was general manager of the Standard Oil Co. of Indiana, and who resigned in January to take up the problem of fostering better unanimity among the independent refineries. It is understood that Mr. Crenshaw's latest organization, the Home Oil Co., will control a considerable quantity of the independent interests.

Standard Oil's Explanation

The only explanation which has been offered for the cut by the Standard company of 1 cent, is because of the unfavorable weather during the month of May and reductions in the price of crude oil. An independent refiner interested with Mr. Crenshaw, says:

"The crude oil market has remained stationary since February. Notwithstanding this fact the gasoline market has been steadily reduced in the field of the Indiana company so that whereas on January 1 the price at Chicago was 11 cents, it is now 8 cents—either they were charging too much then or too little now. The eastern Standard companies, using the same crude, which is pumped through the pipe lines from the Kansas-Oklahoma fields, have recently advanced their market on gasoline. While business in May fell off materially, previous to that time it had been way ahead of last year and indications are that the gain in volume will be continued."

Service Convention in Detroit

N. A. C. C. Members To Standardize Parts Policy

June 28-29

NEW YORK CITY, June 14—A 2-day convention of the heads of the service departments of automobile and truck makers who are members of the National Automobile Chamber of Commerce, Inc., will be held in Detroit, Monday and Tuesday, June 28 and 29, at Hotel Statler. The object of the convention is to draft some definite standard system of factories handling stocks of spare parts with their dealers. One of the abuses that it is hoped to rectify is that of dealers holding stock of parts for several years and then returning them and expecting credits. Some progressive form of parts inventory will have to be worked out. The convention will be called at 10 a.m., June 28, and all of the ninety-seven members of the chamber have been asked to send representatives.

On Wednesday, June 30, the day following the service convention, the meeting of the committee of truck men appointed at the recent truck convention to work on some form of service policy for truck makers will meet at Hotel Statler. Chairman Windsor T. White of the commercial vehicle committee of the N. A. C. C. will preside and the five truck members who are not representatives of the N. A. C. C. who will attend are Victor L. Brown, president Sternberg company, E. T. Birdsall, president Kosmath company, Henry Landale, vice-president Denby company, H. Wilcox, president Wilcox company, and Joseph C. Millman, secretary Stegeman company.

Studebaker Expands in L. I. City

NEW YORK CITY, June 14—The Studebaker Corp. branch quarters in this city at 58th street and Broadway, have been found inadequate and as a result a new building will be erected at the Degnon Terminal in Long Island City to care for both service and storage. The building will be located on the western side of Anable avenue, south of Meadow street and the Sunnyside yards of the Pennsylvania railroad. It will be of concrete, fireproof, 160 by 80 feet, four stories high, and will be ready for occupancy November 1.

The present home of the company on Broadway will be rearranged for purely retail purposes. The first floor will be devoted to a showroom. Used cars will be exhibited on the second floor. As at present, the general offices will be on the third floor. The fourth floor will have a complete assortment of stock and parts, supplementing the work to be done at Long Island City. The fifth floor will be a salesroom for the light trucks.

Market Prices Steady

NEW YORK CITY, June 15—Market prices in general were steady last week. Most of the changes were in the metals markets and were all gains. The most important development was the gain of $1.75 per 100 pounds for lead. This metal experienced a gradual rise from $6.00 on Tuesday to $7.75 at the closing on Monday. Tin went up $3.00 per 100 pounds. Yesterday considerable excitement was manifested in the tin market on account of the sudden rise from $40.75 to $42.50. However, there was only a very moderate volume of business transacted. Both Lake and electrolytic coppers were more or less steady throughout the week, the former closing at 20 cents and the latter at 20 3-8.

Fine Up-River Para was a little stronger in tone last week, the price going up 1 cent. A somewhat larger inquiry was noted from the manufacturers, though trading was restricted during the latter part of the week to small quantities. The consumption of rubber in the tire industry is declared to have been heavy in recent weeks.

There was only one change in the oils and lubricants markets, that being in linseed oil, which dropped 3 cents.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Antimony	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Beams & Channels, 100 lbs.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bessemer Steel, ton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Copper, Elec., lb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Copper, Lake, lb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cottonseed Oil, bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cyanide Potash, lb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Fish Oil, Menhaden, Brown	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Gasoline, Auto, bbl	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lard Oil, prime	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lead, 100 lbs	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Linseed Oil	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Open Hearth Steel, ton	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Petroleum, bbl., Kans., crude	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Petroleum, bbl., Pa., crude	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rapeseed Oil, refined	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Rubber, Fine Up-River Para	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silk, raw, Ital	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silk, raw, Japan	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sulphuric Acid, 60 Baume	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tin, 100 lb	[illegible]	40.[illegible]	40.00	40.75	40.75	42.50	[illegible]
Tire scrap	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Reo Declares Extra Dividend—Benham Payment

DETROIT, MICH., June 16—*Special Telegram*—The Reo Motor Car Co., Lansing, Mich., has declared its extra dividend of 12.5 per cent., thus making a total cash dividend of 15 per cent., or $450,000.

A similar cash dividend is expected to be announced in October while the Reo Motor Truck Co., it is expected, will announce a cash dividend shortly.

Creditors of the Benham Mfg. Co. will shortly receive a dividend of 10 per cent, amounting to $2,500, according to an order of Referee in Bankruptcy Lee E. Joslyn

New Akron Tire Concern

AKRON, O., June 14—Another tire company will make its home in Akron, O. The new concern will be known as the Double Service Tire & Rubber Co. It is incorporated for $50,000. The incorporators are H. F. Guyer, D. T. Bowlus and M. S. Glover.

Goodrich Output 50 per Cent. Over 1914

AKRON, O., June 14—The B. F. Goodrich Co. has maintained its output of tires during the first 5 months of 1915 at a 50 per cent. increase over the same period during 1914. The company is manufacturing close to 11,000 tires a day, and it is stated that it is unable to take care of orders.

Detroit May Get 8-Cent Gasoline

DETROIT, MICH., June 11—Gasoline is being sold at 10 cents a gallon here. An official from one of the independent oil stations said that he thought it will be down to 9 1-2 or even 9 cents soon as the wholesale price is likely to be cut to about 8 cents, as against 8.8 cents at present.

Minneapolis Gasoline Reduced 1 Cent

MINNEAPOLIS, MINN., June 14—Gasoline prices have been reduced by the oil companies 1 cent per gallon on all grades, making the prices 10.5, 13.5, 14.5 and 16.5. The Standard Oil Co. made its reduction June 7 and the independent companies immediately met the cut.

Briscoe Eight or Four in Same Chassis

JACKSON, MICH., June 12—The Briscoe Motor Co., which will shortly give details as to its new eight- and four-cylinder cars has adopted a policy which will be of decided help to both the dealer and the buyer.

Instead of making two different chassis, one for its eight and the other for its four, the company will sell a chassis which can be fitted with either an eight or a four-cylinder motor.

With the exception of the motors the Briscoe eight and the Briscoe four will be alike in general construction, in fact, it will be possible to transform or change one model to the other within comparatively very short time.

Paige-Detroit's Monthly Dividend Now 10 Per Cent.

DETROIT, MICH., June 11—The Paige-Detroit Motor Co. has increased its monthly dividend to 10 per cent., and the eighteen stockholders of the company have been paid $25,000 representing the June dividend. This is at the rate of $300,000 for the year or $50,000 more than the concern's total capitalization. It also represents a rate of a 120 per cent. dividend for the year.

In April the company increased its dividend from 4 to 7 per cent. a month.

25 per Cent. Walpole Dividend

BOSTON, MASS., June 14—The receivers of the Walpole Tire & Rubber Co. have declared an additional dividend of 25 per cent. to the creditors, thus making a total of 50 per cent. to the creditors. Further dividends will be paid, and it is expected that the total will eventually amount to at least 85 per cent. The New York creditors who bought the property were allowed 85 per cent. on their claims in the negotiations with the receivers.

The total receipts since the receivers were appointed, August 3, 1913, up to May 22, 1915, amount to $3,503,887. The total expenditures amount to $3,247,285, leaving a cash balance of $256,602.

Securities Continue To Rise

Crop Reports and Encouraging News of International Controversy Bring Confidence

NEW YORK CITY, June 14—Resistance to all disquieting influences with a consequent active market, strong tone and higher prices were the dominant features of this week's security quotations. All uncertainty in regard to the controversy with Germany seems to have been cleared away as reflected in the heavy buying by speculative and investment interests. Added to this confidence in the business field is the recent Government report which promised a wheat crop of almost 1,000,000,000 bushels.

At the beginning of the week there was an upward rush. After this a selling movement of considerable moment set in. Some of the issues again displayed advances similar to those which were so frequent during April and May. During the middle of the week up to Friday the market was quieter, the market being governed almost wholly by war developments and by the effect of hostilities on different issues. After Friday, prices picked up and held the advance until Saturday.

This week tire issues again featured the market, most of the stocks showing substantial gains. A few of the automobile securities showed good gains, ranging from 1 to 6 points. In the tire division, Kelly-Springfield showed a very substantial gain, its common rising 16 points, its first preferred 2 1-2 and its second preferred, 10 points. Portage Rubber preferred also showed a large gain of 7 points.

A rumor has been spread from Chicago that steps have been taken to list Ford stock on the Chicago exchange.

General Rubber Issues $9,000,000 5 Per Cent. Debentures

NEW YORK CITY, June 10—The First National Bank and the Central Trust Co. are receiving subscriptions at 97 3-4 and interest, to yield about 5 3-4 per cent., to the $9,000,000 General Rubber Co. 5 per cent. debentures, which are dated July 1 and which mature December 1, 1918.

The bonds are guaranteed as to principal and interest, jointly and severally by the United States Rubber Co. and the Rubber Goods Mfg. Co.

Chevrolet Joins Merchants' Association

NEW YORK CITY, June 14—The Chevrolet Motor Co., this city, has been elected a member of the Merchants' Assn. This organization, formed to better business conditions both in this and foreign countries, already has about sixteen automobile firms as members.

MacManus Co. Changes Name

DETROIT, MICH., June 11—The McManus Co., advertising agency, will hereafter be known as the Power, Alexander & Jenkins Co. The officers are: William S. Power, president; Kirk B. Alexander, vice-president and general manager; W. Haddon Jenkins, Jr., secretary; and Charles E. Will, treasurer. These officers and Louis Ling, Wetmore Hodges and George P. Fletcher are the directors.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax-Grieb Rubber Co. com.	220	..	260	..	..
Ajax-Grieb Rubber Co. pfd.	99	..	101	..	..
Aluminum Castings pfd.	98	100	98	100	..
J. I. Case pfd.	90	95	..	80	..
Chalmers Motor Company com.	99	102	95	97	+6
Chalmers Motor Company pfd.	96	99	91	94	—4
Electric Storage Battery Co.	52	52½	52	53	+1
Firestone Tire & Rubber Co. com.	300	304	484	488	—1
Firestone Tire & Rubber Co. pfd.	106	110½	111	..	+1
General Motors Company com.	91½	92	152	154	+1
General Motors Company pfd.	91	95	100	101	+1
B. F. Goodrich Company com.	24½	25	47	48½	+ ½
B. F. Goodrich Co. pfd.	89½	90½	101½	102½	½
Goodyear Tire & Rubber Co. com.	172	176	246	252	+2
Goodyear Tire & Rubber Co. pfd.	97½	98½	105	106	— ½
Gray & Davis, Inc., pfd.	95	102½	..	..	..
International Motor Co. com.	..	5	14½	15½	+ ½
International Motor Co. pfd.	3	18	37	38	
Kelly-Springfield Tire Co. com.	..	..	145	147	+16
Kelly-Springfield Tire Co. 1st pfd.	..	..	85½	86	+2½
Kelly-Springfield Tire Co. 2nd pfd.	..	..	140	150	+10
Maxwell Motor Company com.	14½	14¾	46	47	..
Maxwell Motor Company 1st pfd.	44	45	86	87½	—1
Maxwell Motor Company 2nd pfd.	16½	19	39	40	+1
Miller Rubber Company com.	..	..	185	187	+3
Miller Rubber Company pfd.	..	..	104	106	..
New Departure Mfg. Co. com.	125	127	..	..	..
New Departure Mfg. Co. pfd.	105	107	..	..	..
Packard Motor Car Co. com.	103	..	102	104	..
†Packard Motor Car Co. pfd.	97		96¼		
Peerless Motor Car Co., com.	18	25	65	70	..
Peerless Motor Car Co. pfd.	..	62½	94	96	..
Portage Rubber Co. com.	..	40	35	39	..
Portage Rubber Co. pfd.	..	90	92	93	+7
*Reo Motor Truck Co.	10	10½	14½	15½	— ½
*Reo Motor Car Company	19½	21½	33	33½	+ ½
Splitdorf Electric Co. pfd.	40	50	..	..	..
Stewart-Warner Speed. Corp. com.	42	48½	67½	68½	— ½
Stewart-Warner Speed. Corp. pfd.	97½	99	104	106	+1
Studebaker Corporation com.	32½	33½	73	77	+4
Studebaker Corporation pfd.	87	88	99	100½	..
Swinehart Tire & Rubber Co.	70	80	75	82	—1
Texas Company	146	147	128	130	..
U. S. Rubber Co. com.	58½	59	66	68	+1
U. S. Rubber Co. 1st pfd.	102½	103½	107½	108	+1½
Vacuum Oil Company	225	228	201	205	—3
White Company pfd.	107	110	103	108	..
Willys-Overland Co. com.	77	79	131	132	+1
Willys-Overland Co. pfd.	91	95	101½	103	..

*Par value $10, all others $100 par value. †Ex-dividend.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Chalmers Motor Co. com.	101	102½	91	95	+3
Chalmers Motor Co. pfd.	96½	99	94½	97½	— ½
Continental Motor Co. com.	..	190	180	200	..
Continental Motor Co. pfd.	..	75	84½	86	..
General Motors Co. com.	91	93	150	154	+4
General Motors Co. pfd.	93	95	100	101	+1
Maxwell Motor Co. com.	14½	15½	41	47	+7
Maxwell Motor Co. 1st pfd.	44½	45½	85	88	..
Maxwell Motor Co. 2nd pfd.	18	19	38½	40½	+ 1½
Packard Motor Car Co. com.	103	..	..	104	..
Packard Motor Car Co. pfd.	97	100	96½	99	..
*Reo Motor Car Co.	20½	21½	..	33½	— ½
*Reo Motor Truck Co.	10	10½	14½	15½	— ½
Studebaker Corp. com.	..	..	75½	77½	+2½
Studebaker Corp. pfd.	..	..	..	101	+1

INACTIVE STOCKS.

*Atlas Drop Forge Co.	..	21	..	26	..
Ford Motor Co. of Canada	..	550	930	..	..
Kelsey Wheel Co.	105	..	200	..	..
*W. K. Prudden Co.	..	20½	19½	21	..
Regal Motor Car Co. pfd.	30	..	..	25	..

BONDS.

General Motors, notes 6s, 1915	101	102	..	..	..
Packard Motor Co. 5s, 1916	95	96½	96½	..	..

Natalite a Gasoline Substitute

Obtained from Waste Products of Sugar—Is Safe Against Fire

LONDON, ENG., June 1—The Royal Automobile Club has been conducting tests with a new fuel, to which the name Natalite has been given. The fuel takes its name from Natal, the country of its origin. It is a mixture, the principal ingredient, alcohol, being obtained from the waste products of sugar refining factories. The cost of extracting the alcohol from the raw material is low.

Natalite has a specific gravity of .800 and a freezing point very much lower than benzol or petrol. In recent tests with a hydro-aeroplane fitted with a 100-horsepower Curtiss engine, it was found that the engine would run at 1,450 r.p.m. on Natalite as against 1,250 r.p.m. with gasoline.

Among other advantages is that of safety against fire, for it is claimed that water will readily extinguish the flames.

It has been a common fault with alcohol and its mixtures that unless the combustion is complete and perfect, corrosion of the cylinders is apparent after prolonged use. To obviate this, there is introduced in Natalite a slight percentage of an alkaline substance to neutralize the acidity which leads to the corrosion. In South Africa, a test car has been running exclusively on this fuel in its perfected state for the last 6 months and more, and no trouble of this nature has made an appearance.

In regard to the question of power, and incidentally the ability to run without altering the carbureter, a test has been made with a 15.9 horsepower Charron. The car, in addition to the main tank, was fitted with a test tank on the dash, feeding the carbureter by gravity, and while 1 liter of gasoline carried the car at a moderate speed for 3.7 miles, a similar quantity of Natalite under the same conditions did 4 miles.

A company has been formed to make the new fuel for commercial purposes and it is expected operations will begin at the end of the present year.

Chalmers District Managers in Quarterly Session

DETROIT, MICH., June 10—District managers of the Chalmers Motor Co., assembled for their regular quarterly convention June 7 to 9. Those present were: C. E. Thompson, F. B. Willis and J. A. Wilson, from the Eastern district; L. F. Johnson, Atlanta district; W. W. Morris, Jr., and J. A. Nelson, Kansas City district; L. L. Brockett and E. W. Nicholson, Minneapolis district; C. H. Booth and J. D. Castlow, Detroit district; C. V. Beck and H. H. W. Mackie, Chicago district. Vice-president and works manager S. H. Humphrey took the salesmen through the factory where they were given information on 1916 cars.

There were business sessions almost without interruption all day Tuesday, June 8, the principal being a talk about the new Chalmers motor, by chief engineer C. C. Hinkley. In the evening President Hugh Chalmers presided at a dinner at the Detroit Athletic Club.

Great Smith Investors Get $15,000

GRAND RAPIDS, MICH., June 15—Local investors in the Great Smith Automobile Co. have received $15,000 as salvage from the wreck of the concern. Local investors bought a controlling interest in the company for $50,000 and then subscribed $72,150 additional as new capital to place the company on its feet. Then the company went into the hands of a receiver. The $50,000 was lost in the wreck but court litigation established that the $72,150 was in the nature of a loan, no stock having been issued to cover it, and that those who had advanced it should participate as creditors in the distribution of dividends.

Eccleston Retires—Jarrard Now Handles Apperson Sales

KOKOMO, IND., June 12—J. B. Eccleston, who has been sales manager of Apperson Bros. Automobile Co., since September 1, has retired and this work has been taken up by T. E. Jarrard, vice-president of the organization, who will have assisting him J. H. Newmark, who, in connection with his new sales work, will continue to handle the advertising.

Sterling Car on Road

BROCKTON, MASS., June 12—The first model of the Sterling car built by the Sterling Motor Car Co., this city, is now on the road undergoing tests. The plans have been changed on the price and equipment, and it is now arranged to build a runabout that will retail for about $800. It is expected that deliveries will be made in September.

Carl H. Page Completes Staff

NEW YORK CITY, June 10—The Carl H. Page Motors Co., Mitchell agent in this city, has completed its executive and sales staff as follows: Carl H. Page, president; G. W. Hipple, first vice-president and general manager; R. D. Willard, second vice-president; D. A. Young, treasurer; H. B. Leary, secretary; W. H. Van Deusen, director of wholesale sales;
J. H. Johnson, general retail sales ma
ager; J. A. Clark, Metropolitan sale
manager; Wallace Owen, manager
exchange car department, and Al Cr
macho, manager of the service depar
ment.

Lancia Imports Not Halted by th War

NEW YORK CITY, June 12—Adams
Montant, the exclusive agents for th
Lancia car, in the United States an
Canada, have made special arrangeme
with the Italian Government for the de
livery of 35-horsepower chassis, regar
less of war conditions in Europe.

Although several of the Italian autom
bile manufacturers have turned their a
tention to the manufacture of trucks f
the government and have halted th
manufacture of passenger cars, a few
them are still continuing in the latte
work. The American agents have bee
receiving within the last month, ship
ments of from fourteen to eighteen ca
a week. They state that in a short tim
shipments will come in at the rate
about ten cars a month.

Poole Returns from Europe

NEW YORK CITY, June 12—J. L. Pool
export manager for the Hupp Motor Ca
Co., Detroit, Mich., returned today fro
Liverpool on the American liner St. Pau

New Building for Pope Parts

HARTFORD, CONN., June 12—Groun
was broken this week on the site of
three-story factory building 200 by
feet by the Hartford Motor Car Co. an
the Walker & Barkman Mfg. Co. W.
and C. E. Walker and Ralph M. Bark
man make up the personnel of each o
ganization, the Hartford Motor Car C
having the Dodge agency and th
Walker & Barkman company, the part
making business acquired from the Po
company. The first floor of the ne
structure will be utilized by the Har
ford Motor Car Co. as a service statio
The Walker & Barkman company wi
utilize the balance of the building
making Pope-Hartford car parts.

May Sell Pope Westfield Plant

BOSTON, MASS., June 15—The sale
the Westfield plant of the Pope Mfg. C
to a syndicate, said to contain a numbe
of the Boston noteholders of the Pop
company, is expected to result from
hearing before Judge Aldrich of th
United States district court in Boston
June 18.

The Massachusetts receivers, Colone
George Pope, C. A. Morse and C. A. Pe
sons, state that they cannot continue th
operation of the plant economically
The plant is inventoried at approx
mately $1,000,000.

Wisconsin Has 66,745 Cars

Total Registrations for 1915 May Reach 75,000—Present Figures Exceed 1914 Mark

MILWAUKEE, WIS., June 14—Wisconsin's total motor car registration by private owners reached 66,745 on June 12, adding farther strength to the belief that the total registration for 1915 will total 75,000. Although it is the middle of June, applications for licenses are coming into the secretary of state's office at Madison, Wis., at the rate of 300 a day. The 1914 registration by private owners totalled 53,161 and therefore the present year's registry already shows a gain of more than 13,500. It is figured that the total gain for the year will be 20,000, thus leaving only 8,500 licenses to be issued before December 31.

For the benefit of those desiring the list of registrations, the secretary of state is again publishing the licenses in pamphlet form in series. These lists give the name, address and name of car. A charge of $10 is made for the entire series and no single pamphlets or partial lists are sold. The sale of the lists is in the hands of the superintendent of public property, state capitol, Madison. At present there are ready lists numbering 36,000 licensees, and a book containing the licenses numbered 36,001 to 60,999 is in the hands of the printers. There is a heavy demand for the series by supply manufacturers, dealers, accessory people, car builders and other tradesmen.

Every Sixth Farmer in West Virginia Owns an Automobile

WHEELING, W. VA., June 12—It is estimated that about every sixth farmer in West Virginia is an automobile owner. There are few progressive farmers in this state who do not have an automobile, and some of them have two or three, for business or pleasure. That is, many of them who collect and bring produce to market, especially butter and eggs, have discarded the horse and are using the motor-driven vehicle.

Illinois Registrations May Exceed 150,000

SPRINGFIELD, ILL., June 11—Because of a 71 per cent increase in the amount of business handled by the automobile license department of the secretary of state's office, the legislature has increased the appropriation to $145,000, an increase of $15,000. So far this year, 145,000 licenses have been issued as compared with 135,000 in the same period last year. Indications point to a figure exceeding 150,000 for the year. Secretary Stevenson states that the additional appropriation will enable the department to examine each chauffeur individually as provided by law. Beginning next year, each chauffeur will be required to take an oral, written and road examination under the supervision of a state examiner. The secretary also announced that the size of license plates would be reduced one-fourth, thus effecting a large saving in the cost of manufacture.

144,750 Automobiles and 1,400 Dealers Registered in Ohio

COLUMBUS, O., June 11—According to a report of Ohio Registrar of Automobiles W. H. Walker, up to June 2 there were 144,750 automobiles registered in the Buckeye State. That number exceeds by more than 22,000 the total registration in the state for 1914. It is estimated that 175,000 cars will be registered by the department. Chauffeurs to the number of 1,200 have been registered.

Dealers and manufacturers to the number of 1,400 have been registered. The total receipts of the office up to June 2 were approximately $820,000.

Ontario Registrations Over 28,000

TORONTO, ONT., June 10—At the close of last year the total number of licenses issued was 31,700, of which 25,300 were for cars owned in Ontario, and 6,400 for outside cars. Up to the present or for the first 5 months of this year 28,000 odd licenses have been taken out by Ontario owners, and 3,000 by outsiders. An increase of 3,000 cars in the province, with additions for 7 months to come, is enough to convince the pessimistic that there is still a measure of prosperity in Ontario.

Baltimore Bars Headlight Glare

BALTIMORE, MD., June 12—Motorists who enter Baltimore July 1 or after should know that the law requiring the dimming of headlights will be in effect at that time. They are: Headlights must be extinguished on entering the city limits, and the front glass, or lens, of the headlight can be covered with any substance or material, or treated in any manner that will eliminate the transparency of the front glass or lens.

73,300 Cars in Minnesota

MINNEAPOLIS, MINN., June 14—There are 73,300 automobiles and about 10,000 motorcycles in Minnesota, according to license records. Last month 7,995 automobiles were licensed.

California May Fees $2,418,000

SACRAMENTO, CAL., June 7—During May 2,418 new cars were sold in California, the average price being $1,000, according to statistics given out by the state motor vehicle department. Fees received during that month totaled $2,418,000.

Michigan Registrations Pass 90,000 Mark

LANSING, MICH., June 12—Up to the end of May over 90,000 automobile licenses had been issued by the secretary of state. This is an increase of over 15,000 as compared with the total number issued for all of 1914. At the rate the registration numbers have been going, it will not be surprising if at the end of the year 120,000 cars will have been licensed in the State of Michigan, as compared with 76,389 in 1914.

68,180 Licenses in N. J.

TRENTON, N. J., June 12—An unprecedented increase in the business of the State Motor Vehicle Dept. is shown in a statement issued by Commissioner W. L. Dill today. From January 1 to May 31 there were 13,247 examinations. During the corresponding period last year the total number of examinations was 8,543.

For the first 5 months of this year 68,180 drivers' licenses have been issued. Up to June 1 the receipts of the department amounted to $777,700. The total receipts last year were only $814,535.

2 Years for Car Theft

KANSAS CITY, MO., June 11—Lawrence Noggle, a young man suspected of many thefts of motor cars and accessories in this city, was recently sent to the penitentiary for 2 years.

Stearns New York Manager Killed

NEW YORK CITY, June 16—William Arthur Lesser, manager of the New York Stearns branch, died here today as the result of an accident near Stroudsburg, Pa., on Sunday. When crossing a bridge over a railroad the side of the road gave way, letting the car drop over onto the tracks and crushing Mr. Lesser. His friend, Louis Levy, riding with him, was killed. Mr. Lesser had been manager of the Stearns branch since January 1, 1911.

Gray & Davis Quarterly Dividend

BOSTON, MASS., June 14—Gray & Davis, Inc., quarterly dividend 1 3-4 per cent. preferred stock, payable July 1, 1915, to stockholders of record June 24, 1915.

485 Carloads in 578 Go Out

MINNEAPOLIS, MINN., June 14—There were 485 freight cars of automobiles received at Minneapolis during May and 576 carloads shipped out. These figures were compiled by the traffic division of the Minneapolis Civic & Commerce Assn.

Duesenbergs Star at Galesburg

Take First Three Places in 100-Mile Race—Time for Mile, 1:36

GALESBURG, ILL., June 9—Easily the class of the field of eleven starters, a trio of Duesenberg cars, driven by Eddie O'Donnell, Tom Alley and Billy Chandler, ran one, two, three in the 100-mile race run on the local 1-mile track here this afternoon and captured $2,500 of the $3,000 in prize money hung up for the event.

Two other cars finished inside the money, Joseph Cooper's Sebring and W. W. Brown's Du Chesneau which took fourth and fifth places respectively. The Sebring also uses a Duesenberg motor.

The five cars that split the purse did not stop during the races. The Duesenbergs had too much speed for their rivals and won as they pleased, O'Donnell going to the front at the start and maintaining the lead for the entire distance. Tom Alley gave the pacemaker a challenge all the way and the race developed into a profitable family quarrel.

In winning the race, O'Donnell covered the 100 miles in 1 hour 36 minutes and 3-5 second, an average of 62.5 miles an hour and 3 minutes slower than the time of Ralph Mulford last year. Duesenberg, Alley, 1:36:05; Duesenberg, Chandler, 1:39:30; Sebring, J. Cooper, 1:40:01 3-5; Du Chesneau, Brown, 1:46:22 4-5.

The other cars included a Velie, an Apperson, the Mais Special, the Crown Special, the Bale Special and Andrew Burt's Stutz. A crowd of about 10,000 persons witnessed the race and $8,000 was taken in at the gate.

$5,000 Purse Guaranteed for Arizona Grand Prix

PHOENIX, ARIZ., June 13—*Special Telegram*—The State Fair Commission has guaranteed a $5,000 purse for the Arizona Grand Prix 150-mile race. This will be run over a mile oval dirt track on November 18. G. P. Bullard, superintendent of the race, hopes to have the road races from Los Angeles, Prescott and El Paso end in Phoenix about November 15 when the annual fair opens.

Oldfield Wars on Outlaws

CHICAGO, ILL., June 11—Barney Oldfield has declared war on the International Motor Contest Assn., the organization formed by the state and county fair managers to promote automobile races in connection with the fall fairs. The veteran driver signed a contract to appear at the Nebraska state fair with DeLloyd Thompson, the aviator, from September 6 to 10. The promoters attached a clause to the original document to the effect that Oldfield was to appear in competition should automobile races be run. Barney, in a letter, agreed to this provided the meet was held under the sanction of the A. A. A. contest board. The Nebraska fair managers have signed up the Moross and Sloan teams, now under suspension for participating in the outlaw meet at Detroit last month, for the September dates and have notified Oldfield that he is expected to drive against Disbrow, Hearne, Raimey, Endicott and the other blacklisted pilots. Oldfield has informed the promoters that he will not compete in the meet and the fair managers now threaten him with a suit for breach of contract. Oldfield is going to fight the case and announces that he will remain loyal to the A. A. A. at any sacrifice.

Owen Magnetic Averages 34.1 M.P.H. for 1,935 Miles

NEW YORK CITY, June 10—W. V. R. Whitall yesterday completed a 1,935.6 mile trip in his Owen Magnetic car to Indianapolis and return, making the trip in 56 3-4 hours, or an average of 34.1 miles per hour. For the total mileage of 2,135.6 miles, 200 miles having been driven in and around Indianapolis, the car used 180.2 gallons of gasoline, averaging 12.8 miles per gallon. Five gallons of oil were used, or an average of 427 miles per gallon.

Myers General Manager Indianapolis Speedway

INDIANAPOLIS, IND., June 11—T. E. Myers has been made general manager of the Indianapolis motor speedway. Mr. Myers has for some time been fulfilling the duties of management for the speedway, without, however, receiving public recognition for his work. This has now been given him by official action of the board of directors, Newby, Fisher, Wheeler, and Allison. C. C. Fisher, president of the speedway, however, will continue in active control of the speedway's affairs.

Twin City Speedway Opens Offices

MINNEAPOLIS, MINN., June 14—The Twin City Motor Speedway Co. has opened city offices at 217 Seventh street south, Minneapolis, and at Hotel St. Paul in St. Paul. Dr. C. E. Dutton has been made secretary and manager. Last week a contract for 30,000 barrels of cement was placed and work will soon begin on the 2-mile cement track, as well as on the seven grandstands.

Cole 8 Averages 16.2 M.P.G.

INDIANAPOLIS, IND., June 11—A Cole 8 in a recent unofficial fuel economy test in the streets of this city, showed an average of 16.2 m.p.g.

Romano Wins on Seattle Track

Eight-Cylinder Makes Clean Sweep—Breaks Track Record for Mile

SEATTLE, WASH., June 14—The eight-cylinder Romano car, equipped with a Curtiss aeroplane motor, and driven by Rae Lentz, starred at the meet held on the 1-2-mile track at Madison Park, June 12 and 13, by winning every event in which it was entered.

In a 1-mile trial against time, the Romano made the distance in 1:03 3-5, the best time made on a 1-2-mile track. This same car last June broke the world's record for 25 miles at Portland by making the distance in 22:07 1-2. This time, however, was bettered later by Burman in a Peugeot when he drove the distance at Springfield, Ill., October 22, in 21:37:6.

The Romano has made a clean sweep in all of the events held this year on the Pacific Coast.

The Seattle meet ends the season for the Northwest Automobile Assn. racing campaign. The attendance at each of the 2-day events was about 5,000.

Motorists Defeat Athletes

CHICAGO, ILL., June 12—The Chicago Automobile Club won by a wide margin over the Chicago Athletic Assn. in the interclub reliability run to Fort Wayne and return yesterday and today between teams representing the two organizations. The Automobile club with seventeen cars acquired a total penalization of 207 points for work done and lateness at control and credits for perfect scores amounting to 65 points. The Chicago Athletic Assn. with ten starters was penalized 485 points for work done on the cars and lateness at controls and had a credit of 15 points for perfect scores. The 2-day run was the eighth annual interclub match between the two organizations.

National Used Car Report

CHICAGO, ILL., June 14—The Chicago Automobile Trade Association has just issued its used car market report in national form. It is now called the National Used Car Market Report instead of Central Used Car Market Report. An idea of the number of different models of cars turned out since about 1910 and in the hands of owners is gained from a compilation of the statistics in the book. It lists 2,903 gasoline and steam models and 388 electric, a total of 3,291.

The report—of which this is the fifth edition—covers 131 makes of gasoline car and fourteen electrics and contains data applicable to forty-one of the forty-eight states in the union. It is now 9 x 12 instead of 8 x 10, its former size, and has 119 pages.

Any factory or dealer association which subscribes for a dozen or more reports gets them at one-half the $24-a-year rate. The fourth edition was so subscribed to by Chalmers, Franklin, Packard, Pierce-Arrow, White and Winton. To this has been added for the fifth edition: Chandler, Oldsmobile, Overland and Studebaker.

The list of cars priced has been 131 gasoline and 14 electrics in the last two editions, this list being quite complete. In most cases the listings run back to and including 1910, although earlier models are reported where sales are made.

Buick Discontinues New England Branch

BOSTON, June 14—The Noyes-Buick Co. was formed last week to take over the wholesale distribution of the Buick for New England instead of having the factory handle it and has been incorporated for $250,000 with Harry Noyes as president and treasurer, and R. L. Nichols, secretary. Mr. Nuyes has handled the Buick in this territory for many years. Frederick E. Nichols, formerly with Chalmers, and later New England traveling representative of the Hupp has joined the organization.

Cadillac Makes San Francisco to Los Angeles in 12 Hours 10 Minutes

SAN FRANCISCO, CAL., June 15—A Cadillac eight recently established a record of 12 hours and 10 minutes between Los Angeles and San Francisco, a distance of 491 1-10 miles. The car was driven by T. J. Beaudet and William Bramlett with E. T. McConners and Arthur Austria as passengers. The car was a regulation stock model, the only preparation being made for the trip was the removal of the top, placing an extra brace on the demountable rim. No extra water, oil or fuel was carried.

Des Moines Speedway Work Started

DES MOINES, IA., June 10—Construction work has begun on the Des Moines speedway west of the city. The 1-mile course will be made of 103 miles of 2 by 4 timbers placed on edge. The track is to be completed for a tryout by Barney Oldfield on July 25, and a race meet will be held on the speedway at a later date.

Uniontown Hill Climb June 24

UNIONTOWN, PA., June 12—The third annual hill climb over the 3-mile road from Hopwood to the Summit of Chestnut Ridge will be held Thursday, June 24, at 1 p.m. A total of $2,500 prize money is offered, $1,600 of which goes in the free-for-all event. The climb is 1 mile east of here and is over a concrete road, the average grade of which is 7.754 per cent. The run is under A. A. A. sanction.

800 Buick Dealers Visit Plant

137 from Wisconsin and 150 from Minnesota, the Dakotas and Montana

MILWAUKEE, WIS., June 12—M. J. Monson, manager of the Milwaukee Buick branch, entertained the company's 137 Wisconsin dealers for a full day at Milwaukee and then escorted the party to Chicago, where 400 to 500 other Buick agents joined them for a trip to the Buick factory. The Wisconsin agents were tendered a banquet at Hotel Martin by Mr. Monson, at which the 1916 Buick policy of six-cylinder cars only was outlined as a preface to the inspection of the new models at the shops. Over 800 dealers have visited the plant since June 7.

MINNEAPOLIS, MINN., June 12—After 1 week aboard a special North Western railroad train of steel sleeping cars 150 dealers in Buick motor cars returned Sunday night from Flint and Detroit, Mich. They left 7 days before as guests of the Pence Automobile Co. of Minneapolis. They were from Minnesota, the Dakotas and Montana. From the time they left the Great Northern station until they were set down again the dealers were guests of the Pence company. They ate, slept and lived in the new palatial steel cars of the railroad company. At the end of the train was the special car carrying Harry E. Pence, the moving genius back of this third annual event for Northwestern Buick dealers, and W. R. Stephens, who has charge of country sales. It was the second trip to the factory, the intervening event being a dinner in Minneapolis last year. Monday was spent in Chicago, the next 3 days in Flint, Friday in Detroit and Saturday in Chicago again.

The announcement was made on the trip that the Pence company will sell 4,500 Buick 1916 models, as compared with 3,000 this year.

Wisconsin Dealers Active

MILWAUKEE, WIS, June 12—June is proving an unusually active month with Wisconsin dealers. The Cole Motor Co., Indianapolis, Ind., has leased the new garage now being erected at 485-487 Jefferson street, Milwaukee, Wis., as a permanent home for its Milwaukee branch, which was established 2 years ago, and has had temporary quarters at 188-190 Eighth street ever since.

The Wisconsin-Oakland Co., of this city, organized last week with $100,000 capital by the Hokanson and Miller interests of Madison, Wis., to take the agency for the Oakland for Wisconsin, Upper Michigan and parts of Illinois, Iowa and Minnesota, has leased the big garage at 239-241 Wisconsin street, as general headquarters and executive offices. Agency contracts are now being made and the Milwaukee city and county distribution has been placed in the hands of the Milwaukee Motor Sales Co.

The Milwaukee branch of the Ford Motor Co. on Saturday, June 12, tendered a full day's outing at Waukesha beach to the 250 employees of the Ford branch service station and assembling plant. This was the first annual outing and next year the number of participants will be increased by 400 to 500 because of the establishment of a permanent assembling plant in Milwaukee.

King Dealers Drive Away Ninety Eight-Cylinder Cars

DETROIT, MICH., June 10—Today was drive-away day at the plant of the King Motor Car Co. Dealers and over 100 distributors from Michigan, Indiana, Ohio, Illinois, western New York and western Pennsylvania, were here and drove ninety eight-cylinder cars away from the factory.

Merritt & Seidner, Cleveland distributors, were given the first prize for being the distributors taking along with them the largest number of cars, the total being twenty-eight.

They were taken through the plant during the morning under the direction of chief engineer T. P. Chase. A dinner was given to the dealers at the Fellowcraft club in the evening. Artemas Ward, Sr., principal stockholder of the King company, was toastmaster.

Announcement was made that from now on when the King company will bring out new models at lower prices than previous models, or, if a reduction in prices is announced, dealers and distributors will be given a rebate on whatever number of cars they have in stock from the number they had ordered thirty days previous to the announcement of the new prices.

Dodge Has Drive-Away Day

DETROIT, MICH., June 15—Twenty-one dealers and customers of Dodge Bros. visited the factory on June 10 and took away with them thirteen cars. All of them are New York State men.

New Chalmers Distributor in Toledo

TOLEDO, O., June 14—The Chalmers Motor Co., Detroit, has appointed the Cornelius-Browning Co. as a general distributor in northwestern Ohio and southern Michigan.

Is Abbott and Marion Export Agent

NEW YORK CITY, June 14—The Pullman Sales Co., Broadway and 54th street, has been appointed eastern distributor and export agent for the Abbott and Marion.

Remy Ignition System for Twelves

Uses Hexagonal Cam and Two Breakers—Stromberg Upheld—New Pullman

ANDERSON, IND., June 14—Closely following the announcement of twelve-cylinder cars by some of the leading companies comes a twelve-cylinder battery igniter by the Remy Electric Co. In design this follows the four-, six- and eight-cylinder Remy models but differs in one important respect. Instead of using a cam with the same number of points as sparks required, a hexagonal cam is used and the twelve sparks are obtained by fitting two breakers, one on either side of it. One of these breakers is mounted on a large steel plate which is concentric with the center line of the distributer and has a boss around the hole in the center that the distributer shaft passes through. The second breaker is mounted on a smaller steel plate which is so arranged that when moved all of its parts move in concentric circles above the center line of the distributer. This arrangement insures absolute synchronism in the adjustment of the two breakers. The breaker arms are light to give fast, smooth operation and the fiber block riveted to the center which rides on the cam, is held against it by the use of stiff flat double-leaf springs.

Either manual or automatic spark advance or both are possible with this distributer. A safety spark gap is incorporated in the distributer segment arm. In outer appearance it differs little from other Remy models being provided with the same type of snap-on cover, with the twelve terminals arranged in a circle on the top. A grease cup is provided for lubrication of the distributer shaft bearing.

Stromberg Patents Sustained

NEW YORK, June 11.—Validity of the Ahara patent on carbureter construction, which has been the subject of litigation for some time, was confirmed this week by Judge Hand in the United States district court for the southern district of New York. The decision is the outcome of a suit brought by Stromberg Motor Devices Co. against officials of the Longuemare Carbureter Co. In confirming the validity of the Ahara patent, Judge Hand declared the Longuemare carbureter an infringement of four claims of this patent which is owned by the Stromberg company. The Richard's patent, also held by the Stromberg company, also was passed on by the court which declared that the parts of this patent infringed by the Longuemare carburetor also were present in the Ahara device. For this reason the suit as applied by the Richard patent was ordered dismissed.

Judge Hand in his decision alludes to that of Judge Sanborn in the Chicago district court in the case of Stromberg vs. Zenith and the John A. Bender Co., relating to alleged infringements of the same patent. It is Judge Hand's opinion that the defendant's argument that the Ahara patent should be limited to a hit-and-miss engine does not hold, even though the patent application would indicate such an engine. It is held that the Longuemare carbureter obtains the same results as that of the Ahara design by exactly the same method of controlling the flow of fuel.

Pullman Receiver Dismissed

YORK, PA., June 15—The Creditors Committee which has had charge of the affairs of the Pullman Motor Car Co., of this place, for nearly a year, was dismissed on June 1 and the company is again under the control and direction of its stockholders. The management will remain the same.

The company has decided upon its 1916 program of cars and will produce a five-passenger, Clover-Leaf roadster and two-passenger roadster to list at $740. The car will have a wheelbase 4 inches longer than at present, will use Dixie magneto, leather trimmings and 31 by 4 inch tires. The company also contemplates building a $700 delivery car and later a three-passenger coupé, the coupé using the Cutler-Hammer magnetic gearshift, and listing at $990.

In connection with its new policy a convention of distributors was recently held at the factory, seventy-five attending.

Paterson Cuts Price $100

DETROIT, MICH., June 16—The W. A Peterson Co., Flint, Mich., will continue its model Four-32 for next year and this model will be sold at $100 less than during the present year, the new price being $995. The car will be practically the same in general construction as the present except that it will have a more roomy body for five passengers and will have other improvements. The company states that it will not bring out an eight-cylinder model as has been rumored.

Bosch for Jeffery and Marmon

NEW YORK CITY, June 16—The Thos. B. Jeffery Co. will use Bosch magnetos as standard on its 1916 cars and trucks. The Nordyke & Marmon Co. has also contracted for Bosch ignition, lighting and starting systems on its 1916 line.

R.R. Protests Truck Competition

Asks Relief from Long and Short-Haul Law—Wants To Reduce Rates

LOUISVILLE, KY., June 10—For the first time in Kentucky automobile traffic coming in competition with a railroad line has caused the railroad to ask relief from the operation of the long and short-haul law. The complainant is the Cincinnati, Flemingsburg & Southeastern Railway Co., which runs from Flemingsburg to Johnson, where it connects with the Louisville & Nashville, and all its business originates in or is consigned to Flemingsburg.

Its rates are based on the regular distance tariffs on the Louisville & Nashville, while an automobile truck with a capacity of 3,000 pounds makes daily trips over the pike between Flemingsburg and Maysville, 17 miles, which latter city has been relieved from the long and short-haul law and has river rates; so that the road complains much traffic that otherwise would go to it goes to Maysville and thence is hauled overland, the motor truck charging only 8 cents per 100 for full loads of freight and 12 1-2 cents for light bulky articles that would take first-class rates by rail.

The complaint points out that the motor truck is not under control of the Railroad Commission and has no franchise to be assessed; it pays a license of $10 for a hack line and an automobile license and will be taxed only at the usual valuation for such property; wherefore it prays permission to reduce rates from points on connecting lines to Flemingsburg sufficiently to meet the competition.

Gasolock Sales Co. Organized

DETROIT, MICH., June 12—The Gasolock Sales Co. has been organized and incorporated, being capitalized at $5,000. This company will now act as a selling agent for the Gasolock Specialty Co., which manufactures the gasolock and other automobile specialties. The incorporators are: Charles R. Chisholm, president and treasurer; Robert G. Clark, vice-president and secretary; Roy B. Johnston. There are now between 3,500 and 4,000 Gasolocks in use on cars which are operated in Detroit. The Michigan business has been increasing with such rapidity lately that it was found advisable to form a separate selling company.

Is Paige Distributor in Northwest

SEATTLE, WASH., June 10—Owen McCusker, Jr., Seattle, is distributor and district manager for the Paige company in charge of its interests in Washington, Oregon and Idaho.

Factory Miscellany

Ajax-Grieb to Add—The Ajax-Grieb Rubber Co., Brennig avenue, Trenton, N. J., is taking bids for the erection of a one-story addition to its rubber factory, 28 by 88 ft.

Independence Co. to Move Plant—The Independence Motor Car Co., Lima, O., will move its plant from Lima to Atlanta, Ga., and will establish a new factory. W. A. Williams is manager.

Pneumatic Tire Co. Incorporated—The Pneumatic Tire Co. is the name of a $100,000 corporation chartered under the laws of Kentucky which will establish a tire factory at Madisonville, a suburb of Cincinnati, O.

Weber Implement Adds.—The Weber Implement and Automobile Co., St. Louis, Mo., has begun the erection of a large four-story addition to its building at 1900 Locust street, extending the present structure to Olive street. The addition will be of reinforced concrete.

Haywood Tire Adds—The Haywood Tire & Equipment Co., Indianapolis, Ind., has acquired the building adjoining its present location on North Capitol avenue, and is fitting same up for immediate occupancy. The new building will give the company 10,000 square feet additional floor space.

Toledo Home for Harvester Co.—A $100,000 home for the International Harvester Co. will be constructed at Hamilton and Erie streets, Toledo, O., where the motor trucks manufactured by the company will be sold. One of the features of the building will be a display room and a tractor shed for the demonstration of tractors. The work of construction will be undertaken at once.

Goodyear Buys Site.—The Goodyear Tire & Rubber Co. has bought a 2-acre tract of land near the Belt Line Railroad with a frontage of 600 feet on River street. A three-story brick building, 25 by 125 feet, will be erected on the site. The building will be an addition to the core tire department and will have a floor space of 37,000 feet. The company is employing 7,500 men. The Goodyear buildings combined will have a floor space of 2,000,000 feet.

Los Angeles Electric Co. Moves—The Los Angeles Ignition Works has moved to its new locations, 1007-1011 South Main street and 1006-1010 South Broadway, Los Angeles, Cal., where it has one of the best-equipped electrical automobile plants in the state. The salesrooms, battery-charging plant, magneto and coil shop and general electrical repair shop are so well apportioned that all classes of automobile electrical work can be done scientifically and without delay to customers.

Puritan Machine Buys Property—The Puritan Machine Co., Lafayette boulevard and Tenth street, Detroit, Mich., dealer in automobile parts, has purchased the property at 432 Lafayette boulevard and will erect thereon a large addition to its present quarters. The company has added two floors to this plant and has made arrangements for the construction of a large 5-story warehouse on property adjacent to the main building. The company has purchased outright the service and repair parts of sixty-one makes of automobiles not now manufactured.

Gulf Refining's $750,000 Plant—One of the largest oil mixing plants in the country is nearing completion in Lynchburg, Texas, by the Gulf Refining Co. The different departments and buildings of the concern are built upon the unit system with the view of adding to the plant as the demands of the business may require. The cost of the new plant up to this time is approximately $750,000. In connection with the industrial works the company is making extensive improvements to deep-water and pipe-line terminal facilities here. It is reported that it will obtain much of its crude oil supply from the Tampico (Mexico) fields. Its first tank steamer is due to arrive here the latter part of the month.

Working on Ford's Milwaukee Plant—Construction work is now well under way on the new Milwaukee branch plant of the Ford Motor Co. at Prospect avenue and Kenilworth place and the Northwestern tracks. Complete plans for the structure have been filed with the building inspector's department and show ground dimensions of 300 feet on Prospect avenue, 120 feet on Kenilworth place and 150 feet on the Northwestern line. The structure will be of reinforced concrete and steel, five stories high, with a deep basement. The site affords room for a duplicate of the building now projected. The building alone will cost $250,000 and the equipment an additional $150,000. The plant is to be ready for business by November 15 or December 1 and will employ 400 to 500 men.

The Automobile Calendar

June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 15	Peoria, Ill., Track Race, 100 Miles, National Implement and Vehicle Show
June 15-17	Chambersburg, Pa., Run to Atlantic City.
June 26	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Utica, N. Y., Hill Climb, Automobile Club of Utica.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
July 5	Visalia, Cal., Road Race, Tulare Co. Auto. Assn.
July 7-8	Taylor, Texas, Track Race, Taylor Automobile Club.
July 6	Burlington, Ia., 100-Mile Track Race, Tri-State Fair
Aug.	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Races.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race, F. E. Perkins.
Sept. 9	Detroit, Mich., Speedway Race; Detroit Speedway Club
Sept. 6-11	Hamline, Minn., 2-Day Meet at State Fair Grounds between Minneapolis and St. Paul, State Fair.
Sept. 13	Oakland, Cal., Pan-American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct.	St. Louis, Mo., Show, Forest Park Highlands, St. Louis Automobile Manufacturers and Dealers' Assn.
Oct. 1	Minneapolis, Minn., Track Race, Twin City Motor Speedway Co.
Oct. 1-2	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 2	New York City, Sheepshead Bay Motor Speedway Track Meet.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace
Oct. 11-12	Dayton, O., National Paving Brick Manufacturers' Assn., Annual Meeting
Nov. 18	Arizona 150-mile Grand Prix
Dec. 31	New York City, Show; Grand Central Palace
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.
March 4-11	Boston, Mass., Truck Show, Mechanics Bldg

The Week in the Industry

Steiner, St. Louis, Velie Mgr.—Alex. Steiner has taken charge as manager of the Velie Motor Co. of St. Louis, Mo. He succeeds W. A. Gray, who resigned.

Kroh Now Sells Appersons—H. A. Kroh, formerly New England representative of the Continental Asbestos Corp., with headquarters at Boston, Mass., has resigned to accept a position with the Brown-Apperson Co., New England distributor for the Apperson line.

Henderson Goes to Bath—C. T. Henderson, formerly manager of the Skowhegan, Me., Garage, has gone to Bath, and with J. F. McCole has leased the Washburn garage on Broad and Commercial streets. Mr. Henderson will have charge of the mechanical department.

Hall Gets More Territory—Sherwood Hall, Jr., who has the agency for the Paige Detroit in Boston, Mass., has secured more territory from the factory, and now he has Cheshire, Rockingham and Hillsboro counties in New Hampshire, which gives him the cities of Keene, Portsmouth and Nashua.

—

Garage

Take Colorado Tire Agency—C. W. Raymor and I. E. Beaver have taken the agency at Marion, O., for the tires manufactured by the Colorado Tire & Leather Co.

N. Y. Tire Agency Moves—The salesroom of the Steel Pneumatic Tube and Tire Co., New York City, has been moved to the factory at 146 West Fifty-second street.

Kendall Takes Graphinoil—F. H. Kendall has taken the Southern New England agency for Graphinoil, with headquarters at 109 Washington street, Providence, R. I.

To Handle Accessories in Columbus—The G. M. Service & Specialty Co. is the name of a new concern located at 275 North Fourth street, Columbus, O., to handle accessories.

Highland Body's Louisville Branch—The Highland Body Mfg. Co., Cincinnati, O., has established a branch at 728 South Fourth street, Louisville, Ky., with A. J. and E. G. Schoen as managers.

Toledo Gabriel Snubber Agency Changed—J. C. Eppens has taken over the distributing agency in northwestern Ohio, with headquarters at Toledo for the Gabriel rebound snubbers formerly held by C. J. Clapp. The business will be continued at 1015 Jefferson avenue.

Motor Men in New Roles

Reynolds Joins Puritan Machine—T. E. Reynolds has joined the Puritan Machine Co., Detroit, Mich., in the capacity of manager of the accessory department.

Doyle Heads U. S. Tire Agency—The United States Tire Co. has opened a distributing agency at 1120 Lady street, Columbia, S. C. J. E. Doyle, formerly of Norfolk, Va., is the manager of the new agency.

Ericson Heads Louisville Empire—A. A. Ericson is manager of the Empire Auto Sales Co., agent for the Empire car in Louisville, Ky. This company recently established an office and salesroom at 437 South Second street.

Hobbs District Sales Mgr.—E. M. Hobbs has been appointed district sales manager of the Hoyt Electrical Instrument Works, with headquarters at 967½ Woodward avenue, Detroit, Mich. This company manufactures meters at Penacook, N. H.

Stephenson Retail Sales Mgr.—G. L. Stephenson, head of the one-time Stephenson Motor Truck Co. and Stephenson Motor Car Co., Milwaukee, has been engaged as retail sales manager for the Lauson-Salentine Co., 228-232 Wisconsin street, Milwaukee, Wisconsin distributor for the King.

Starr Heads Cal. Assn.—L. V. Starr, manager for the J. W. Leavitt Co., Los Angeles, Overland distributor for the Pacific coast, has been elected president of the Motor Car Dealers' Assn. The other officers and directors elected are: H. L. Arnold, P. A. Lord, Volney S. Beardsley and W. E. Bush.

Plummer Heads Insurance Dept.—E. S. Plummer has been appointed head of the automobile department of the American Central Insurance Co., St. Louis, Mo., and will make his headquarters at the home office of the company here. Mr. Plummer's territory will be that covered by the Western Union Insurance Bureau.

Gillette Joins Chase—C. N. Gillette, formerly employed at the Chase Motor Truck Co. plant, Syracuse, N. Y., but more recently manager of the Chase Agency in Charlotte, N. C., has joined the staff of division sales managers covering the states of North and South Carolina and Virginia, with headquarters at Charlotte, N. C.

West Makes Change—Albert West, who has been for some time connected with the Firestone Tire & Rubber Co., of which his brother Wylie West is Southern manager, is now connected with the Southern Tire & Rubber Co. at 225 Peachtree street, Atlanta, Ga., and will manage the agency for O. A. Moran, who is district manager.

Brown Dodge Supervisor—W. I. Brown, formerly with the sales department of the Studebaker Corp., Detroit, Mich., and later distributor for that concern in Indianapolis, Ind., has been appointed supervisor of districts for Dodge Bros. He will have direct charge of all the district representatives, the allotment of territory to dealers and the distribution of cars.

Albach Gibney Western Sales Mgr.—C. I. Albach, formerly of the St. Louis, Mo., branch of the Fireside Tire & Rubber Co., has been appointed Western sales manager of the Gibney Tire & Rubber Co., Conshohocken, Pa. He will make his headquarters with the Schelp-Budke Co., recently appointed agents for the Gibney tire in St. Louis. Albach covers eastern Missouri, southern Illinois, Arkansas, Kansas City and Indianapolis.

—

Dealer

Discontinues Agency—The Auto Tire Co. at 129 Ellyn street, Hartford, Conn., has discontinued the Oakland agency.

N. Y. Cadillac's New Lease—The Detroit Cadillac Motor Car Co., New York City, has leased a store in the building at 3, 5 and 7 West Sixty-first street.

Buffalo King Moves—The Mutual Motor Car Co., distributer in western New York for the King, has moved into new quarters at 913-927 Main street, Buffalo.

Franklin Agency Moved—The Franklin agency in Oakland, Cal., the J. F. McClain Co., has moved to larger quarters on Broadway. W. F. Dandy is manager.

Newark Agency Moves—A. P. Hess, agent for the Ford, Hudson and Dodge in Newark, O., has moved into new quarters in the Pythian Temple Building on East Main street.

Detroit Chevrolet Moves—The Detroit, Mich., branch of the Chevrolet Motor Co., which heretofore was located at 815 Woodward avenue, has moved to 1246 on the same street, now occupying larger quarters, formerly the local branch of the Cartercar Co.

Milwaakee Garage Moves—The Lakeside Garage, Milwaukee, Wis., under the management of G. W. Boller, has moved to 370-374 Brady street.

Da Pont Fabrikoid Moves—The Du Pont Fabrikoid Co. has moved its New York City sales office to the Equitable Bldg., 120 Broadway.

Racine Tire in Seattle—Under the management of Edward Allen, the Racine Tire Sales Co. has opened in Seattle, Wash., at 1609 Eighth avenue.

Maucotel Buys Dallas Remy—E. A. Maucotel has purchased the Remy service station on Lane street, Dallas, Tex. He was formerly manager of the station.

Philadelphia Cole Moves—The L. S. Bowers Co., Philadelphia, Pa., distributor of the Cole car, has removed from 326 North Broad street to 245-247 Broad street.

Detrait Federal Rubber to Move—The Federal Rubber Co., now at 846 Woodward avenue, Detroit, Mich., will move the latter part of May to 247 Jefferson avenue, East.

Michelin Tire in Des Moines—The Michelin Tire Co. has opened a branch house in Des Moines, Ia. F. J. Potter is manager of the new concern. Headquarters are at 1109 Walnut street.

Davenport Co. Moves—The Positive Supply Co., Davenport, Ia., manufacturer of portable steam tire vulcanisers, has moved into the new three-story building, the Positive Bldg., 209 East Second street.

New Co. at Boston—The Magneto and Generator Exchange of New England is the name of a new company that has just taken quarters in the Motor Mart, Park square, Boston, Mass., with A. A. Gouldhart in charge.

Another Graphinoil Station—The Dunlap-Brown Co., Boston, Mass., distributor for Graphinoil, has signed a contract with F. H. Kendall to handle the product in southern New England, with headquarters in Providence.

Canada's New Tire Agencies—The Consolidated Motor Co., Vancouver, B. C., has opened a branch for Fisk tires at 1216 Granville street. McGavin & Ely have taken the representation of the Federal tire in Victoria, B. C.

Roskam-Scott to Move—The Roskam-Scott Co., New York City, has moved to larger quarters at 1896 Broadway. The company will continue to handle slightly used cars. A list of cars for sale will be issued monthly.

Republic's Newark Tire Agency.—The Republic Rubber Co. has made arrangements whereby Messrs. H. H. Wilcox and M. R. Clodio will handle its tire in Newark, N. J., under the name of the Republic Tire Agency, at 64 Halsey street.

Fafair Bearing Opens in Detroit—The Fafnir Bearing Co., New Britain, Conn., has opened a branch office in Detroit, Mich., at 752 David Whitney Bldg. M. H. Cox, who represents the interests of the company through Ohio, Indiana and Michigan, will be in charge.

Has New Bldg.—The Boice-Perrine Co., one of the largest accessory houses in New England, has moved into a new building at the corner of Brookline avenue and Landsdowne street, Boston, Mass., where it has salesrooms and service departments under one roof.

Los Angeles Goodrich Moves—Manager Frank Carroll of the Goodrich Tire & Rubber Co., Los Angeles, Cal., has moved into his new quarters at 406 West Pico street. The service department is now in charge of R. J. Loomis. The total area of the Los Angeles Goodrich plant is 53,250 square feet.

Accessory Co. in Cumberland—The United Accessories Co. has been organized at Cumberland, Md., with J. H. G. Miller as president. Automobile and motorcycle accessories will be sold and special attention will be paid to garage equipments. The store is located at 20 North Centre street.

Fleetwood Opens Selling Branch—The Fleetwood Metal Body Co., Fleetwood, Pa., has opened a selling branch in connection with a designing department at 1789 Broadway, New York City. Ernst Schebera, for several years designer of the A. T. Demarest Co., New York City, has been put in charge of the New York branch.

Frisco Kelly-Springfield Agent—One of the most important changes in San Francisco (Cal.) tire circles is the announcement by District Manager W. H. Bell, of the Kelly-Springfield Tire Co., that the Weinstock-Nichols Co. will hereafter handle the Kelly-Springfield tires in both its San Francisco and Oakland stores.

New Home for Reo Agency—J. M. Linscott, who has the Reo line in Boston, Mass., has signed a long lease for a section of a new building under construction at the corner of Beacon street and Commonwealth avenue, that will be ready for occupancy by July 1, and he will move his salesrooms and service station there from his present quarters on Columbus avenue.

Safety Signal Co. in Detroit—The Safety Signal Sales Co., Detroit, Mich., has been organized by F. C. Braden, G. W. Russell and N. J. Janisse to sell a new safety signal device which consists of a miniature semaphore attached to the rear of the automobile. It is worked automatically from the brake pedal and carries colored lights at night. The offices of the company are at 404 Sun Bldg.

Hudson's New Philadelphia Home—Plans have been prepared and estimates invited for the construction of a large automobile warehouse and salesrooms at 253-255 North Broad street, Philadelphia, Pa. The proposed building, which will be eight stories high, will occupy at lot 48 by 120 feet and upon completion will be the home of the Gomery-Schwartz Motor Car Co., representative of the Hudson car. The site of the improvement is already occupied by the Gomery-Schwartz Co., but during the erection of the new building the company will have temporary headquarters at Broad and Cherry streets.

Lozier Places Service Stations—Arrangements have been made by the Lozier Motor Co., Detroit, Mich., to take over the service stations at New York City and Philadelphia, formerly conducted by Harry S. Houpt. The San Francisco (Cal.) service station has been placed in charge of G. A. and J. L. McPherson, of Detroit. The orders placed for New York City and Philadelphia amounted to 150 cars.

Large Garage for Milwaukee—One of the largest garages in Wisconsin to be devoted to used car sales exclusively is that being erected for the Wisconsin Auto Exchange at 115-117 Sycamore street, Milwaukee. The company is occupying temporary quarters at 173-175 West Water street, in the Plankinton block. The new garage will be 60 by 130 feet in size, one story high and nearly one-half of the floor space will be devoted to the machine shops for rebuilding and overhauling cars. Harry Kohn is general manager of the business.

To Rebuild Old Tires—The Oklahoma Tire Construction Co., Oklahoma City, Okla., has been organized with A. M. Loomis, of Chickasha, Okla., as president. Headquarters have been established there and work of reconstructing old tires into new has been started. State rights to the process have been obtained and machinery has been installed. The company proposes to take two casings of the same size and then by a process of sewing and cementing a double tread tire is produced at about one-fourth cost. The new tire is warranted 90 per cent. puncture and blowout proof with a double mileage.

Anthony's New Service Scheme—Earle C. Anthony, Inc., California distributor for the Packard, Chalmers and Grant cars, with headquarters in Los Angeles, has established a service scheme which is something new in its line. The system consists of coupon books entitling the buyers of new cars to stated amounts of service labor on their cars each month for a certain period of months, the amounts varying according to the price of the car. These coupons are good not only at the Los Angeles shops, but at every one of the 177 service stations established throughout that state by the company.

Automobile Agencies Recently Established

PASSENGER CARS

Arizona

Phoenix	Mitchell	Oscar Irvin
Phoenix	Stearns-Knight	Oscar Irvin

Arkansas

[illegible]	Oldsmobile	Theo. Cox & Sons
[illegible]	Saxon	J. L. Thompson

California

[illegible]	Mitchell	C. F. Lorenz
[illegible]	Stearns-Knight	C. F. Lorenz
[illegible]	Chalmers	Roscoe E. McCabe
[illegible]	Grant	W. F. Goetz
[illegible]	Mitchell	L. J. Renshaw
[illegible]	Stearns-Knight	L. J. Renshaw
[illegible]	Apperson	C. F. Stahl
[illegible]	Apperson	Pioneer Garage
[illegible]	Apperson	H. A. Chaffee
[illegible]	Apperson	J. M. Slaughter
[illegible]	Oldsmobile	T. C. Phelan
[illegible]	Apperson	Boulevard Garage
[illegible]	Oldsmobile	The Tire Garage
[illegible]	Mitchell	Bell & Canfield
[illegible]	Stearns-Knight	Bell & Canfield
[illegible]	Apperson	Whaw & Bradley
[illegible]	Mitchell	V. C. Melchoir
[illegible]	Stearns-Knight	V. C. Melchoir
[illegible]	Apperson	F. P. Lowry
[illegible]	Grant	Duncan Cooley
[illegible]	Auburn	Karl Martin
[illegible]	Chevrolet	Stewart-De Vaux
[illegible]	Mitchell	F. H. Warden
[illegible]	Stearns-Knight	F. H. Warden
[illegible]	Mitchell	J. W. Smith
[illegible]	Stearns-Knight	J. W. Smith
[illegible]	Apperson	L. E. Van Patten

Colorado

[illegible]	Grant	Hertford Garage
[illegible]	Grant	Midland Trail Garage
[illegible]	Grant	H. N. Richmond & Sons
[illegible]	Grant	C. W. Schultz
[illegible]	Studebaker	F. A. Seward
[illegible]	Grant	A. C. Gilbert
[illegible]	Grant	Stephens & Carrington
[illegible]	Studebaker	E. R. Cassidy
[illegible]	Grant	R. Riggs
[illegible]	Grant	W. F. Berry
[illegible]	Grant	Adolph Udin

Connecticut

[illegible]	Chevrolet	Chevrolet Motor Co.
[illegible]	Saxon	F. G. Atwood
[illegible]	Saxon	Meriden Auto Co., Inc.

District of Columbia

[illegible]	Saxon	D. S. Hendrick Co., Inc.

Florida

[illegible]	Koehler	W. G. Porter

Georgia

[illegible]	Saxon	Daniel & McKee

Idaho

[illegible]	Chevrolet	L. C. McLain

Illinois

[illegible]	Chevrolet	Holland & Baker
[illegible]	Chevrolet	F. H. Noack
[illegible]	Sayers	B. Hass Elec. & Mfg. Co.
[illegible]	Oldsmobile	C. Bradley & Co.
[illegible]	Chevrolet	C. H. Ross & Co.

Indiana

[illegible]	Chevrolet	Lincoln Garage
[illegible]	Saxon	Beverly Cycle Co.
[illegible]	Chevrolet	W. H. Brown

Iowa

[illegible]	King	R. W. Thompson & Co.
[illegible]	Chevrolet	Fairfield Motor & Supply Co.
[illegible]	Chevrolet	F. I. Lauer
[illegible]	Chevrolet	Hansen & Tyler Auto Co.
[illegible]	Oldsmobile	G. H. Horton & Son
[illegible]	Chevrolet	Ben Cohen
[illegible]	Maxwell	L. V. Harpel

Kansas

[illegible]	Reo	H. J. Haskard

Kentucky

[illegible]	Maxwell	Tevis & Shaw
[illegible]	Chevrolet	Louisville Auto Exchange
[illegible]	Maxwell	I. G. Bybee
[illegible]	Maxwell	Motor Sales Co.
[illegible]	Saxon	Motor Sales Co.
[illegible]	Maxwell	Cedar Brinley Co.
[illegible]	Saxon	Young & Russell
[illegible]	Maxwell	F. S. Nielsen
[illegible]	Maxwell	H. C. Carpenter
[illegible]	Maxwell	R. L. Pettibone & Sons

Massachusetts

Boston	Hupmobile	Hupp Motor Car Co.
Boston	Scripps-Booth	A. N. Shaw
Springfield	National	I. B. Drew
Springfield	Saxon	Saxon Springfield Co.

Minnesota

[illegible]	Franklin	S. B. Hatch & Co.
[illegible]	Chevrolet	Schroeder Brothers

Maine

[illegible]	Saxon	Saxon Motor Co.
[illegible]	Saxon	C. I. & A. P. Cobb
[illegible]	Ford	Peterson Garage
[illegible]	Oldsmobile	Shearer & Worcester
Portland	Saxon	Portland Saxon Co.
Portland	Studebaker	A. Neale
Sullivan	Saxon	H. L. Cleaves & H. W. Dunlap

Michigan

Battle Creek	Chevrolet	Heyne Finlay Motor Co.
Berrien Springs	Saxon	Kelsey Bros.
Clare	Chevrolet	J. J. Brown & Son
Cheboygan	Saxon	Vet S. Malony
Dearborn	Saxon	J. Kott & J. S. Wright
Detroit	Chevrolet	L. J. Crane
Detroit	Chevrolet	Chevrolet Motor Co.
Flint	Chevrolet	Oscar Anderson
Flint	Chevrolet	Monroe Motor Co.
Flint	Chevrolet	Angus Paterson
Fremont	Briscoe	Jackson Garage
Gaylord	Saxon	Gaylord Auto & Repair Co.
Jackson	Chevrolet	C. H. Hayes
Marine City	Saxon	J. C. Bell
Muskegon	Chevrolet	Apple M. Auto Co.
Otisville	Chevrolet	Scott Kendrick
Owosso	Chevrolet	J. M. Stewart
Pigeon	Chevrolet	Peerless Auto Sales Co.
Port Huron	Cole	Port Huron Tire & Repair Co.
Port Huron	Chevrolet	Wm. Nichol
Washington	Chevrolet	Wright & Houghton

Mississippi

Greenville	Saxon	Chas. A. Fillers
Tupelo	Saxon	D. A. Harkey

Missouri

Farmington	Oldsmobile	J. R. Morgan
Jefferson City	Chevrolet	H. D. Brown
Lexington	Koehler	J. W. Cheatham
Marshall	Koehler	P. H. Rea Garage
Memphis	Koehler	W. C. Chern
Tarkio	Oakland	Hanna & Gabriel

Nebraska

Friend	Buick	Ray Page
Gothenburg	Oakland	C. O. Seeden
Gresham	Oakland	Fuller & Templeton
Hastings	Koehler	Stephen Schultz
Stanton	Buick	Pill Brothers

New Jersey

Freehold	Saxon	Freehold Motor Co.
Perth Amboy	Saxon	Perth Amboy Garage Co.
Redbank	Saxon	F. H. Van Duyn Auto Co.
Somers	Saxon	Somers Garage

New York

Cape Vincent	Oldsmobile	E. C. Cooke
Carmel	Saxon	F. Fowler Auto Co.
Gouverneur	Oldsmobile	F. H. Farmer
Salamanca	Franklin	Charles R. Colman
Syracuse	Saxon	Hoon Hagman

North Carolina

Warsaw	Chevrolet	F. S. Gautier

Ohio

Akron	Chevrolet	Chevrolet Motor Sale Co.
Akron	Chevrolet	Goodyear Tire & Rubber Co.
Alliance	Chalmers	C. L. Camm
Arlene	Chevrolet	W. E. Slider
Canton	Chevrolet	W. A. Kennedy Motor Co.
Chillicothe	Apperson	W. H. Mallow
Cincinnati	Grant	Eureka Auto Co.
Cincinnati	Hollier	Eureka Auto Co.
Columbus	Chevrolet	Winders Motor Sales Co.
Columbus	Jeffery	The Hilane Garage
Columbus	New Era	Hanson Motor Car Co.
Columbus	Pullman	Lutz & McKelvey
Columbus	Stewart	Daniels Motor Car Co.
Delaware	Apperson	Howard Lemon
Jeromesville	Chevrolet	C. I. Ewing & Son
Kenton	Saxon	Ed Rose
Kelleysville	Apperson	H. S. Thompson
McConnelsville	Apperson	F. L. Le Athorn
Mt. Gilead	Chevrolet	A. H. Tave
Newark	Oldsmobile	Clyde Roemer
Springfield	Chevrolet	F. H. Hall
W. Mansfield	Chevrolet	W. H. Needham

Oklahoma

Jet	Regal	S. H. Thomas

Oregon

McMinnville	Oldsmobile	Jack Spears

Pennsylvania

Fayette City	Chevrolet	J. P. Shisler
Greensburg	Chevrolet	W. M. Stranger
Towanda	Saxon	G. W. Coolbaugh

Rhode Island

Providence	Maxwell	H. G. Duckworth
Providence	Oldsmobile	J. A. Webb

South Dakota

Alexandria	Oakland	Tabor Motor Co.
Centerville	Oakland	Nels Lind
Marion	Maxwell	Wm. Petersen
Stratford	Saxon	Hutchinson & Hutchinson
Stratford	Metz	Hutchinson & Hutchinson

Tennessee

Ardmore	Maxwell	J. D. Spears
Brownsville	Maxwell	H. C. Winston & Son
Centerville	Maxwell	H. Willis & Son
Lewisville	Maxwell	Lori Mabry
Dickson	Maxwell	Scotland Motor Co.
Dixon	Maxwell	Fork Motor Co.
Franklin	Maxwell	Harbison Auto Co.
Franklin	Maxwell	Franklin Auto Co.
Frankfort	Maxwell	Nabel Garage
Harrisville	Maxwell	C. A. Henson
Jellico	Maxwell	H. M. Jones
Lawrenceburg	Maxwell	J. P. McWilliams
Middleton	Maxwell	H. F. Mosch
Murfreesboro	Maxwell	McCullough Bros. Vel. Co.
Nashville	Maxwell	Chester Motor Car Co.
Portland	Maxwell	J. E. Kelley & Sons
Richmond	Maxwell	C. J. Tinney
Savannah	Maxwell	Savannah Motor Co.
Sparta	Maxwell	Stone Motor Co.
Sire Citra	Maxwell	A. F. Vattern & Son
Waverly	Maxwell	McFeild Tenn. Auto Co.
Wicare	Maxwell	H. E. Fisher
Winchester	Maxwell	Highland Garage & S. Co.

Vermont

Burlington	Franklin	F. A. Beedie

Virginia

Chatham	Saxon	Southside Automobile Co.
Crewe	Saxon	MacTavish Motor Car Co.
Richmond	Oldsmobile	Commonwealth Motor Co.

West Virginia

Charleston	Saxon	E. R. Calloway
Clarksburg	Saxon	Martinsville Auto & Garage Co.
Fayetteville	Chevrolet	J. C. Hamilton
Logan	Saxon	E. R. Mullins

Wisconsin

Brodhead	Herff-Brooks	Fleck & Kneel
Brodhead	Jackson	Fleck & Kneel
Brodhead	Cleveland	Fleck & Kneel
Clinton	King	E. Terwilliger & Son
Cobb	Sphinx	Gibbs Bros.
Delavan	Franklin	Stewart Garage
De Pere	Apperson	McGeehan Sons Co.
Fond du Lac	Chevrolet	J. H. Giddings
Hudson	Buick	G. T. Kaiser
Janesville	Saxon	J. A. Strimple
Lone Rock	Patterson	Jordan & Wehmer
Manitowoc	Chevrolet	Olson & Pauley
Marshfield	Jeffery	Peter Daul
Menomonie	Reo	Edmund Pogue
Milwaukee	Inter-State	Cook Motor Sales Co.
Merrimac	Chevrolet	Elbert & Jones
Rhinelander	Case	T. C. Wood Hardware Co.
River Falls	Dodge	Elias Winter
Seymour	Jeffery	Otto Motor Co.
Sheboygan	Studebaker	H. & P. Schlichting
Sturgeon Bay	King	J. Peltier
Sturgeon Bay	Reo	LaMere Bros. Co.
West Bend	Stegeman	Koester Bros.

Wyoming

Gillette	Grant	Arthur Harvey
Granby	Grant	A. P. Curtis
Grand Junction	Grant	Western Colo. Motor Sales Co.
Holyoke	Grant	P. Zimmerman
Idalia	Grant	G. T. Conrad
Kiowa	Grant	Russell Gates Mer. Co.
La Jara	Studebaker	P. C. Jones
Lamar	Studebaker	Lamar Hardware Co.
Loveland	Grant	Loveland Novelty Wks.
Longmont	Grant	L. L. Sherman
Loveland	Grant	C. W. Coffman
Manzanola	Grant	Manzanola Auto Co.
Monte Vista	Grant	Charles Kerb
Newcastle	Grant	J. Sedgwick
Rawlins	Chevrolet	M. M. Rutner
Sheridan	Grant	W. C. Reid & Son
Wheatland	Grant	Wheatland Garage

COMMERCIAL VEHICLES

Indiana

Columbus	Koehler	The Williams Garage
Richmond	Koehler	Shirley & Gear.

Kansas

Coffeyville	Koehler	Coffeyville Garage

Massachusetts

Beverly	Koehler	J. W. Elliott

Michigan

Detroit	O. K.	Moore Mullen Co.
Jackson	Signal	Lewis Allen

Missouri

Joplin	Koehler	J. W. Gerrisch

Nebraska

Hastings	Koehler	Stephen Schultz

New Hampshire

Bethlehem	Koehler	F. H. Glenn & Co.

North Carolina

Statesville	Koehler	N. W. Fox

New York

Utica	Koehler	C. V. Kirkland
Westbury	Koehler	M. J. Kissling

Pennsylvania

Warren	Koehler	I. A. Hubbard

Virginia

Lynchburg	Koehler	Benton Auto Repair Co.

Wisconsin

Shullsburg	Kissel-Kar	G. M. Baker

ZENITH

SIMPLICITY

THE strongest appeal of the Zenith lies in its absence of moving parts and adjustments. Once properly installed the car owner forgets he has such a device on his machine.

Because right down to elementals—to the very bed rock of carburetion—goes the Zenith. Outside of the constant level mechanism and of the butterfly valve all else is rigid and proof against carburetor ills.

This extreme simplicity means permanent carburetion satisfaction. Where you have a multiplicity of adjustments which can be thrown out of order by the inquisitive novice—you have trouble. Where there are springs or valves or pistons to eventually fail in their proper workings you will surely get variable mixtures—and trouble. Complication is expensive to maintain. Why use it when it is unnecessary?

The secret of the Zenith lies in its fundamental principle in the Compound Nozzle. In this exclusive and basic idea can be found the many reasons for Zenith simplicity and superiority and remarkable results. Without it, complication piles up or results are lacking. With it, the perfect mixture balance is constantly maintained. The record of the Zenith through seven years of ascending popularity proves its worth.

Repeat orders year after year tell the Zenith story. Holding old customers and making new friends in an ever widening circle drives home this fact. The simplicity of the Zenith principle is exclusive and fully protected. It is always at your service.

CARBURETOR

DETROIT · · · U - S - A ·

Charles Y. Knight, Inventor, Says:

"An American producer of first rank will shortly announce a Knight motored car to sell at a price in the neighborhood of $1,000.

"This producer, after three years of careful preparation has mastered the problem of building Knight Motors in large quantities.

"And building them equal to the Knight engines of the [illegible] foreign makers.

[illegible] I believe, convince the public tha[illegible] destined to wholly displace all oth[illegible]med purchasers of motor cars in this [illegible]

Automotive Industries

MAGAZINE LOAN COLLECTION

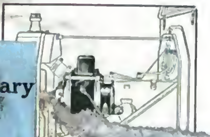
The AUTOMOBILE

Vol. XXXII
No. 25

NEW YORK, JUNE 24, 1915

Ten cents a copy
Three dollars a year

MAGAZINE LOAN COLLECTION



—to those interested
in Ford

either as c
owners, a

stem for Ford
$75

THE GRAY … in actual use on over
200,000 aut

It is not a "theor … or may not give satisfactory service.

The performance … pen book to any motorist. The efficien … automobiles are driven.

Consider that th … cars costing as high as
$7,000. Conside … hirteen differ
of 1915 automob

Then realize th
GRAY & DAVIS system—GRAY & DAVIS
and performance

Is it any wonder that FORD ow
can build them?

Sen

GRAY & DAVIS, Inc.

Cleveland Public Library

MAGAZINE LOAN COLLECTION

Date when due marked below

C.P.L. Form 1218 Reading

Before You Buy Another Tube—Think This Over

More tires are ruined through the use of cheap, faulty tubes than through any other cause.

We know. We make tires and consequently we make adjustments, and nine times out of ten when examining a ruined tire we find that a cheap porous tube was the actual cause of the damage.

The Reason

The best tire in the world will break down and rim cut if it is not kept properly inflated. This is because the fabric in an insufficiently inflated tire is being constantly subjected to an abnormal breaking strain which eventually causes the layers, which compose the carcass, first to crease—then to break and—then to blow out. When a tire is at all soft and inclined to "give" when it strikes a bump, the strain on the fabric becomes terrific. It can't stretch, consequently *it must give.*

Cheap Tubes Are Not Cheap

It is impossible to keep even a good tire properly inflated if it contains a cheap, faulty inner tube. For ordinary cheap, machine-made tubes are porous. They leak. They are made of but one thick sheet of rubber rolled on a tube and then vulcanized, which leaves all the tiny air pockets and bubbles and flaws especially inherent to cheap rubber *in the tube.* You can't see them, but they are there just the same.

And although you may start on a trip with tires properly inflated they *slow leak.* They leak *through* the rubber and around the valve base. They require inflating often else the shoes are quickly ruined.

National Special tubes are made of the finest selected rubber stock money can buy—Upriver Para. We could compound ordinary good rubber for 1/3 the price we pay for this selected stock. Then when we build the tube we build it of many thin layers—not of one solid sheet. Each layer is rigorously inspected as it is applied in order that flaws, if any, may be detected and removed. Each layer is applied under ten tons of pressure. Then the tube is built *thick*—thicker than any other tube you have ever seen.

It takes time and money to make tubes in this way but the results obtained are well worth the added cost, for these tubes are non-porous and are so guaranteed. They *stay* inflated. They are proof against deterioration. They have from three to five times the life of ordinary machine-made tubes.

Think This Over

Before you buy another cheap tube think of more than the initial price. Consider how long it will wear. Will it be a constant source of annoyance and endanger the life of your tires—the *real* item of expense? Will it lose its toughness and elasticity after being in use for only a short time? Will it stand heat—friction heat plus the heat of a hot summer day without going to pieces? Is it worth while—this saving of 50 cents on a tube at the expense of a good shoe?

Play safe. Get 100% tube value. Buy National "Special" Red Tubes.

National Rubber Company
Factory and Main Office,
Pottstown Pa.

Size	Price	Size	Price
28x3	$3.10	36x4	$5.90
30x3	3.20	37x4	6.14
30x3½	4.10	34x4½	7.10
31x3½	4.25	35x4½	7.25
32x3½	4.40	36x4½	7.50
34x3½	4.70	37x4½	7.75
36x3½	5.00	35x5	8.50
31x4	5.20	36x5	8.70
32x4	5.30	37x5	9.00
33x4	5.50	39x5	9.30
34x4	5.65	37x5½	10.30
35x4	5.75	38x5½	10.50

National
l Red Tube

Vol. XXXII New York—Thursday, June 24, 1915—Chicago No. 25

The AUTOMOBILE

Members of the S. A. E. party cruising through the Thirty Thousand Islands of Georgian Bay

S. A. E. Cruise Big Success

Valuable Discussion on Sixteen Papers Covers Broad Phases of Industry—Six Standards Reports Passed

By J. Edward Schipper

DETROIT, MICH., JUNE 17—Today closed the 4-day convention of the Society of Automobile Engineers, held on the waters of the Great Lakes, and never before has the art of automobile engineering received a mightier forward impulse. Characterized by fine attendance, the frankest of discussions and the laying aside of prejudice and the personal feeling which often interferes with pure analysis, this meeting has been a success from the supreme standpoint of accomplishment.

The professional part of the program included sixteen papers and twelve reports of standards committee divisions. Of these fourteen of the papers were read and the entire standards program carried out. Of the twelve standards reports six have gone far enough to be submitted by letter ballot according to the new procedure to members of the society, and the other six were progress reports.

President VanDervoort's handling of the meeting attracted favorable comment on all sides. Particularly noticeable was his success in bringing men vitally concerned in a subject into the discussions. The attendance at the individual meetings, even with the highly specialized subjects, hardly ever dropped below 100 and was generally above that figure. Keenest interest was exhibited throughout the meeting. The new procedure of the standards work in submitting approved reports to the members for mail vote was carried out successfully, and these matters will soon be presented.

The Noronic's main salon in which the meeting was held gave ample space for the meeting, and in fact the manner in which the meeting was conducted proved so satisfactory that it is proposed to hold an entire week trip next summer.

The keynote of the entire meeting was without doubt the discussion which followed the paper by A. P. Brush, of the Brush Engineering Association, which brought up the question paramount in the minds of the public as well as those professionally connected with the automobile industry: What is the proper number of cylinders? To briefly summarize the points made in this discussion into a concrete line of thought, one who listened to the discussion would carry away with him the impression that the keynote of the entire situation is the displacement per cylinder. Between 40 and 50 cubic inches per cylinder seemed to meet the ideas of quite a few who participated in this discussion to a nicety. The problems presented by extreme high-speed motors with excessive high-gear ratios were also examined from many different angles.

The discussion brought out by the paper on Farm Tractors and Their Motors by Philip S. Rose was another high spot in the meeting. The discussion hinged upon the point of good performance at low price. The duty of the farm tractor is a strenuous one in that the motor must be operated for long periods under full load. This puts a high performance demand upon the motor and at the same time the farmer will not consent to high prices. The price limita-

Listening to the papers on board the Noronic, where the engineers held their meeting while cruising the waters of Georgian Bay

tion for practice in considering the market containing the mass of buyers seemed to be between $600 and $1,000.

Another discussion which will stand out in the minds of those who attended was that on the paper entitled Aluminum Alloy Pistons, by Eugene Gruenewald.

No Objections Offered

The big point in it was that no one seemed to have anything to say against the aluminum piston and there did not seem to be any doubt in the minds of those present that aluminum pistons have come to stay. The question of slap which has been brought up in the past was again brought up, but it seemed to be the consensus of opinion that while the slap does occur for the first few explosions, it is lighter than a cast-iron piston slap and does not bother the car owner.

Other papers which were provocative of interesting and instructive discussions were Automobile Clutches, W. F. Hurst; A Formula for the Comparison of Automobile Performance, C. T. Myers; Rational Method of Electric Vehicles, T. H. Schoepf; Increasing Truck Efficiency with Trailers, A. R. Miller; Automobile Lubrication, C. W. Stratford; Spiral Bevel Gears, A. L. Stewart; Pressed Steel Wheels for Pleasure Cars, Orrel A. Parker; Spring Design, C. H. Gleason.

Picnicking on Sans Souci, one of the Thirty Thousand Islands of Georgian Bay

The Standards Committee reports, which have been adopted for decision by letter vote, are those of the division on carbureter fittings, electrical equipment, electric vehicles, iron and steel, miscellaneous and springs. Statements of progress were made by the divisions on ball and roller bearings, chains, international standards, lock washers, and truck standards. These reports are largely the result of the April meeting of the standards committee and cover the points mentioned at the time of that meeting.

In bringing the business sessions to a close, President W. H. Van Dervoort introduced Captain J. S. Critchley, past-president of the Institution of Automobile Engineers of Great Britain, now acting as inspector of the Motor Transport Division of the British Army, who was on board. Captain Critchley is now working on the truck war orders being filled by American manufacturers. In addressing the members, Captain Critchley stated that the I. A. E. had planned for the S. A. E. trip last year and was greatly disappointed that war conditions prevented their coming. He, however, expressed the wish that the trip would be made at the conclusion of the war, and also said that the English engineers were looking forward to a trip over here. Speaking of the impressions gathered during the discussions, he stated that it is interesting to note the development of the American automobile engine, and though their high-speed type has been studied to a greater extent in Europe, it is evident that the Americans are now taking it up with enthusiasm. Regarding the multi-cylinder engine, he expressed his belief that this will force the higher development of the others.

Winter Session 1 Day

President Van Dervoort mentioned the appreciation which was felt of the close relation between the two societies and hoped for many pleasant exchanges in the future.

Speaking of the winter meeting, which will be held in New York, in connection with the New York Show, the president announced that this meeting will be for 1 day only, the standards committee meeting on the Wednesday of show week, and the session will take place all day Thursday, with a dinner at a prominent hotel in the evening. By this method it is hoped that a very full attendance will be had and a rapid conclusion of the business program.

Several suggestions have already been made regarding the next summer's meeting, and the consensus of opinion seems to be that the cruise this year was a day or 2 too short. Many felt that they would like to make an entire week's trip, and the idea of going to Duluth was submitted. It was pointed out that the Great Lakes seem to be the most ideal for a cruise of this kind.

Votes of Thanks

The agitation for a Chicago section was mentioned and bids fair to become a reality. There are 175 members in the territory around Chicago, and many are of the opinion that a strong section should be formed there. The October meeting of the standards committee is to be held in Chicago and at that time an effort will be made to start the section. President Van Dervoort has written to all members in that territory, and up to the present he has had 65 favorable replies.

Votes of thanks were unanimously carried in appreciation of the work of the meetings committee, the Detroit section for the arrangements made, the Daily S. A. E. which enlivened the trip greatly, the work of the steamship officials and the crew in taking care of everything so nicely, the music furnished by the Packard band when the boat was leaving Detroit, and the courtesy of the various Detroit concerns for lending cars to take the people to the boat and around the city. A rising vote of thanks was also tendered President Van Dervoort for the very efficient manner in which he conducted the sessions and put things through. The latter voiced his personal appreciation of the attendance at the meetings, of the interest shown and of the close harmony in the Society's work. He hopes for many more cruises of the same kind on the Great Lakes.

During the trip, exceptional opportunity was obtained for social enjoyment and for recreation. Arriving at Midland, Ont., on Tuesday afternoon at about 5 o'clock, the members of the party immediately gathered through the village and organized parades.

Tuesday night an entertainment was furnished by the Metropolitan section, including a playlet entitled, The Sad Mystery of the Wiggle Drive, which depicted the war order as the cause for the adoption of the Wiggle drive and a series of tableaux vivants representing the past presidents of the society. Wednesday night, the Detroit section entertained with a minstrel show, which scored a complete success. A dancing contest held just before the boat returned to Detroit was won by Miss Polly Souther, daughter of Henry Souther, past president of the Society, and John W. Watson, President of the American Bronze Co.

City Queen above and Waubic below, the shallow draft vessels which took the engineers through the channels among the Thirty Thousand Islands

The only professional session held on Wednesday was in the evening, the whole day being taken up by the cruise on the smaller vessels through the islands. A stop was made at one of them, San Souci, for a short time during the afternoon and a picnic enjoyed. The party then re-embarked and were carried through the narrow island channels to Parry Sound where the large steamer was rejoined.

Left, members of the meetings committee: E. T. Birdsall, consulting engineer; J. G. Perrin, consulting engineer Continental Motor Mfg. Co.; Robert McAllister Lloyd, consulting engineer, and Joseph A. Anglada, consulting engineer. Right, members of the nominating committee: Howard Marmon, engineer Nordyke & Marmon Co.; David Fergusson, engineer Pierce-Arrow Co.; Henry Souther, Ferro Mach. & Fdry. Co.; President W. H. Van Dervoort, president Moline Automobile Co.; Coker Clarkson, general manager S. A. E.; J. G. Perrin, consulting engineer Continental Motor Mfg. Co.; K. W. Zimmerschied, metallurgist General Motors Co.

40 to 50 Cubic Inch Cylinders

President W. H. Van Dervoort, who conducted the S. A. E. convention

Brushisms

1—Speeds should vary 3 to 60 miles per hour on high speed.

2—Motor speed range 125 to 2,500 r.p.m. crankshaft speed.

3—Zone of satisfactory cylinder diameters from 2.5 to 3.5 inches.

4—Stroke bore ratios satisfactory between 1.33 to 1 and 1.5 to 1.

5—Power and flexibility best increased by adding more cylinders.

6—Eight gives 100 per cent. power increase over four with simple crankshaft.

7—Europe's motors not as high speed as newer American.

FUNDAMENTAL PROBLEMS OF ENGINE DESIGN

A. P. Brush, consulting engineer, author of engine design paper

IF A. P. BRUSH'S paper had been designed for the purpose it could not have brought out better discussion on the vital question of the number of cylinders. His paper was entitled Fundamental Problems of Engine Design, and in it he touched upon the high-speed motor, stating that this seemed to be the accepted design for motor vehicle use. He fixed the speed range of these motors as between 125 r.p.m. and 2,500 r.p.m., and the speed fluctuation of from 3 to 60 miles per hour on high. The stroke bore ratio he fixed at between 1.33 and 1.5 to 1, and in stating the zone of satisfactory cylinder diameters he gave from 2.5 to 3.5 inches. Mr. Brush stated that fours will always be used, that the six represents no increased comfort value, as does the eight, due to the increase in number of impulses per revolution. He also says that the only justification for lengthening the wheelbase of the car for increased engine space and the introduction of a three-plane crankshaft is a 200 per cent. increase in impulses and a 200 per cent. increase in piston displacement over a four of equal dimensions. The discussion on this was participated in by many engineers who are vitally concerned with the subject and seem to bring out a consensus of opinion that it was a matter of piston displacement per cylinder, how many cylinders should be selected. The paper in part follows:

There is certainly a majority and probably a unanimous opinion among engineers that the small-bore long-stroke high-speed motor is the best adapted to automobile service, at least in pleasure vehicles. Let us make a brief analysis and see if we cannot accept this statement as an axiom, and base our further consideration of motor car engine design and construction upon this one fundamental truth.

In stationary work efficiency has pretty generally increased with the size of the cylinder, but this apparent contradiction can be easily rationalized if we begin at the beginning and consider the conditions and requirements of the class of motor car service in question. In the first place, weight reduction is a prime requirement; and relatively high speed is the most obvious method of securing weight reduction. In the second place, the class of service under consideration demands flexibility throughout a range unapproached in any other service. If from three to sixty miles per hour be accepted as reasonable minimum and maximum road speeds on top gear, we have a 95 per cent. speed fluctuation, throughout which speed range our motors must operate satisfactorily at from zero to full power. In a high-speed automobile engine this might represent a speed range of from 125 revolutions per minute to 2500 revolutions per minute, a range not only not impossible but not even difficult. For an extreme comparison, let us assume an attempt to get the same speed range on a large engine capable of say a maximum of 100 revolutions per minute, and we have the impossible minimum of 5 revolutions per minute required.

Accept Small High-Speed Motor

It therefore becomes apparent that we can accept this small high-speed engine as the best adapted to automobile service because of low weight and flexibility.

From this much of our analysis we might conclude that the smaller the cylinder diameter the better, but there is also one fundamental reason why the piston diameter should be kept as great as is consistent with continuous operation at full load and maximum speed, namely: the superficial area of similar volumes varies as the square of their similar line dimensions, while the volume varies as the cube of their similar line dimensions. This means that the smaller the combustion chamber, the greater is its superficial area in proportion to its volume, and consequently at a given rate of speed, the greater will be the amount of heat lost through the relatively cold confining walls.

Two fundamental necessities in motor car service (light weight and great flexibility) can be met satisfactorily only by a motor design capable of continuous operation under full load at speeds at least as high as 2500 revolutions per minute. From the preceding analysis it is obvious that the piston and exhaust valve diameters will be definitely limited, if satisfactory performance and durability are to be secured in the hands of the average user, and it is equally demonstrated that we must not go too far below these limits if satisfactory efficiency is to be secured, because of the already noted geometrical fact of relative volume and area ratios, in connection with the pre-heating and cooling effect of combustion chamber walls.

I will not attempt to say just what the best compromise between these two conflicting limitations is, but in my opinion the zone of satisfactory cylinder diameters lies between a maximum of 3 1-2 inches and a minimum of 2 1-2 inches, and I shall base further consideration upon this assumption as stated.

Very satisfactory power curve characteristics can be secured with a stroke-bore ratio as high as 1.5 to 1, and the cylindrical type of cylinder construction and valve arrangement will show with as low a ratio as 1.33 to 1 superior efficiency to that of the longest stroke L-type cylinder construction which it is practicable or advisable to use.

Let us assume, for the purpose of further discussion, that a cylinder of 3 inch bore and 4 1-2 inch stroke, with inverted or overhead valves, will give the highest average efficiency and still meet satisfactorily the requirement of continuous performance under full load at speeds at least as high as 2500 revolutions per minute, or in other words when subjected to maximum temperatures and pressures at least as often as 1250 times per minute.

Number of Cylinders

These cylinder dimensions give a displacement of approximately 32 cubic inches and can safely be relied upon to give, in the hands of the ordinary user, at least 3.2 horsepower at 1000 revolutions per minute (500 cycles per minute), and to approximate proportional power delivery throughout a wide range of higher and lower speed.

If two of these cylinders be combined in a two-cylinder engine, we have double the piston displacement per revolution with less than double the total engine friction per cylinder, and again, if the number of cylinders be doubled, we again double the piston displacement but do not quite double the total engine friction per cylinder. In fact, increasing the power by multiplying the cylinders has a tendency to increase the efficiency of an engine so long as the same power per impulse is required.

The only problem which tends to decrease efficiency, as the number of cylinders is increased, is the problem of uniform and adequate charging of the cylinders.

I assume that no one will question the axiomatic truth that all other things being equal, the greater the number of impulses per revolution of the crankshaft, the greater will be the flexibility of the motor. This increase in flexibility due to increased cylinder numbers is of maximum value in automobile service, because it is an increase which is added entirely at the lower end of the speed range.

There is obviously no reason for discussing any number of cylinders less than four, as it has been conclusively demonstrated that that number gives the least number of impulses per revolution of crankshaft that will be tolerated by the most economical class of motor car buyers. I believe that the four-cylinder motor will continue to be standard for the lowest price class of automobiles so long as the four-cycle internal combustion engine continues to be the accepted source of power for this type of vehicle.

As I have already pointed out, two exceedingly important factors in the comfort value of a car, namely, power and flexibility, can be bettered by increasing the number instead of the size of the cylinders, with less sacrifice of fuel efficiency and with an actual gain in durability.

Let us now compare the two first steps beyond the four-cylinder vertical motor in relation to increased comfort value. I refer to the six-cylinder vertical and the eight-cylinder V-type motors.

For purposes of comparison let us assume the same cylinder dimensions, 3 inch bore and 4 1-2 inch stroke. The six-cylinder motor will give an increase of 50 per cent. in power; the number of impulses per revolution will be increased 50 per cent. The cost of this increase will be the two extra cylinders with their pistons, connecting-rods, valves, valve operating mechanism and other minor supplemental parts. Also we must depart from the simple all-in-plane crankshaft of the four-cylinder motor, and to keep the same passenger capacity we must increase the wheelbase of the car something over two cylinder-diameters.

Eights and Twelves

The advantages of the eight consist in a 100 per cent. increase in power and a 100 per cent. increase in number of impulses per revolution. The increase in the number of major working parts is, as in the six, substantially in proportion to the number of cylinders added. I say substantially, because we must except two of the major working parts, the crankshaft and camshaft with their inter-connecting gear, the number of these parts being the same independently of the number of cylinders.

In the eight V, however, we have this much less price to pay for the greater increase in power and flexibility: the crankshaft remains of the four-cylinder all-in-plane type; the increase in wheelbase need not be more than half of one cylinder-diameter.

I think, therefore, that we must conclude that the eight-cylinder V-type motor makes possible a decidedly greater increase in the comfort value of the car, as effected by motor performance, than the six-cylinder vertical, at a cost in dollars and cents and in car weight at least as low.

David Fergusson, chief engineer Pierce-Arrow company; Russell Huff, engineer Packard company; Howard Coffin, engineer Hudson company; D. McCall White, engineer Cadillac company, and Howard Marmon, Nordyke & Marmon Co., who took part in engine discussion

As a corollary to this, I think we must conclude that any lengthening of the wheelbase of the car, for increased engine space, and the introduction of a three-plane crankshaft, can be justified only in case we wish to secure a 200 per cent. increase in number of impulses per revolution and a 200 per cent. increase in piston displacement over a four of equal cylinder dimensions; or in other words, if we wish to increase the comfort value of the car as affected by engine performance up to the point where the twelve-cylinder V-type motor is advisable.

Victor Page, engineer New Departure Co.; A. Ludlow Clayden, engineering editor THE AUTOMOBILE, who participated in discussion on engine design

In connection with V motors in general, some interesting facts in major vibratory tendencies appear. Taking the V four, for example, if all cylinders would work properly on a single crank-throw, as compared with the vertical four of the same cylinder dimensions, all major vertical vibratory tendencies would disappear and in their place would be found a horizontal vibratory tendency just twice as great as the vertical vibratory tendency of the vertical four.

In the V eight as compared with the vertical four of the same cylinder dimensions, the vertical vibratory tendency disappears and in its stead there is a horizontal vibratory tendency of the same general characteristics, 1 3-7 times as great as the vertical vibratory of the vertical four.

In this connection it has been interesting to observe that a properly constructed chassis seems much better able to absorb this horizontal vibratory tendency than the vertical vibratory tendency of the vertical four.

The V twelve seems to have the same major vibratory tendencies and characteristics as the vertical six; that is, instead of a tendency to reciprocate the entire motor mass with four reversals per revolution of the crankshaft, as in the vertical four and V eight, there is a tendency to set up periodic vibrations within the motor mass, the amplitude of these vibrations being in proportion to the work the engine is doing.

This six vertical and twelve V vibration seems to be a function of crankshaft flexibility. This was met more or less successfully some years ago by some of the foreign engine builders by use of a friction damping method. What we might term the American method of overcoming it, by increased crankshaft and crankcase rigidity, is, I think, much more scientific and workmanlike.

Overhead-Valve Construction

I have referred previously to the fundamental advantages of the inverted- or overhead-valve type of construction and made the statement that the problems of valve operation had been solved satisfactorily. In proof of thermal advantages of this type, I would like to call your attention to the fact that in automobile engines this is the only cylinder type which has survived in the direct- or air-cooled engine; and I believe this survival has been due almost entirely to, first, the inherent thermal superiority of this cylinder form, and, second, the brilliantly simple manner in which the problem of valve operation has been met, a method so simple that it has apparently escaped the general attention.

The overhead rocker type of valve-operating mechanism has been criticized as being noisy, because of the greater mass of the moving parts involved. With valve rockers pivoted at their centers, this is an obvious and inherent defect. It is the Franklin company's practice to locate the rocker pivot twice as far from the center line of the valve stem as from the center line of the push-rod. This means that for the same valving characteristics, the cam-rider, the push-rod, and the push-rod end of the rocker have just half the movement, and consequently half the maximum velocity of the valve, and in turn just one-fourth the kinetic value in proportion to their weight, with the result that the kinetic value of all of the moving masses of the valve-operating mechanism is nearly if not quite as low as in the average practice in L or T type of engine designs.

The selection of this best commercially possible thermal cylinder and valve arrangement, in connection with the really splendid bit of engineering skill, has secured commercial quietness of valve operation in the air-cooled type of engine mentioned, in which owing to the lack of water jackets quietness is most difficult to achieve.

I believe that by taking one more step we can make this indirect valve-operating mechanism commercially superior to any other known type. By making the position of the offset rocker-pivot adjustable, the adjustment parts thus becoming stationary, in connection with the offset rocker and lightened moving parts there will be secured kinetic values at least as low as those of the best direct-action types, in proportion to the effective valving. In addition we attain a convenience of adjustment for the user that has not been approximated heretofore in any constructions with which I am familiar. President Van Dervoort declared the paper open for discussion.

F. E. Moscovics opened the discussion on this paper by saying, "I wish to take exception to Mr. Brush's suggesting the limiting of 'useless experimentation.' Think back 6 years. And how many of the developments since that time have been the result of so-called useless experimentation?"

"I would like to ask," continued Mr. Moscovics, "what is a high-speed motor? How many r.p.m. would constitute a high-speed motor?"

Mr. Brush replied that he was having the misfortune of being constantly misunderstood during the progress of the session. He said, "If you should put your hand upon a hot stove, and that stove should burn you, any placing of the hand upon that stove subsequently would be useless experimentation."

Herbert Chase, engineer of the Automobile Club of America, said regarding the minimum area of the combustion chamber, that he could not see the practical advantage in limiting the combustion chamber area since greater wall area does not make a material difference. "We should give less attention to theoretical limits of wall area and more attention to the adjustment of the carbureter, since a small turn of an adjusting screw makes a tremendous difference."

Mr. Brush replied that the reason he has selected a four-cylinder car in his paper was simply to narrow the discussion to this point. "As to temperature of cooling water,"

Scenic view among the Thirty Thousand islands of Georgian Bay, through which the engineers took a side trip

Panorama characteristic of the waters of Georgian Bay, through the islands of which small steamers conveyed the S. A. E. party

he said, "this is immaterial, as to base conclusions on this would be to base them on uncertain premises. The change of the inside temperature is less than the change of the temperature of the water. The cylinder wall only takes the heat from a small layer of gas adjacent to the wall of the cylinder. Understand," Mr. Brush continued, "we do not advocate that the design of the carbureter shall be neglected for engine design, but rather that both should be studied independently."

Asks for Multi-Cylinder Men

President Van Dervoort asked for the champions of the sixes, eights and twelves, stating that the engineers were anxious to hear them.

C. W. McKinley, engineer of the Willys-Overland Co., told of experiments of a similar nature on two types of motors having the same displacement, but one of which had a spherical combustion chamber and the other had a very flat chamber. These experiments were carried out to maintain a parallel between the two motors and under similar working conditions. These tests, according to Mr. McKinley, showed little or no variation between the two motors, and he expressed it as his belief that there is really little effect due to the shape of the combustion chamber. He further stated that the design of the intake is as important as any other point and that in present designs it is necessary to make a sacrifice in maximum power and speed in order to secure the best starting. In other words, he pointed out that the intake manifold design is a compromise between the securing of high power and the facility of starting and running at idling speeds.

Professor F. R. Hutton called attention to the part of the paper which states: "The strength of any structural element of any given material increases inversely in proportion to its size. To illustrate, a steel ball 1 inch in diameter will carry several thousand times its own weight, while a ball of the same material one mile in diameter would fall apart of its own weight."

Professor Hutton pointed out the mathematical error in the way the statement was made in the paper. To this criticism Mr. Brush replied that he did not intend the expression in the manner in which it was printed, but meant to state instead that the proportion held, but not in a direct ratio.

C. T. Myers, engineer of the Timken-David Brown Co., said: "Mr. Brush has assumed many fundamentals. Along the present line I believe the four-cylinder motor to be capable of higher development than any other type."

Victor Pagé, experimental engineer of the New Departure Co., in a contributed written discussion stated that the big objection against the multi-cylinder engines is in their added repair expense. He believes that the number of cylinders justified to secure easy running should be used, but after the justified number is reached the designer should endeavor to make things as easy for the operator of the car or the ultimate consumer as possible. Fewer vibrations, smooth power application and the other products of the large number of cylinders will lessen the number of repairs necessary on the car, but there is always sure to be a certain depreciation and to men of only moderate wealth the cost of these repairs is sure to be a serious matter. The large middle class of buyers, who own cars, are not technically informed and hence simplicity is a great factor to be considered.

Mr. Pagé mentioned as a special example the grinding of the valves. "Suppose the operator traveled without the spark properly advanced. This would be hard on the exhaust valves due to the increased temperature of the exhaust and the result would be that the valves would need grinding at a much earlier time. When it comes to the cost of this operation I have done the work on a four-cylinder, block motor in 2 hours. On a singly-cast motor the work would take 3 hours. If the motor has sixteen valves it will take twice as long. At the usual garage rates the charges for the four-cylinder motor would be $2.50, for the eight this would be multiplied by two and for the twelve it would be multiplied again. In the same proportion the charges would be multiplied for every piece of work done throughout the car. The result would be twin-multiple repair bills."

William Stout, engineer the Scripps-Booth Co.; C. W. McKinley, engineer the Willys-Overland Co.

David Fergusson, engineer of the Pierce-Arrow company, in commenting on Mr. Brush's paper, said, "Mr. Brush's paper is of great interest in view of the rush for the high-speed motor of multi-cylinders. The medium-speed engine will last 10 years. Europe has developed high-speed motors in the last 3 years geared 3.3 to 1 and they do not run at really high speeds unless at 70 or over miles per hour. At 40 miles per hour the engine speed is 1,300 r.p.m. and at 70 miles per hour it is 2,250; therefore, these motors running at medium speeds should have long life. Taking some of the eight-cylinder motors of American manufacture geared at 5 to 1, these make a higher speed than the European type. At 40 miles per hour they are making 1,900 r.p.m. and at 70 miles per hour they are making 3,300 r.p.m.

Larger Motor Sweeter Running

He went on to cite the example of Pierce cars, which are made in three sizes of motor, 4 by 5.5, 4.5 by 5.5

(*Continued on page* 1145)

Spiral Type Bevel Gear

No Adverse Criticism Found in Discussion

SPIRAL BEVEL PROPERTIES

- Have longer life.
- Less unit strain.
- No greater wear.
- Greater quietness.
- More tolerance in adjustment.
- Higher gear ratios possible.
- Retain permanent conjugate form.

A. L. Stewart, Gleason Wks., author of paper on spiral bevel

TAKING the paper entitled Spiral-Type Bevel Gears for Automobile Drives, by A. L. Stewart of the Gleason works as an indication it would seem that this type of gear had come to stay, for little if any adverse criticism was brought out in the paper itself or in the following discussion on this design. The general concession of long-life and noiselessness together with the admission that any loss in efficiency must be very slight was quite significant.

According to the author and those who followed him at the professional session of the S. A. E. longer life can be expected from the spiral type because of the greater surface over which the load is carried, in spite of the fact that the load in itself may be greater. Greater quietness and the possibility of a marked departure from absolute adjustment are other features. Speaking of strength and wear the author says:

Strength and Wear

Perhaps the most satisfactory way to consider the strength and wear of spiral-type bevels is by comparison with straight-tooth gears. For the same power transmitted, and other things being equal, the load on spiral teeth is greater than on straight teeth, because the spiral tooth must carry the additional thrust-load. This thrust-load varies with different angles of spiral, but assuming an angle of spiral of 30 degrees, the total load on the tooth is about 15 per cent. greater than the corresponding tooth load for straight-tooth gears. To offset this extra load the spiral-type gear has more teeth in contact at all times than the straight-tooth gear. Assuming that the spiral lead is such as to give an overlap equal at least to once the circular pitch, there will always be one more tooth in contact. While the contact of the extra tooth will not be full-length, still it will be more than enough to make up for a 15 per cent. increase in load. That is to say, spiral teeth, while they have a greater load to carry, have that load so distributed as to put less strain on each tooth. We have known of very severe tests of an electric car spiral-type drive in which a nine-tooth six-pitch pinion running with a sixty-six-tooth gear with a face length of 1 1-4 inches, has stood up under repeated reversals of the motor when running at high speed. The total load, including three passengers, was about 4,000 pounds. The pinion was made of 5 per cent. nickel steel case hardened, and was, of course, solid with the shaft.

Referring again to the comparison of spiral-type bevel gears and helical-spur gears with parallel axes, it will be seen that inasmuch as the spiral-type bevels have no more sliding action than straight-tooth bevels or spurs, there will be no more tendency to wear from the nature of the action. This can be seen from another point of view, by considering a spiral-type tooth as made up from a straight tooth which has been cut into a number of sections normal to the tooth, the sections or laminae then being offset with respect to each other, or stepped, so as to conform to the spiral curve. Each section would then roll with the corresponding section of the mating tooth with the rolling action of straight-tooth gear. If the number of sections is increased the tooth approaches a spiral type tooth with a smooth curve, but the increase of sections does not introduce any more sliding action. A spiral type tooth may be considered as made up of an infinite number of such sections each infinitely thin, but the action will still be the same. Thus if there is no increase of sliding action, the only condition which will tend to increase the wear is the increased tooth load. The length of tooth measured along the spiral is, however, increased in the same proportion as the load itself, so that the unit pressure is the same as for straight teeth.

Contrasts Spiral and Worms

In opening discussion on A. L. Stewart's paper on spiral-type bevel gears, C. J. Fitzpatrick asked whether the spiral spur gear were not more like a worm than the spiral-type bevel. Was not the spiral-type bevel an essentially different acting gear from the spiral spur gear? Mr. Stewart said the spiral forms were all alike in action as long as the axes were parallel. If the axes are not parallel a spiral tooth gear is akin to a worm. C. J. Fitzpatrick then asked if there were more distortion in hardening the spiral-type tooth bevel gear and Mr. Stewart replied in the negative.

Henry Hess, asked whether any members had data on the advantages of different tooth forms as opposed to gear forms. Was there anything to choose between the involute form and the Bilgram octoid, for instance? He pointed out that where a spiral-type bevel tooth is coming into the loaded area the part of the tooth in contact is supported by the part out of contact the latter acting as a flank. There was no difference as regards sliding between straight or spiral forms of tooth.

A. P. Brush, said that he would like to suggest a qualification to Mr. Stewart's statement that all gears with axes parallel are equivalent to an infinite number of infinitesimal straight tooth gears arranged in a curve. He would say that this was true of all gears with the axes in the same plane. The reason for the great durability of spiral gears is that there is always pitch line contact on the teeth in contact owing to the overlap of tooth by tooth. Slip or rubbing takes place as the point or line of contact on a tooth departs from the pitch line, thus a straight tooth will always wear away faster above and below the pitch line, than on the pitch line. In the spiral gear, as there is permanent pitch line contact, no other part of the tooth can possibly wear away faster than the pitch line part, which means that a conjugate form of tooth is maintained despite wear.

In the spiral-type bevel cut with a straight sided cutter the tooth is an octoid and not an involute, but both forms for the short length used are practically identical.

Henry Hess begged to differ from Mr. Brush, there was no form of gearing which would retain original tooth form. A gear ought to do this but never really did so. The discovery of a form of gear tooth which would retain its original form had been sought for a very long time and the solution of the problem would be of immense importance.

Mr. Brush, explained that he did not intend to give the idea the spiral tooth retained its original form, but that, owing to the continuous pitch contact, it retained a permanent *conjugate* form.

President Vandervoort called attention to the valuable feature of the spiral-type bevel in needing less accurate meshing to give good results.

Adjustment Toleration

H. W. Alden said he had made experiments to see how much the cone center could be shifted and found it could be rotated around a sphere 1-16 inch diameter. That is, the pinion could be moved 1-32 inch out of the theoretical position in any direction without creating undue noise. Regarding the question of tooth face wear raised by Messrs. Brush and Hess, if a pair of straight tooth bevels are taken and examined after use a distinct line can be seen marking the pitch contact of tooth on tooth. With the spiral gear the surface is polished evenly all over and there is no line to be found. He asked for information concerning the strength of pairs of gears with the same ratio and number of teeth since, although the tooth in the spiral gear would be longer, it would also be thinner. He would like to hear if any tests had been made. Practice showed that trouble with broken teeth was less common with spiral than with straight tooth gears.

Mr. Hess called attention to the Wilfred Lewis machine for testing the strength of gears both ultimate and as regards durability. This machine was now at one of the universities and he suggested as the subject was so very important the research committee of the S. A. E. might consider financing or aiding the making of tests.

David Landau said the machine which Mr. Lewis had built most recently was at the Massachusetts Institute of Technology.

Mr. Brush, remarked that tooth strength was of no importance practically though it might be so academically, since to give necessary durability the ultimate strength is greatly in excess of the necessities of load support. Regarding the tooth formation Mr. Stewart had said the bevel tooth as now used was not a true spiral, but since there are so many true spirals of different kinds he would like information as to Mr. Stewart's exact meaning.

Mr. Stewart replied that Mr. Brush was correct in saying there were many true spirals but the tooth used in the spiral-type bevel was none of them.

Rey Johnson asked whether a nine-tooth pinion had been tried with spiral-type bevel gearing. It had been stated that ten and eleven teeth had been tried successfully and he would like to know whether it was possible to go further than this in view of the demand for even lower ratios to suit high speed engines.

President Vandervoort said this was a pertinent question and brought in the question of tooth strength because, as we used lower gear ratios, there arose a desire for finer pitches.

V. R. Heftler of the Zenith Carbureter Co. spoke regarding the Citroen double-helical bevel and said he had seen successful five-tooth pinions with this form of gear. The double helical or herringbone bevel gear was made with an end mill and could be cut to any desired true spiral form.

C. T. Myers, said that while Messrs. Brush and Alden expressed perfectly accurate practice, Mr. Hess was none the less correct on the subject of tooth wear. If there were true rolling at the pitch line there would be no wear, but as spiral-type bevel teeth touched all over, if there was any rubbing the pitch line was forced to rub just as much as any other part of the tooth face. Whatever rub takes place occurs equally all over the tooth. Comparative tests of worm and other gears should be accepted with caution because it was never possible to be sure that any test was carried out with both forms of gear working under the best conditions. In a properly designed and mounted worm gear the oil film is never broken down and the strength of worm tooth is so greatly in excess of that of any bevel tooth that it is not worth discussion. Worm gearing, if correct, will outlast the rest of the car and is practically indestructible so long as it is properly lubricated. Also since the worm is hard steel and the wheel soft bronze, any wear takes place in the latter. The hard worm retains its true shape and maintains that true shape on the bronze of the wheel. Just as good a mileage per battery charge in an electric vehicle could be obtained with worm as with any other form of gearing.

Mr. Hess said that if we could keep an oil film always unbroken between the surfaces of any sort of gear and also keep out all grit the gear would be everlasting.

Deck scenes, typical of cruise of Society of Automobile Engineers' members and their families on waters of Georgian Bay

S. A. E. Standards Committee Work

Six Reports Adopted, Six of Progress

Reports Adopted

- *Carbureter Fittings*
- *Standards Exchange*
- *Electrical Equipment*
- *Iron and Steel*
- *Miscellaneous*
- *Spring Division*

Progress Reports

- *Electric Vehicle*
- *Ball and Roller Bearings*
- *Truck Standards*
- *Chain Division*
- *International Standards*
- *Lock Washers*

CARRYING out to the letter the program of the standards committee as given in THE AUTOMOBILE for June 17, notable strides have been made in this important work. Adoption of a report by the society in its open meeting now means that the report is submitted to the society for a letter vote and this must be taken before the practice really becomes adopted as an official standard. This guards against any possibility of standards being passed at meetings of small attendance.

The divisions whose reports are now ready for this vote are those dealing with carbureter fittings, standards exchange, electrical equipment, iron and steel, miscellaneous and springs. Progress reports were made by the electric vehicle, ball and roller bearing, truck standards, chain, international standards and lock washer divisions.

Jerome J. Auil, mechanical engineer, the Lunkenheimer Co., summarized the report of the carbureter fittings division. K. W. Zimmerschied in commenting upon this remarked that there had been considerable controversy among members of the trade concerning the standard hot-air stove for attachment to the exhaust manifold, and read a letter from the Mossberg company expressing itself as desiring standardization and being in favor of the integral type in which the stove is cast as a unit with the manifold. They also mentioned, however, advantages of the pressed-steel type over the integral due to the fact that the unit casting requires some difficult core work.

Mr. Zimmerschied suggested that provisions be added to the report providing for the pressed-steel stove and further stated that perhaps many firms would find the latter more desirable and that it should be included.

Mr. Auil advised that it is the intention of the division to include the pressed-steel type and that perhaps paragraph 14 of the report which reads, "To overcome these defects and to obtain a measure of uniformity where confusion now exists, the carbureter fittings division recommends the practice of casting a cored passage of suitable size and shape integrally with the exhaust pipe, whenever it is practicable to do so; this device to be known as "carbureter air heater," is somewhat too strong. Paragraph 24, however, corrects this as it states that carbureter air heaters differing from the type shown, whether integral with the exhaust pipe or separate attachments, should have heating surfaces and areas at least equal to the type shown in the sketch suggesting the integral design. As regards the difficulties of coring, Mr. Auil contends that the manner in which the design is worked out in the illustration provided with the report of the division, gives a satisfactory coring arrangement that should not prove difficult.

K. W. Zimmerschied, metallurgist of the General Motors Co., chairman of the Standards Committee.

The report was carried and will be presented to the society for a vote by mail in accordance with the new procedure in the adoption of standards.

Zimmerchied's Report on Bell Housings

Chairman, K. W. Zimmerschied of the standards committee in reporting on bell housings for the motor crankcase and port end of gearboxes in unit power plant designs, advised that the power report has been held to. He said: "Your defunct bell housings division known as the standards exchange committee met with some trouble on account of last year's report and another meeting was held to revise this matter in accordance with letter which have been received from interested concerns. The result is that they have practically held to that report merely changing a few details in the flange dimensions."

It was decided that the report as given be presented to the membership for a letter vote.

Electrical Equipment Division

The report of the electrical equipment division by W. H. Conant, manager of the Detroit branch of the Gould Storage Battery Co. chairman of the division, provoked no discussion and will be presented by the committee to the society for a mail vote. This will make interchangeable the single-wire system plug ends with bulb bases of the two-wire systems.

Iron and Steel Report

The important report of the iron and steel division was summarized by K. W. Zimmerschied metallurgist of the General Motors Co. and chairman of this division, who reported that the new matter in the report raises the minimum vanadium percentage from .12 to .15. A new steel known as 3330 which is a nickel-chromium steel midway between 3320 and 3340, has been added.

The most important addition is the introduction of the physical properties of carbon steel. Mr. Zimmerschied said that from time to time, additional notes on the physical properties of the S. A. E. steels will be added. The paragraph relating to gray cast iron was stricken out, but the paragraph of the report referring to malleable iron was left as it stands. This chemical formula for malleable iron gives the manganese as .30 per cent. to .70 per cent., the phosphorus not to exceed .20 per cent., sulphur not to exceed .06 per cent. and silicon not to exceed 1.00 per cent. Recognising the wide variance in methods used for the determination of sulphur, the final reference method shall be the gravimetric (aqua regia) method, by oxidation.

This report will be presented to the society for a vote by mail.

The report of the miscellaneous division made by J. G. Utz, Consulting Engineer of the Perfection Spring Co. combined a report of definite methods of procedure and of progress on other parts and contained a suggested set of limits on brake linings given at the meeting. In tabular form this was as follows:

		Brake Linings				
Limits	Plus or minus	.010	Plus 0 minus 1-32			
	Wide thick	1/8	3/16	1/4	5/16	3/8
	1	X	X	X		
	1¼	X	X	X		
	1½	X	X	X	X	
	1¾		X	X	X	
	2		X	X	X	X
Plus 1 32	2¼		X	X	X	X
Minus 1 16	2½		X	X	X	X
	2¾			X	X	X
	3			X	X	X
	3½				X	X
	4				X	X
	4½					X
	5					X

It will be noted that the 1-2 and 5-32-inch sizes are omitted and in regard to this E. A. Wales of the Royal Equipment Co. could not understand the omission of the 5-32 size as his company had over a certain period made 100,000 brake linings of this size and none of the 3-8 size. This matter was referred to the attention of the division as was a suggestion by Russell Huff, Consulting Engineer of the Packard Motor Car Co. that the limits be increased from plus or minus 1-32 inch to plus or minus 1-16. As regards the 3-8 size he thought trucks need it for countershaft brakes and that the demand for this size will increase. This suggestion as to the increase in the limits echoed an opinion by Henry Hess, President of the Hess Steel and other companies, that wherever possible limits should be large in order to decrease the cost of production and hence the cost to the ultimate consumer.

Mr. Utz stated that the division thinks the limits can be made wider and would concede that fact in drawing up the final report of the committee.

Henry Souther, Vice-President of the Ferro Machine & Foundry Co. said, "Mr. Utz has told me that he has had few replies to his letters endeavoring to secure some information leading to the formation of a report on pistons. This is too bad as it is necessary to standardize these, particularly since diameters are becoming smaller. I do hope, as a piston maker, that this will be given careful consideration as it will help materially in reducing cost, especially with the introduction of the aluminum-alloy pistons."

Mr. Zimmerschied formally moved that the plus or minus 1-16 inch limitation be incorporated in the report as a substitute for the limits given on brake linings and with this amendment it was voted that the report be presented to the society for a mail vote.

Electric Vehicle Division

R. McA. Lloyd read the report of the electric vehicle division. There is some doubt according to Mr. Lloyd as to the recommended standard voltages which are given in the report as 80 to 85 for one class of vehicle and 60 to 66 for another class. The outcome of the action on this point is still in abeyance. At the standards committee meeting, which preceded the general meeting, it was decided after considerable discussion, that the report did not refer to industrial trucks used in factories or railroad stations. These vehicles, it was said, operate most efficiently on much lower voltage.

Springs Report Suggests Changes

C. W. McKinley, chief engineer of the Willys-Overland Co. read the springs-division report which was in the main, the same as last year, the important additions including a drawing to bring out the meaning of the wording regarding the standard test for the parallelism of eyes and master leaf of springs. The allowed variation from parallel has been changed to 3-16 inch from 3-8 inch.

Jerome J. Aull, mechanical engineer the Lunkenheimer Co., Chairman Carbureter Fittings Division

The tolerances for eye bushings have been increased to make them agree with common practice and another alteration has been the dimensions of center bolt heads for both passenger and commercial cars. Another addition is that where rear springs are underslung 1-8 inch should be added to the clip diameter. In case the rear springs take drive or both drive and torque the spring eye should be 1-4 inch larger in diameter on the drive end. This is an addition to the tabulations covering the spring widths, eye diameters and clip dimensions.

Ball and Roller Bearing Progress

F. G. Hughes, chief engineer of the New Departure Mfg. Co. made a progress report for the ball and roller bearings division, the most important point of which is the standardization of certain bearing bores. It is proposed that the bores will be 5-8 to 1 1-4 inches progressing by 1-16 inch increments; from 1 1-4 to 2 1-2 inches by 1-8-inch increments, and from 2 1-2 to 4 1-2 by 1-4 inch increment. It is proposed to have both a long and short series and prepare a table of bore chamfers taking as a basis twice the S. A. E. ball bearing chamfer. A sub-committee is to be formed to take up the matter with the bearing companies both as regards the inch and metric sizes. The inch size will precede the metric.

Chairman K. W. Zimmerschied in reporting progress for the research committee said that the only matter on hand was that of tap drill sizes on which it was hoped to have a report at next year's meeting.

Chairman Zimmerschied also reported progress for the truck standards division stating that the most important matter before this body was the report on industrial trucks. He stated that the report of another organization was before the body at the present time covering this same matter and that the division would wait to see how this report made out before he would take any further action. The matter of tires for these trucks is before the body and they are at present undecided as to the number of sizes to be adopted and as to the advisability of exactly what sizes to keep and what sizes to abandon.

R. McA. Lloyd; Henry Hess, president Hess Steel Co.; Henry Souther, general manager Ferro Machine & Foundry Co; J. G. Utz, consulting engineer Perfection Spring Co.

Engineers Present on S. A. E. Cruise

Left to Right: F. E. Sweet, Consulting Engineer, Cadillac Motor Car Co.; Reese Noel, Sales Engineer, Stewart-Warner Speedometer Corp.; George Briggs, Schebler Carburetor Co.; George Dunham, Consulting Engineer; C. W. Hatch, Perfection Spring Co.; Ray T. McAdam, Steel Products Co.; E. T. Birdsall, Consulting Engineer; G. P. Dorris, Engineer, Dorris Motor Car Co.

O. G. Bohn, Chief Engineer, Hudson Motor Car Co.; James Diamond, Engineer, Aluminum Castings Co.; Max Rudkin, Manager, Pressed Steel Wheel Dept., Detroit Pressed Steel Wheel Co.; Louis Marburg, Mechanical Engineer, Marburg Bros.

Howard Marmon, Chief Engineer, Nordyke & Marmon Co.; and David Landau, Engineer of the Sheldon Axle Co.

Victor Page, Experimental Engineer, New Departure Mfg. Co.; R. Nauckhoff, Frank Mossberg Co., Attleboro, Mass.

Above—Herbert Chase; A. C. & C. J. Fitzpatrick; President W. H. Van Dervoort, The Moline Automobile Co., and Philip B. Rose

Right—H. F. [illegible], Assistant Engineer, Perfection Spring Co., and [illegible] Burchard, Consulting Engineer

J. E. Hale, Experimental Engineer, Goodyear Tire & Rubber Co., and F. L. Blackburn, Westinghouse Elec. & Mfg. Co.

Some of Those Who Read Papers

C. H. Gleason, Engineer, Kalamazoo Spring & Axle Co.—Spring Design; Joseph Anglada, Consulting Engineer—Motor Fire Apparatus; W. F. Herst, Factory Manager, Brown-Lipe Gear Co., Automobile Clutches; C. W. Stratford, Engineer, Pratt & Washburn Refining Co.—Automobile Lubrication.

Capt. J. S. Critchley, Past President of the I. A. E. of Great Britain, who addressed the meeting.

Arthur L. Stewart, Engineer, Gleason Works—Spiral Bevel Gears for Automobile Drives; P. S. Rose—Farm Tractors and Their Motors.

Neil MacCaull who read paper on Aeroplane Engines.

C. T. Myers, Engineer, Timken-David Brown Co.—A Formula for the Comparison of Automobile Preformance; Albert R. Miller, Transportation Engineer, Troy Wagon Works—Increasing Truck Efficiency with Trailers; T. H. Schoepf, General Engineer, Westinghouse Elec. & Mfg. Co.—Rational Method of Determining Mileage of Electric Vehicles; P. W. Litchfield, Factory Manager, Goodyear Tire & Rubber Co.—Size and Inflation of Pneumatic Tires

Aluminum Pistons Pass Unchallenged

No Doubt Expressed at S.A.E. Convention as to the Success of the Lighter Alloys in the Small-Bore High-Speed Motors

Why

Tensile strength as great as cast-iron piston metal
Good castings can now be made with consistent results
Less vibration of motor at higher crankshaft speeds
Less carbon deposit found on the heads of the pistons
Less wear on the main bearings and fewer overhaulings
Cylinder walls less worn as aluminum pistons are soft
Aluminum pistons wear excellently with ordinary oiling
Weight reduction has quieting effect on whole motor

ONE OF THE remarkable features of the meeting was that in the discussion following the paper on Aluminum Alloy Pistons, by Eugene Gruenewald, engineer of the Moline Automobile Co., not one statement to the affect that the aluminum alloy piston had not come to stay, was heard. In fact it seemed to be universally accepted as another of the interpretations of the small-bore, high-speed movement. The only point raised against the aluminum piston was the presence of a slight tap at the time of the first few explosions due to the great clearance necessary with the rapidly expanding metal. As this tap is so light and so soon disappears it was universally thought at the S. A. E. professional session, that this is no great disadvantage. In fact, it was pointed out that even this could be avoided by using an oil of higher viscosity. Mr. Gruenewald's paper follows in part:

The reduction in weight of reciprocating parts is of the greatest importance in the high-speed automobile engine practice, and it is the first aim of the designer to reduce the weight of the pistons. Many means to do this have been employed, but it has been found that commercially the aluminum alloy is the most suitable material for the purpose. The weight of the finished alloy piston is practically one-third of that of the gray iron piston.

About eighteen years ago it was discovered that with a small percentage of magnesium in the standard aluminum alloy the physical properties of the castings could be improved very much. Alloys based on this experience have made it possible to produce piston castings that will do the work as well as gray iron pistons. It is rather difficult to give an accurate analysis of piston alloys, as foundries specializing in them do not care to give out full information. Analysis of the castings does not indicate the relative amount of magnesium, for example, as it burns out easily. Apparently, the basis of piston alloys is 96 to 97 per cent pure aluminum, magnesium and small amounts of copper, silicon and iron.

Design Is Important

The design of piston made of such alloys must be based upon the strength of the material and its coefficient of expansion. The tensile strength of the light-metal alloy is as great if not greater than that of the average piston iron, consequently aluminum pistons can be designed commercially the same as cast-iron pistons, except that the head should be 1-32 in. to 1-16 in. heavier, or, if of the same relative thickness as the cast-iron piston head, be reinforced by ribs. In a motor of 3 1-2 in. bore the heads of aluminum alloy pistons were purposely reduced to 3-32 in. thickness. Only under full load at a speed of 2,000 r.p.m. did the heads give out as a natural consequence of high temperature. These particular pistons were not reinforced by ribs; otherwise they would have withstood even such a severe test. Many aluminum alloy pistons, with a head thikness of 1-32 in. over the standard cast-iron piston thickness, and without ribs, have been in service in 4 in. and 4 1-8 in. motors for over three years, some of the cars equipped with them having covered as much as 60,000 to 70,000 miles, without the least indication of any weakness in the pistons.

The most important characteristic of aluminum alloy for pistons is its coefficient of expansion. The clearances cannot be the same as in the case of the use of cast iron. Furthermore, the clearance cannot be determined by the coefficient of expansion. Many tests have shown that light-metal alloy pistons vary in expansion as they differ in design. A straight-head piston has a different expansion than a concave- or convex-head piston of the same size. It is advisable to allow from .003 to .004 more clearance than in cast-iron practice, and then determine by dynamometer test whether the allowance is correct. A piston which has proper clearance will not rap after the first few explosions, or show any sign of a tight fit after the engine has been run at high speed and under heavy load. A few careful tests will determine quickly the proper clearances above and below the rings. If the foundries exercise care to maintain the alloy mixture, very little difficulty as to expansion will be experienced after the first tests. The piston-pin bearings also must be considered. The larger

Alfred Reeves, general manager, Automobile Chamber of Commerce, and Milton Tibbetts, Patent Counsel, Packard Motor Car Co., talking over axle matters. Right, group of editors of the daily S. A. E. published on the Noronic during convention

Chas. F. Splitdorf, vice-president, Splitdorf Electrical Co.; Joseph A. Atwell, New York Manager, Michelin Tire Co., and R. P. Johnson, general manager Warner Gear Co.

the diameter of the piston-pin, the greater the difference in expansion of the piston-pin and the boss on the piston. Consequently there is some danger of the piston-pin working loose, which is especially annoying in quiet motors on account of the possibility of a slight knock. Therefore, the piston-pin should be well secured in the piston to prevent any movement.

Advantages Many

It is not necessary to restate the various advantages of reduced piston weight as affecting the motor in general. Engines equipped with aluminum pistons have been in service for many thousand miles without the least sign of loose bearings. The accumulation of carbon on the piston head is reduced, on account of the cooling effect of the aluminum. The poppet-valve motor equipped with aluminum pistons can be kept in service for a gerater length of time before it is necessary to remove the carbon than if equipped with cast-iron pistons.

Aluminum alloy piston wears excellently with the usual lubrication. One set of pistons which has been under observation has shown a quarter of a thousandth wear after 14,000 miles of average work. Naturally, the cylinder walls are less affected, as the aluminum alloy is much softer than cast iron. The ring grooves did not show any wear, and only one piston-pin hole indicated a loose pin. The record of wear as a whole is at least as good as can be found for cast-iron pistons.

The disadvantage of the aluminum alloy pistons is its greater expansion, necessitating greater clearance, which must be determined very carefully as stated. It will be noticed that a motor equipped with aluminum alloy pistons has a light piston-slap during the first few explosions, but after the temperature of the pistons has risen they are as quiet as cast-iron pistons. The weight reduction has, of course, a quieting effect on the whole engine.

Commercial Features

Up to a short time ago aluminum alloy pistons were approximately twice as expensive as cast iron ones, due to the high cost of the alloy, and the waste in machining sand cast pistons, but even then the results with such pistons justified their use. Within the last few months American aluminum foundries have produced permanent mold or die cast pistons which of course not only save a great amount of waste in machining but also increase in general the tensile strength and uniformity of the material. The progress made in the development of aluminum alloys and their use assures the employment of aluminum alloy pistons in a great many motors in the near future.

E. S. Fretz, Light Mfg. & Foundry Co. gave three conditions for success with aluminum-alloy pistons. These are: first, engineering must take care of greater expansion and contraction; second, the mixture, and third, the foundry practice. Best results come from an aluminum with 4 to 6 per cent. magnesium content. In Europe, the usual practice is to have an alloy composed of 90 per cent. aluminum, 7 per cent. copper and 3 per cent. zinc.

D. W. Sowers, Sowers Mfg. Co., asked regarding the effect of heat upon the tensile strength of the alloy and Mr. Gruenewald replied that tested bars chilled in sand molds and that these showed a tensile strength of from 24,000 to 25,000 pounds per square inch. However, he hopes to secure some test bars made in permanent molds, and therefore to get better results.

In regard to knocking, a point which was brought up due to the greater clearance necessary with such pistons, he contends that it is true that knocks will show up at low temperatures, but as soon as the pistons heat up, they expand sufficiently to eliminate knocks from this cause. They are consequently noisy during the first few explosions, which is one disadvantage, but it is offset by the many advantages.

Ribs for Piston Heads

J. E. Diamond, Aluminum Castings Co., believes that all alloys deteriorate under high temperature as regards tensile strength. At temperatures from 1,800 to 1,900 degrees, the tensile strength ranges down to 12,000 to 13,000 pounds per square inch. In the conventional type of piston the head ought to be ribbed. When the diameter is under 3 inches, one rib is sufficient, but over this, cross ribs are advisable. The only way to arrive at the proper clearance, according to Mr. Diamond, is to cut and try and to forget about the standard clearances for cast iron. He knows of practically no case where aluminum-alloy piston seizure has hurt the cylinders, and it is also usually possible to repair the piston as well. He thinks the clearances, however, as set down by Mr. Gruenewald are about correct.

Permanent-Mold Piston Best

Mr. Diamond thinks it especially essential in high-speed engines to rib the head, and also that the permanent-mold piston, due to the chilling of the mold itself, increases the strength 25 per cent. over the sand-cast piston. This refers to aluminum alloys, of course.

Herbert Chase, of the A. C. A. asked if in using aluminum alloys any difference had to be made in ring clearances or in the ring design. Mr. Gruenewald said that the ring matter was not affected, and added that it was not necessary to make any change in the method of lubrication unless the slight slap at the start is objected to, in which case he recommended an oil of slightly higher viscosity, say around 300.

Winners of the dancing prize, John W. Watson, president American Bronze Co., and Miss Polly Souther and winners of second prize John R. Ide, salesman, New Departure Co., and Miss Marjorie Stewart

Group of members of the Society of Automobile Engineers' party on their cruise through the Thirty Thousand Islands of Georgian Bay

Weight and Speed Suspension Factors

Paper Presented By C. H. Gleason Produces Discussion Which Shows Variance of Opinion on Fundamentals of Design—Hard and Fast Rules Impossible

THAT we are still nowhere near a settlement of even a set of elemental principles of spring design was clearly brought out at the S. A. E. meeting in the paper on this topic given by C. H. Gleason, designing engineer, Kalamazoo Spring and Axle Co., and the discussion which followed.

The paper clearly pointed out that spring making is not an exact science and the use of the close limits of toleration, as used in other parts of chassis construction, are impossible. In his paper the author states that weight, load carried, speed and wheelbase are important details having to do with the proper determination of the suspension. The weight of the car and the load to be carried are the fundamentals which determine the proportions. Regarding speed, if the car is to travel at 35 to 45 miles per hour the front deflection must be reduced or the riding qualities will be poor.

The discussion hinged about the factors which determine the length of the spring and also got back to the much-mooted cantilever when the explanation of the lesser throw of this type was given as due to the fact that the deflection under static load is so great with this type.

Mr. Gleason in his paper says in part:

Other conditions having been met satisfactorily, the speed of the car will not affect the action of the rear springs seriously. The front springs, however, require thought where the speed is above the average. In a general way, where it is desired to have the front springs at their best at a greater speed than 35 to 45 m.p.h., the deflection must be reduced or the front of the car will be sloppy and hard to control. Reduction of deflection to the proper amount will improve the riding of the entire car. With the loads which are to be carried established, there is a suitable and proper deflection for the springs to take. To give them less deflection than is proper will make the car ride "crankily." This will become more apparent as the speed is increased, especially in the rear springs. Having found the happy medium, there will be no room for argument as a compromise is the practical solution.

Spring Points

Brought Out in Paper on Spring Design and Discussion Which Followed

Gleason—Speed affects front spring deflection
Nothing is gained by using a narrow spring
Spring design determines front axle drop
Hess—Shock is produced by cumulative impacts
McMahon—Deflection, not load, determines reaction
Rumney—Section modulus is not altered by heat treating
Chassis frame rotates about the front axle

There is a wide difference in the action of the front and rear springs. The front spring, being the first to take the shock, has not only to meet it, but to carry the force of the entire load, driven by the power and momentum of the car. To do this successfully the deflection must be less than would otherwise be necessary. When the rear wheels strike the obstruction the load and the momentum are an aid to the spring itself.

The reaction of a spring is determined by its length and is approximately uniform. The shape of the spring has as much to do with its reaction as anything. With excessive camber the reaction will be sharpest, while a flat spring will be lazy by comparison. Friction between the plates, the type of spring and its proportions all have their effect. The amount of deflection will fix the time of the reaction, but the speed at which the spring moves will be fairly constant. If one had to consider only the reaction, designing a suspension would be easy; all cars could be treated much alike; first determining the ideal reaction, then the proper dimension of spring to get this result, the problem would be solved. But what is satisfactory when applied to one car may be disappointing when applied to another. If the spring is of the proper dimension for the car, and working at the proper deflection, the reaction need not be considered seriously. Its chief value lies, therefore, in determining the proper spring for the car.

A spring in action will deflect each way from the carrying point the same distance it has deflected from its normal position to that point, plus an additional amount for "slam" under extreme conditions. The cantilever spring seems to be an exception to this rule, in that it almost never takes any slam.

The other types of spring will take a slam in greater or less degree according to their type; the half elliptic the least, the platform slightly more, the three-quarter elliptic still more, and the elliptic the largest amount. It will thus be seen that for a given deflection a car can be hung lower on cantilever springs than on any other type. With other types additional clearance must be provided according to their characteristics.

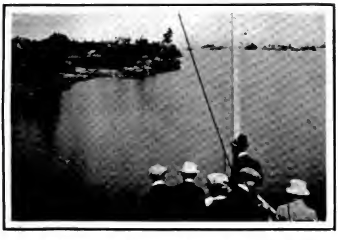
A spring is at its best when it is horizontal and the master plate is straight. It will take the shocks of the road better, will be found steadier, its action will be lazier, and the car will pitch less. My experience is that it will have slightly greater capacity when being deflected beyond a straight line than when deflected to that line.

Nothing is gained by using a narrow spring. Within reasonable limits the wider the spring the more steadily and more satisfactorily the car will take the road. Piling up the number of plates to get the required capacity is expensive. A spring of this type seldom maintains the full capacity of each individual plate. A simple rule can be depended upon to give good results. Where the spring is thicker at the thickest point than it is wide, it is desirable as well as economical to increase the width and reduce the thickness.

It is essential for best results to maintain a proportional deflection between the front and rear springs. If the deflection of the front spring is proportionally too great, it will affect adversely the riding of the whole car. If the deflection of the front spring is proportionally too small, while the effect will not be so noticeable as in the other case, the suspension as a whole will not measure up to what one has a right to expect. As between the two extremes, however, it will be found better to hold the spring below the ideal deflection rather than above. This will be especially true if any considerable speed is to be made. As the weight it is to carry determines the proper deflection of the rear spring, and the deflection of the front spring should be determined from the deflection of the rear spring, the rear suspension should be laid out first. Having reached this far, the rest will be easy.

It may not be out of place to call attention to a common practice. The spring suspension is seldom considered before the axle and the frame have been selected. While it is possible to make a spring that will fit into almost any place within reason, it often happens that to do so means reducing its efficiency, and added cost which could have been avoided easily if the spring had been considered first. What is desirable in the way of drop of the front axle and the shape of frame is determined from the spring. A slight modification for the purpose of improving the suspension is usually entirely feasible if considered in time. What might appear to be very minor changes in either the openings or dimensions may mark the difference between an excellent suspension on the one hand and an ordinary or indifferent one on the other.

Before the general discussion of Mr. Gleason's paper on spring design was opened, Henry Hess, president of the Hess Steel Co., was given an opportunity to speak regarding some new spring designs which he has found to be very practical. They are not theories, he said, but actual tried-out constructions. He has long been investigating spring design and has had ideals of what a spring should be, gained through experience as a rider in cars. The desirable things in a spring in Mr. Hess' mind are that it should be exceedingly responsive to very small shock, and that it have the maximum amount of allowable deflection under load. It should have the maximum length at maximum load and minimum length at zero load.



Looking over the bow of the vessel on the cruise through the lakes

Party of S. A. E. cruisers ashore exploring the interesting country

The main point Mr. Hess sought to establish was that a spring should be designed to produce no shock. Shock, he explained, is due to a second vibration coming on at the apex of the previous wave, thereby having a cumulative effect. That spring is best which has such a characteristic that there is only a single vibration. In Mr. Hess' opinion, the cantilever comes closest to the ideal in this respect.

Mr. Hess had a model apparatus with a rotating element fitted with blocks to give the unevenness of a road surface. On this a wheel revolved and a lever connected to it represented the chassis. Pointer connection with this part gave a means of tracing on a drum one curve showing the motion of the axle and another tracing the action of the spring. This apparatus is used to show the results attained with various types of spring, models of them to proper scale being used.

Mr. Hess showed two new forms of springs, one known as the Schwarz and the other he calls the cam single-leaf type. In comparing these designs with other more conventional forms, he stated that for a similar carrying capacity and action, the Schwarz saves 20 per cent. on either heavy cars or light ones, while the single-leaf is lighter in a ratio of 3 to 1.

Deflection Determines Reaction

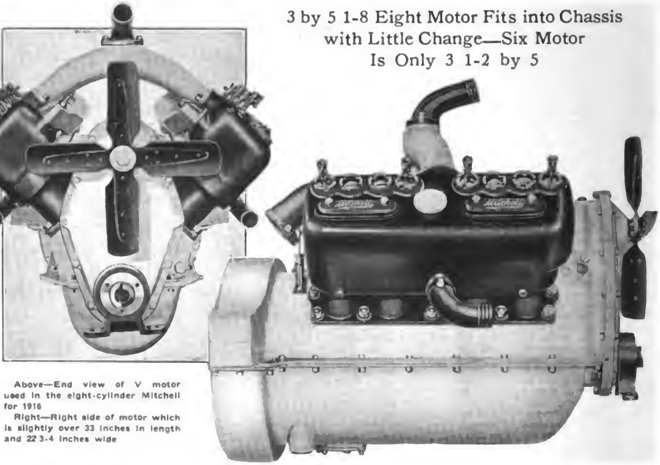
In the general spring discussion following the paper and Mr. Hess' talk, there was considerable divergence of opinion among those taking part, and it is evident that interest in springs is not waning.

H. R. McMahon, Standard Steel Spring Co., wrote in criticism of the paper, saying that while it is entitled spring design, he could see no aids in that direction in it. He took exception to one statement to the effect that the reaction is determined by the load placed upon the spring. He thinks that reaction is determined by the deflection and not by the load. The reason advanced for the less throw of the load with a cantilever spring is that the deflection under static load is usually 100 to 150 per cent. greater than with other types.

M. J. Rumney, manager Detroit Steel Products Co., does not think that the capacity of a spring varies with its heat treatment. The modulus of the section is unaffected by the treatment. As regards the position of the axle clips he regards the rear end of a chassis as pivoting about the front axle and that the rear end of the frame rises and falls in an arc of a circle having the front axle for its center. This being the case the axle clip should be forward of the center in proportion to the wheelbase of the car.

Mitchell Brings Out Eight and Six

3 by 5 1-8 Eight Motor Fits into Chassis with Little Change—Six Motor Is Only 3 1-2 by 5



Above—End view of V motor used in the eight-cylinder Mitchell for 1916

Right—Right side of motor which is slightly over 33 inches in length and 22 3-4 inches wide

FOR 1916 the Mitchell-Lewis Motor Co., Racine, Wis., has brought out an eight-cylinder model selling at $1,450 in two or five-passenger form and also a six-cylinder car—the Six of 16—marking the invasion of the field of lighter and lower-priced sixes. As reported in THE AUTOMOBILE for June 3, the new six sells for $1,250, or $335 less than the lowest-priced Mitchell six of 1915, and the same price as the 1915 four. The eight-cylinder model shows nothing foreign to former design insofar as the body and running gear are concerned, the new motor fitting into the chassis with but little change.

The Eight-Cylinder

Taking up the eight-cylinder model, the 3 by 5 1-8-inch engine consists of two blocks of four cylinders each set at 90 degrees in a staggered position. The crankshaft is a three-bearing construction with side by side connecting-rods and cooling is by thermo-syphon. The clutch is a stamp steel cone while the remainder of the transmission system is made up of three-speed amidships gearset, a single-universal propeller shaft and floating rear axle. A Westinghouse cranking, lighting and ignition system is used. Wheelbase of the car is 116 inches and it is fitted with 34 by 4-inch tires, non-skid in the rear.

In adopting the eight-cylinder motor, the Mitchell company has not changed the hood length because the overall length of the motor is slightly over 33 inches. The width is 22 3-4 inches. In the Mitchell motor the cylinder blocks are bolted to an aluminum crankcase which is split horizontally into two parts, the lower serving as an oil pan and the upper as the crankshaft support. The top of the crankcase between the cylinder blocks is provided with a removal plate which gives access to the camshaft, which lies directly above the crankshaft. Also between the cylinder blocks is the carbureter which feeds by side outlets through a hot-water jacketed manifold. The exhaust manifolds also are in the V and are bolted to the cylinder castings.

Valves Are Large

The L-head cylinders have extended base flanges which carry the push rod operated by an internal camshaft with eight cams, each one operating two opposite rods. The valve mechanism is inclosed by cover plates and provision is made for oiling these parts by means of oil vapor from the crankcase. The valves are 1 11-16 inch in diameter and have a clear opening of 1 1-2 inch which is one-half the cylinder bore. The use of these comparatively large valves perhaps is contributory to the high power development claimed for this motor.

A feature of simplicity of the motor is the use of but three timing gears. The timing set is composed of a gear on the crankshaft, one on the camshaft and one on the generator shaft. These cars run in a bath of oil supplied by a feed from the oil pump and are readily accessible on removal of the front cover plate.

In order to lighten the pistons and at the same time to prevent smoking of the motor, the pistons have drilled skirts which permits the excess oil to drain back into the crankcase.

The cooling water is made to pass entirely around each cylinder and around the valve seats. Baffles are used so that the water, as it enters the jacket, is discharged against the interior of the valve seats. There are large inlet and outlet passages the former being in the center of each block. The outlet is by means of the jacketed inlet manifold so that there is but one passage to the radiator. Cooling is assisted by a four-blade fan, gear-operated from the front end.

In the lubrication, oil is forced from a reservoir in the crankcase to the main bearings, by means of direct leads and the crankshaft is drilled so that a portion of the oil makes its way to the rod bearings and the excess which drops from the rods is used for cylinder and piston oiling. The timing gears and camshaft are fed by direct leads. Each cylinder block has a breather opening between the second and third cylinders.

The carbureter, which is a Rayfield, is fed from a Stewart vacuum tank and ignition is by the Westinghouse interrupter and distributer mounted on the generator which is driven directly from the crankshaft.

The motor is suspended at three points, the two at the rear being formed by extensions of the crankcase. Immediately behind is a universal. The clutch is a cone type with visible spring adjustments and drives a three-speed gearset which uses a square shaft for the sliding pinion. The front end of the main shaft is mounted on a roller bearing and the rear end on a ball type with the countershaft operating on roller bearings.

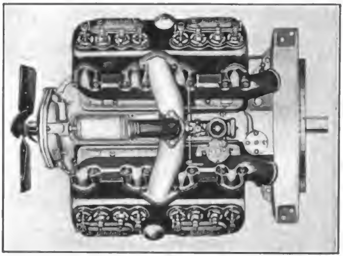
Driveshaft in Torque Tube

The drive from the gearset is by a shaft inclosed in a torsion tube, a construction which is not new to Mitchell cars. The rear axle is a floating design with straight bevel gears affording a ratio of 4 to 1. The differential and wheel bearings are rollers.

Spring suspension in the eight differs from that in the new six-cylinder car in that, instead of the cantilever springs used on the six, three-quarter elliptic rear springs are fitted. In order to lower the center of gravity and thus minimize skidding, the springs are slung under the axle. The brakes are external and internal and operate on 14 by 2 inch drums.

In the steering mechanism an item of easy maintenance is offered by the use of a full gear instead of a sector in combination with the worm. This provides four positions of the gear and thus affords four renewals of the wearing services.

The characteristic wedge shaped frame of channel section with exceptionally wide gussets is continued in the eight giving a somewhat heavier frame than the lattice work construction employed in the new six.



Plan view of motor used in the Mitchell eight

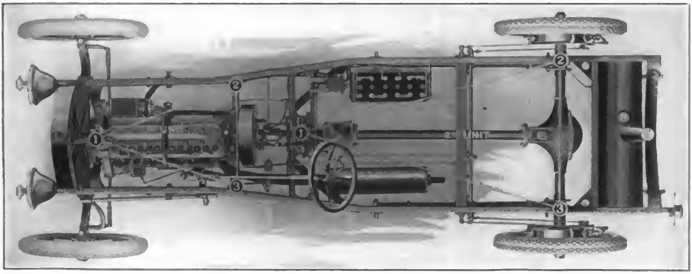
Turning to the new six, the engine is smaller than the smallest 1915 six from the Racine factory, being 3 1-2 by 5 inches against 4 by 5 1-2 for 1915. Wheelbase is 125 inches which is 2 3-4 inches less than the 1915 six and the car is appreciably lighter than its predecessor.

Nevertheless the Six of 16 is not a little six in any sense of the word unless it be perhaps in the matter of fuel economy and ease of handling. An hour at the wheel of the new car sufficed to show that in the matter of power and getaway the smaller motor left nothing to be desired.

There is one feature of Engineer Bates' new design which is worthy of special mention and this is the vastly improved riding quality. Whether or not this can be credited chiefly to the new design of cantilever rear springs or to the general balance of the car as a whole, has not been determined. In any event, there is a noticeable lack of throw.

Accessibility a Feature

A striking improvement is extreme accessibility of all parts of the chassis. The designer has gone a step beyond anyone else in the field in making the whole chassis completely getatable from above with the touring car body in place. This is accomplished by arranging for the very quick and easy removal of the floorboard—a point which could be well improved



Plan of Mitchell six chassis, with the double three-point system of suspension. The same system is used on the eight. Note the strong cross member which forms the forward support of the second unit

Intake side of Mitchell six motor showing carbureter and motor-generator mounting

in many designs, but further the portion of the body under the seats consists of simply a lattice work, which can be lifted out when the seat is removed, thus exposing the entire chassis back of the dash with the exception of the strip immediately below the forward part of the seat frame and the seat back. To provide space for the tools, which in conventional designs are carried under the front seat, a steel tool box is fitted under the hood, between the frame and the left side of the motor, so that all the tools needed for work on the motor are normally at hand. Unusually ample pocket space is provided in the doors, so that smaller tools and fitments may be carried there. The Jiffy curtains are taken care of by having them roll back across the rear of the top. The battery which is carried within the frame, just back of the dash, is accessible by removing the forward floorboard.

Car 400 Pounds Lighter

A rather surprising reduction of weight, amounting to some 400 pounds, has been accomplished by cutting down the mass of a number of units by better design without decreasing their strength. For instance, the somewhat massive frame construction which has characterized Mitchell cars recently, has been greatly lightened.

The 3 1-2 by 5 motor is a high-speed type and with this end in view, special efforts have been taken as to balancing and lightening the reciprocating parts. The pistons are drilled to decrease weight and are provided with rings in the two lower grooves which are made up of four steel rings to eliminate loss of compression. The top ring is of the conventional iron construction. Small holes drilled through the machine oil grooves around the piston allow the surplus oil to flow back into the crankcase.

Cylinders are L-head, block cast and integral with the crankcase, to give rigidity to the motor and reduce the vibration. The cylinder head is a one-piece casting secured by three rows of bolts and a leakproof fit is assured by the use of a one-piece, copper-asbestos gasket. The cylinder heads can be removed without disturbing any other part of the engine. The crankcase, a barrel type, having the lower half formed by a light, seamless, steel stamping, divided into two compartments, the upper fitted with overflow openings, and troughed for the connecting-rod spoons, the lower comprising the oil reservoir.

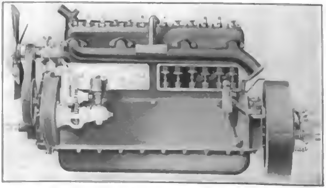
The three-bearing crankshaft is offset 1-2 inch from the center of the cylinders. The gears which drive the camshaft and distributer and tire pump are inclosed in a housing which is a part of the crankcase. Gears are lubricated by a separate oil lead and have helical teeth. The lubrication is a combination of circulating and splash, the circulation being maintained by a plunger pump operated by camshaft eccentric. A small quantity of oil is carried to the clutch bearing. A unique idea is carried out in the oil indicator. In place of the usual sight feed on the dash a plunger type operated by the oil pressure is used consisting of a small rod protruding from the dash, proportionately to the pressure of the oil in circulation. In addition an oil lever indicator is provided on the crankcase. Push rods and valve stems are supplied with an oil vapor through breather openings into the crankcase.

Another unusual bit of design is in the combination of fan and water pump. At the front of the motor, instead of mounting the centrifugal pump on a layshaft, it is mounted on the fan shaft where it is driven by the endless fabric fan belt. Adjustment is provided by a wing nut which swings the entire fan and pump assembly. The integral fan and pump brackets also forms the outlet for the water pump, thus simplifying the construction to a point where only one hose connection to the pump is necessary. The waterjackets have been extended down so that they have extra capacity around the exhaust valve seats.

Ignition is by storage battery with an automatic circuit breaker and distributer of the single-unit type driven through worm gear from the timing gears of the motor. The high-tension wires to the plugs are carried by a special supporting bracket which prevents chafing and leaking.

Stewart Vacuum Fuel Feed

The Rayfield carbureter is on the right and the intake manifold is cast inside of the cylinders, and passes between the middle cylinders from the carbureter on one side to the valves on the other. Fuel is supplied from a tank at the rear by the Stewart vacuum system. Within the flywheel is a cone clutch comprising a stamped steel spider faced with chrome leather, and having auxiliary springs. Adjustment



Exhaust and valve side of Mitchell six motor with one cover plate removed and showing mounting of ignition distributer. Note hot air intake for carbureter passing over cylinder block

Mitchell eight-cylinder touring car which lists at $1,450

Mitchell six—the Six of 16—which sells for $1,250

is by three adjusting nuts, which provide correct engagement.

The electric system comprises a combined motor-generator driven by silent chain at the front end of the motor.

The three-speed gearset, considerably improved, has been decreased in both size and weight without decreasing either the size or strength of the gears and shafts. Instead of a jaw clutch on direct as in earlier designs, an internal gear coupling is employed and the shafts are otherwise shortened so that the gearbox is 4 inches shorter than in the 1915 car. At the same time the throw of the lever has been shortened and the latter is set well to the front so that it does not interfere with entering or leaving the forward compartment. The power transmission system is called by the Mitchell people the two-unit, three-point suspension, one unit being the engine and clutch, and the other, the gearset and rear axle. Between the clutch and gearset is interposed a universal, and the gearbox is mounted on the front end of the torsion tube and supported by trunnions from the main cross member of the frame.

Propeller Shaft Is Hollow

Another method by which excess weight has been eliminated without sacrificing strength is in the propeller shaft. It is hollow and of chrome-vanadium steel. Final drive is by pinion and gear and a special feature is a bearing behind the driving pinion. The gear ratio is 4.07 to 1 on direct. The floating axle drive shafts have splined shafts, the load being carried on steel tubes riveted to the malleable center housing. Roller bearings are provided throughout.

Brakes are internal expanding and external contracting. The brake cross shafts are hollow to cut down weight. The drums are 14 inches in diameter and turnbuckle adjusters located conveniently permit of taking up any wear.

Cantilevers Cleverly Mounted

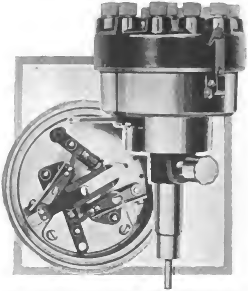
It is in the springing that there has been a particular achievement. The cantilever rear springs are mounted directly under the frame side members and attach to the seats by double spring bolts, spring seats turning on the axle housing. The forward ends fasten to the side frame by shackles allowing free play for the spring action. Bushings are provided for the eye bolts.

Mitchell bodies for 1916 are of the smooth, boatline type as may be seen from the accompanying illustration. A feature is the mounting of the headlights directly on the sides of the radiator. Instrument board equipment includes a priming device, 60-mile speedometer, oil gauge, lighting and ignition switches, horn button and instrument board lamp, the latter being provided with an extension cord permitting it to be used as a portable inspection light. Both six and eight are fitted with 34 by 4 tires, non-skid in the rear, on demountable rims, with one spare rim.

Headlight dimmers are provided by a series parallel arrangement of the lamps designed to meet requirements for both city and country driving. Other equipment includes windshield, one-man top, power tire pump, quick-acting side curtains, robe rail and foot rail.

Remy Ignition for Twelves

In order to provide positive ignition for twelve cylinder motors, the Remy Electric Co., has brought out a timer-distributor unit which has two breaker boxes in one, operated by a single hexagonal cam as illustrated below.



Exterior view of the new battery ignition system for twelve-cylinder cars manufactured by the Remy Electric Co., Anderson, Ind., together with a view of the breaker box. Instead of using a cam with the same number of points as sparks required, a hexagonal cam is used and the twelve sparks are obtained by fitting two breakers, one on either side of it. Either manual or automatic spark advance or both are possible with this distributor

Inquiries

The purpose of the Rostrum department is primarily to aid in the solving of motorists' problems. Readers of THE AUTOMOBILE *are requested to allow our editorial staff aid in the solution of difficulties as they arise and perhaps through this assistance reduce the cost of upkeep of their cars and gain a useful knowledge in the economical phases of the vehicle.*

The Rostrum

Communications

The editor of the Rostrum is anxious to secure from car users and others, communications dealing with the overcoming of difficulties in making repairs and in the numberless other phases of every-day automobiling. This department is mutual and is a common ground upon which an interchange of ideas and opinions can be made as freely as in the clubroom.

Radiators Not Designed by Formulae

EDITOR THE AUTOMOBILE:—Can you refer us to any information, either in book form or in the columns of THE AUTOMOBILE, dealing with the design of automobile radiators and cooling fans?

What we want is something which will answer the question of radiator area required for a 4-inch bore, 5 1-2-inch stroke, and the motor running at a speed of 800 r.p.m.

2—What is the most efficient angle of the fan blade?

N. Y. C. F. E. ROGERS.

—The size of the radiator cannot be calculated exactly by formulæ as there are so many conditions which enter into the problem that it cannot really be reduced to any definite standpoint and therefore has always been solved by a trial-and-error process. It may be taken as a general rule, however, that one-third of the heat units in the gasoline consumed in the cylinder is given off through the cooling water. If, for instance, a quantity of fuel containing 15,000 B.t.u. were consumed in the cylinder in a unit of time then the radiator would probably have to handle a sufficient quantity of water to remove 5,000 B.t.u. in the same length of time from the waterjacket.

Measured in B.t.u.

The cooling effect of a certain quantity of water is directly measured in B.t.u. and, roughly, may be stated as follows: If a given weight of water, W, in pounds passes through the radiator in 1 minute, and the difference in temperature between the water as it enters and as it leaves the radiator is T, the number of B.t.u. given up by that water is equal to WT. It will be thus seen that there are two variables, the weight of the water passing through the system and the difference in temperature on entering and leaving. The amount of water will depend upon the capacity of the radiator in the first place and the capacity of the pump, or circulating medium, in the second place. The temperature in and out, will depend upon the arrangement of the cooling area, the amount of exposed surface, the conductivity of the radiator metal, the difference in temperature between the water and the exterior air, the efficiency of the fan and a multitude of other less important factors. Therefore, considering the large number of variables which enter into the problem of radiator design, it will be seen that the most economical method of handling the problem is to place a radiator on the car that will handle the water safely under the worst possible conditions of high atmospheric temperature and extended low gear travel.

Theoretical Blade Angle Impractical

2—There is no such thing as the most efficient angle of a fan blade, every different speed of the car, every different variation of the velocity of the wind of the speed of the motor and diameter of the fan itself, would make the theoretical pitch undergo wide changes. As stated by one authority, it is impossible to give any general rules or formulæ covering the proportions of parts of fans and blowers. There are no less than fourteen variables involved in the construction and operation of a fan, a slight change in one producing wide variations in the performance. Therefore the design of a new fan is largely a matter of experimentation until a compromise design is finally reached.

Preventing Noise in Oldham Coupling

Editor THE AUTOMOBILE:—I am running a Buick model 16 and the coupling between the clutch and transmission is very noisy. Could you tell me of a coupling which I could use here to eliminate this and what it would cost?

Lawrence, Mass. C. E. C.

—The clutch to transmission couplings on the model 16 Buick consists of an Oldham coupling ring inserted between the clutch sleeve and the forward end of the gear square shaft. This coupling is made in three pieces; including the sleeve, ring and a square male piece which fitted over the forward end of the clutch gear. There are therefore two places where wear can occur and result in noisy action: First, at the lugs of the Oldham ring and second, on the square sides of the male coupling. You should look at both these points and measure the clearance. If the clearance is too great new pieces should be secured to fit.

Clincher and Q. D. Tires Are Same Size

Editor THE AUTOMOBILE:—What is the difference in size of tires of the clincher and clincher Q. D. types, or why is it that a clincher tire will not fit the same rim that a clincher Q. D. of a given size will fit?

2—What is the proper way to align the wheels of an automobile?

3—What are the proper positions in angular measurement relative to the centers for the opening and closing of the inlet and exhaust valves of the eight-cylinder V-type engine?

4—How may one determine the position of the armature of a magneto at which the contact breaker in the primary should open to give the spark of greatest intensity?

Ancon, C. Z. ALLEN EDWARDS.

—The difference between the clincher and the Q. D. clincher type is not one of size, but rather of bead construction. The bead of the regulation clincher tire is soft and made to stretch over the rim, whereas, in the Q. D. design, the bead does not have to stretch over the rim, and hence can be made stiffer.

2—The proper method to align the wheels of an automobile is shown in the accompanying illustrations, Fig. 1. At the same distance above the ground as the center of the hub, the measurement is taken across the width of the spread of the two front wheels from the inner side of the rims of each. When this measurement has been carefully checked the wheels are rotated to different positions and measurements taken at the same height. They should always be the same. When the wheels have been found to be true, as far as this measurement is concerned, similar measurements are made at the rear of the wheel. The distance across the wheels at the rear will be slightly larger than in front on account of the toe-in generally allowed. This amounts to 1-4 inch as a rule.

3—The valve timings of all the eight-cylinder engines differ, no stated rule being followed. An example, however, may be given in the case of the Cadillac eight, the timing of this motor being as follows: Inlet opens at top center and closes 46 degrees 40 minutes past lower center, exhaust opens 46 degrees 40 minutes before lower center and closes at top center.

4—All the magneto manufacturers have instruction books covering their own type which give specific directions as to how the armature setting should be made. Before specific directions can be given, the make and model of the magneto must be known.

Either Gasoline or Gasolene Is Correct

Editor THE AUTOMOBILE:—Why is there a difference in the spelling of the word gasoline? We have seen it spelled gasoline and gasolene. Which is correct?

Lake Mills, Wis. A. C.

—Either gasoline or gasolene is correct. The suffix ine, means pertaining to, while chemists have more or less agreed upon the use of ene, as a substitute for ane in speaking of members of the hydro-carbon series. Hence, while the spelling among chemists may be ene, and among others, ine, they are perfectly interchangeable and either is correct.

Carbureter Needs Adjustment in Summer

Editor THE AUTOMOBILE:—I have a 1914 Coey Junior engine, four-cylinder 2 3-4 by 4, with a 7-8-inch Mayer carbureter and am experiencing much trouble with same. I received this car in the winter and the engine worked all right. It has no hot air connection to the carbureter and as soon as the warm weather arrived I began to have trouble, making it necessary to frequently adjust the carbureter.

The engine will work well sometimes, but after closing the throttle and reducing the speed to 10 or 12 miles, on reopening the throttle the engine will miss and fire badly, and very often I must change the gears to keep from stopping entirely. Frequently it is very difficult for me to start the engine without making adjustments on carbureter. The float allows the tube to be just full without flooding. There are no air leaks between carbureter and cylinders.

Derry, Pa. A. S. AGEY.

—You can probably cure this trouble by taking the bottom part of the carbureter off and putting a little more tension on or reducing some the tension on the spring. This is accomplished by pressing the spring between the thumb or removing part of a coil or all of one coil from it. It is impossible to say just what condition you have to deal with but it is quite certain that the adjustment can be obtained by manipulating the spring one way or the other by giving it more tension or less tension.

Can Fit Magneto to Rambler

Editor THE AUTOMOBILE:—Please advise me if a Splitdorf model D magneto or Remy model S, Model T or R L magneto is suitable for a model 44 serial number 20,277 40-horsepower Rambler.

Norfolk, Va. GEO. SMITH.

—The Splitdorf model D magneto or any other of the four-cylinder types will fire this car. On the Remy the model S would be the most suitable, as we believe it could be installed without any special fitting. The model T and R L however, would be very suitable for this car but you would have to have fittings made to accommodate their installation.

Timing of the Maxwell Mercury Model

Editor THE AUTOMOBILE:—Kindly give me the following information on the 1914 Maxwell Mercury roadster:

1—Timing in degrees of the inlet and exhaust valves.

2—Gear ratio on high.

3—Explanation of the oiling system.

4—The bore and stroke.

5—Would it be possible for me to get an instruction book on this car?

6—Was this car tuned for speed and how fast should it be when in perfect shape?

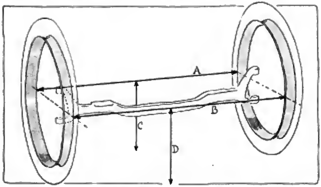
Poughkeepsie, N. Y. LLOYD C. DECKER.

—1—The motor is timed as follows: Inlet opens 15 degrees past upper dead center and closes 40 degrees past lower dead center. Exhaust opens 40 degrees before lower center and closes 10 degrees after top center. See Fig. 2.

2—The ratio of this car on high gear is 3.5 to 1. This is on direct drive.

3—The oiling system is a splash design, the oil being kept to a definite level by a standpipe in the center of the crankcase. The pump takes the oil from there and returns it to the tank. The same pump takes the oil from the tank through the sight feed oiler and by gravity it runs from there to the front of the crankcase and finds its level in the standpipe. This pump does not oil the clutch compartment and it is necessary to put oil in the clutch compartment from time to time. The disks in the friction clutch should run in a bath of oil to the depth of 3-4 inch, which will be sufficient to lubricate all parts of the clutch compartment.

4—The bore of this motor is 4.25 inches and the stroke also 4.25.



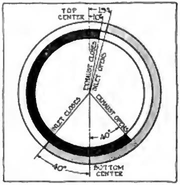


Fig. 1—Left—Diagram illustrating the proper way to align the front wheels to obtain correct steering and prevent side wear on the tires. Fig. 2—Right—Valve timing diagram of the Maxwell Mercury

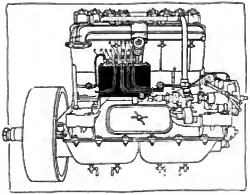


Fig. 3—Lubrication system on the 1909 Pope-Hartford, showing all lead connections

5—The Maxwell Motor Sales Co., Newcastle, Ind., is forwarding an instruction book direct.

6—This car was tuned for speed and with a Stromberg carbureter using a sharp nozzle will develop 60 miles an hour when in perfect condition.

Lubrication of Old Model Pope-Hartford

Editor **The Automobile**:—I have a Pope-Hartford 1907 or 1909 model which gets too much oil in cylinders 2 and 3. Can you publish illustrations of the oiling systems of these two models and suggest to me how to remedy the trouble?

Wheaton, Minn. O. H. B.

—Since these cars were made an improved oiling system has been installed in these models. This is a matter entirely pertaining to the pistons, and the Hartford Motor Car Co., which is handling the parts and repairs for this car, states that if the pistons were forwarded to them they could be machined to the latest design at a cost of $5 for a set of four, transportation charges additional. This work can be done and pistons returned within 24 hours after receipt of same. It may be possible on account of the service that these models have seen, that the cylinders are worn. They could be reground and special pistons and rings made which would eliminate the trouble you are experiencing, although of course this is an expensive proposition. The cost of reboring of cylinders, making new pistons and rings would be $50 for each car provided that they are four-cylinder cars. It would require about one week for this work.

The method of lubrication on these cars is as follows: In the model L, 1907, a seven-feed sight-feed mechanical pump oiler operated by a belt driven from the camshaft provides lubrication for the cylinders and main engine bearings, camshaft front bearing and crankcase; the pipe leading to the crankcase should not be depended upon for the total supply of oil for crankcase. It is important that the oiler be adjusted to feed so that one drop only at a time will show in the sight feeds A, B, C, D, E, F and G, to each cylinder and bearing except the center bearing which should be wide open.

The supply is regulated by screws on top of the oiler; by screwing them down you decrease the supply, and by screwing them up you increase it. The sight feed on the dash will show the quantity of oil being supplied to each tube.

The main crankshaft is lubricated at both front and rear bearings by feeds from the mechanical oiler and in addition by splash, suitable ribs being cast on the inside of both ends of crankcase for this purpose. The center bearing is also lubricated by splash taking the drainage from both sides of the partition in the crankcase. The camshaft has three bearings all inclosed within the crankcase. The front bearing is lubricated from the oil pump, while the center and rear bearings are lubricated entirely by splash, suitable oil pockets, holes and grooves being provided for this purpose.

Oiling the Wristpin

The wristpin has its bearing in the piston itself and is lubricated from an annular groove cut in the piston just above the hole made for the wristpin and has suitable holes leading to the grooves cut on the inside of the bearing which distributes the oil their entire length. When the piston reaches the bottom of its stroke this groove uncovers a corresponding groove in the wall of the cylinder which is supplied with oil from the oil pump and, as the entire wall of the cylinder is also covered with oil from the splash from the crankcase, perfect lubrication of the wristpin is assured.

The lower cover to the crankcase, which is merely an oil-pan, is arranged in two compartments, one for each pair of cylinders, each compartment being sub-divided by a rib which stands about 1-8 inch higher than the oil level to be maintained in the crankcase, each compartment of which should contain about 1 pint of oil. This arrangement prevents the trouble so often experienced by flooding either the front or the rear cylinder in ascending and descending hills and necessitating frequent cleaning of the spark plugs.

The camshaft, magneto and pump gears are inclosed in a separate case attached to the front of the crankcase and are packed with a special grease, a can of which is supplied with each car. These gears should be repacked about every 500 miles. This can be accomplished by taking off the cap at the left of the case, remove pump gear, then force in as much lubricant as possible.

On the model S, 1909, there is a five-feed sight-feed mechanical pump oiler, Fig. 3, shaft driven from the pump-shaft provides lubrication for cylinders and front gears. These pipes should not be depended upon for the total supply of oil for the crankcase. It is important that the oiler be adjusted to feed so that one drop only at a time will show in sight feeds to each cylinder and three drops to front gear-case.

Micrometer Adjustments Regulate Supply

The supply is regulated by micrometer adjustments which are located on the top of the oiler as per Fig. 3. A regulates oil supply to the gearcase. B regulates oil supply to cylinder 1; C regulates oil supply to cylinder 2; D regulates oil supply to cylinder 3; E regulates oil supply to cylinder 4 and sight feed on dash. By screwing to the right you increase the supply. The sight feed on the dash will show that the oiler is working and also show the amount of oil being supplied into fourth cylinder. Individual sight feeds are on top of the oiler. By pressing down on bleeder No. 1 the amount of oil entering front gearcase will be shown in sight feed. Bleeder 2, the amount of oil being supplied front or No. 1 cylinder. Bleeder 3, the amount of oil to cylinder 2 and bleeder 4 the No. 3 cylinder.

The main crankshaft bearings are lubricated by splash, suitable pockets being cast on the inside of both ends and center of crankcase for this purpose. The camshaft has three bearings all inclosed within the crankcase which are lubricated entirely by splash, suitable oil pockets, holes and grooves being provided for this purpose.

The wristpin has its bearing in the piston itself and is lubricated from an annular groove cut in the piston just above the hole made for the wristpin and has suitable holes leading to the grooves cut on the inside of the bearing which distributes the oil their entire length. When the piston reaches the bottom of its stroke this groove uncovers a corresponding groove in the wall of the cylinder which is supplied with oil from the oil pump, and as the entire wall of the cylinder is also covered with oil from the splash in the crankcase, perfect lubrication of the wristpin is assured.

The lower cover to the crankcase, which is merely an oil-pan, and should contain 2 quarts of oil at all times, is arranged in two compartments, one for each pair of cylinders, each compartment being sub-divided by a rib. Each compartment should contain about 1 quart of oil, or a total of 2 quarts, which can be supplied to the crankcase through the hand hole cover on right side of crankcase or through the front gearcase by removing the winged nut on top. The quantity of oil should give a level of sufficient height to allow the studs of the connecting-rods to be submerged 1-8 inch when at their lowest point. This level should be maintained at all times and the mechanical oiler feed pipe should be regulated accordingly. This arrangement of dividing the oil pan prevents the trouble so often experienced by flooding either the front or rear cylinder in ascending and descending hills and necessitating frequent plug cleaning.

It is advisable to clean out the engine case occasionally by opening the drain cocks in the bottom of the case and cleansing it thoroughly with kerosene, after which the case should be supplied with the original quantity of fresh oil.

The camshaft, magneto and pump gears are inclosed in a case cast integral with the crankcase and are lubricated by the splash from crankcase and by feed pipe from mechanical oiler; pockets are cast in case to retain sufficient oil suitable for all gear bearings.

Magneto Probably Needs Overhauling

Editor THE AUTOMOBILE:—Can you tell me how to wire a single-cylinder engine so that it will work on both batteries and a Wizard type B. C. I magneto? The diagram, Fig. 5, shows how I wired it, but it will not work so that it will run on the magneto. Can you show me my mistake? I have tried it with and without the coil in the magneto but to no avail. When I touch the opposite terminal with the end of the wire from the opposite terminal or magneto, it sputters and sparks well but will not make the buzzer on the high-tension coil vibrate when it is connected as I show in the illustration. Only a single spark will show between the platinum points of the buzzer.

2—Will this magneto burn out with the friction pulley on and working right?

3—How many volts and how many amperes will this magneto draw?

This magneto has not been used for 2 years. The magnets seem to draw the armature with difficulty when the end bearing is taken off and the brushes and commutator are clean, but the commutator gets warm when it is run a while and sparks at the brushes every way I adjust them.

Lidgewood, N. D. L. H. W.

—Your wiring diagram appears to be correct. It is quite possible that the breaker mechanism is improperly synchronized with the armature position. The breaker points should separate at the same time that the magneto armature is generating the greatest current by cutting the maximum number of magnetic lines of force between the poles. This position of the armature can be determined approximately by rotating the armature shaft and noting the position at which the poles exert the greatest drag. Since the magneto has not been used for 2 years the magnets themselves may have become partially demagnetized, and in view of this it would probably be wise to have the magneto overhauled.

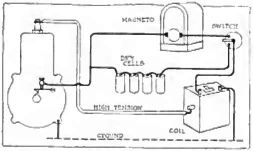


Fig. 5—Diagram for wiring single-cylinder motor to operate on either high-tension magneto or battery and coil

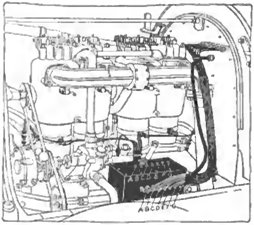


Fig. 4—Details of oiling system on the 1907 Pope-Hartford, with sight feed pipes

2—The magneto will not burn out with the friction pulley on and working correctly as it is a low-tension instrument.

3—The voltage of this magneto should be in the neighborhood of 6.5 and the amperage will depend upon the speed.

Headlight Lamp Is Out of Focus

Editor THE AUTOMOBILE:—One of the electric headlights on my car throws a smaller radius of light than the other, the lamps being of the same candlepower and one seems as bright as the other. Why the difference?

Scranton, Pa. V. H. C.

—The probabilities are that one of your lamps is out of focus. If you will examine your lamp you will note that the bulb can be moved forward and backward in relation to the reflector. This adjustment should be made until the ray of light thrown out by the lamp is equal to the others. In order to first ascertain, however, that it is the focal adjustment which is incorrect it would be a good idea to take the bulbs out of the lamps and interchange them. Then, if the same light gives the greatest illumination and the reflectors are both clean, it will certainly be a matter of adjusting the focus. Generally the adjustment of the focus is just back of the lamp proper and is effected by means of a screw.

Lubricate Bushings on Spring Seats

Editor THE AUTOMOBILE:—Would any harm result if I put a metal bushing on a rear axle housing to tighten spring seats on a Buick model B-36. The factory put on a grease cup, but I would rather have it tight, as it seems to make a noise when I go over a rough piece of road.

Angelica, Wis. J. L. D.

—There can be no harm in bushing the spring seats, providing that care is taken to cut oil grooves and drill holes for grease so that the bearing surface may be kept lubricated.

Splitdorf-Apelco Starting and Lighting for Fords

Single-Unit System with Chain Drive and Automatic Regulation Is Easily Attached

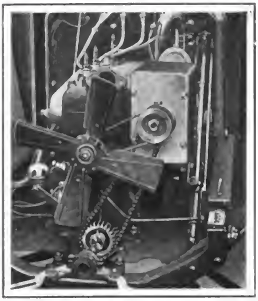


Fig. 1—Splitdorf-Apelco system on Ford showing chain drive to crankshaft

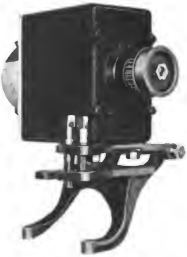


Fig. 2—The bracket on which the motor generator is mounted permits chain adjustment in both directions, vertically by two set bolts and sideways by the nuts on each end of the hinge bolt

THE latest starting and lighting system for Ford cars is the Splitdorf-Apelco, for which arrangements for manufacturing on a large scale have just been completed by the Splitdorf Electric Co., Newark, N. J. It is a single-unit system, the motor-generator being designed for attachment to the left side of the engine driving by a chain to the front end of the crankshaft. The aim of the design has been to reduce the number of parts to the minimum and simplify fitting to the engine. The complete outfit comprises the motor-generator, a 6- and 12-volt battery with case for mounting on the running board, an adjustable bracket for the motor, starting and lighting switches, chain and sprocket, fan belt, and all necessary cables and clips.

Practically no machining is necessary in fitting, the single exception being a slight cut on the existing fan pulley to take a pulley extension for the new belt by which the fan is driven from the end of the motor-generator shaft instead of the crankshaft.

Chain Adjustment Provided

The cast-iron bracket which carries the motor is attached by three bolts which replace two in the crankcase flange and one at the base of the forward cylinder. The upper face of the bracket, Fig. 2, is hinged at one side for adjustment of the chain. For this purpose two set screws are provided, one for raising and tightening the chain and the other for slackening. Great importance attaches to this feature on any chain driven motor generator set as the drive is from opposite ends in starting and lighting and the strain in starting may be severe. Sideways alignment of the drive is also obtainable by screwing in or out the hinge bolt of the bracket. The gear ratio is roughly 2 to 1, the motor pinion and crankshaft pinion having respectively 13 and 27 teeth. There is no other form of gear, the drive being positive.

In fitting, the existing pulley on the crankshaft for the fan belt is removed and the chain pinion substituted. It is held in place by a taper pin passing through an existing hole in the crankshaft, a split pin holding this pin in the pinion. Owing to the presence of the chain it is necessary to move the fan belt position further back and it is for this purpose that the pulley extension on the fan is provided. This extension pulley is simply driven on top of the old pulley after taking a slight cut over the flange.

Bucking Coil Regulation

The motor-generator is a two-polar design having two windings, one for generator purposes and the other for starting. Regulation of the current while generating is obtained inherently by the use of bucking coils.

When the unit is operating as a motor the bucking coils are not in use. On generating, however, the main current flows in series around these coils and as they are wound opposite to the main shunt field coils their effect on high speeds is to cut down the magnetization of the fields and hence the current output. Four carbon brushes are used and inspection can be made by removing a lid on the aluminum end cover.

Through the use of a change-over starting switch the battery is connected to supply current at 12 volts for starting though it is charged and the lamps are furnished with a 6-volt current. The starting switch is placed under the floor boards with a plunger pedal projecting near the base of the driver's seat where it can be depressed by the heel.

Charging and discharging is indicated by a positive acting indicator clamped to the base of the steering column which shows the words "ON" or "OFF." An automatic switch in the generator circuit cuts in the generator when the speed reaches 850 r.p.m., which is equivalent to a car speed of about 10 miles per hour. The lighting switch is provided with a dimmer for the headlights.

The complete installation weighs 150 pounds of which the generator represents 38 pounds. Fitting can be accomplished by any repairman in four or five hours. The price complete is $65.

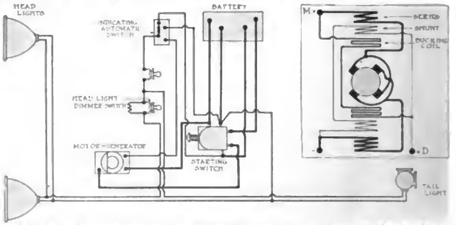


Fig. 3—Diagram of connections of the Splitdorf-Apelco electric system for Fords. Right—Winding diagram of the motor-generator showing the bucking coils which regulate the output

Machines for Warner Gear Making

Ingenious Devices for Gear Blank, Pitch Indicator and Housing Manufacture

New design Cleveland automatic for transmission gear blanks

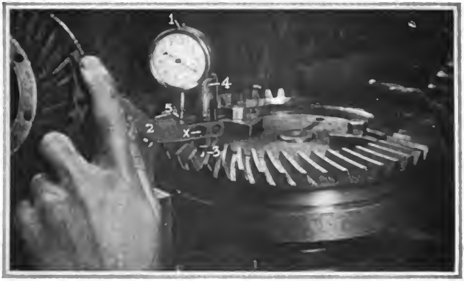
IN the factory of the Warner Gear Co., Muncie, Ind., there are three machines which are great factors in the rapidity of production and accuracy. The first is a new design of Cleveland automatic for turning out transmission gear blanks, the second, the fixture for indicating spiral bevel gears on the pitch line, and the third, a boring apparatus for use on the gearset housing. These are illustrated respectively at the top, center and bottom of this page.

With the automatic, the gears are blanked out complete ready for the gear cutters, from cold rolled bar stock. All the operations after the set-up are automatic. The effectiveness of this machine can be judged readily from the size of the chip. With these the cost is cut two thirds because one man takes care of three machines. The time of cutting the part shown, which is the most costly gear blank in the gearset, is 12 minutes. This is a drive gear with 11-inch shank. Each machine handles bar stock up to 6 inches in diameter and weighs 8.5 tons.

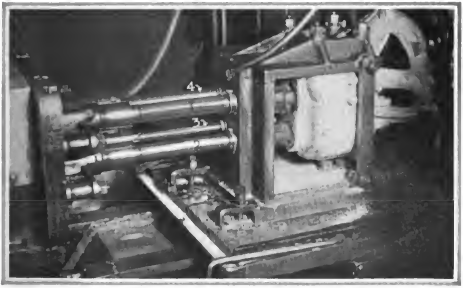
The dial pitch indicator is used in a directly opposite manner from that in which it is generally used. Instead of the indicator pinion being the movable part, it is stationary and the dial itself moves up and down in a vertical plane. A small shaft 3 passing up through the fixture frame has one end turned to a perfect ball and the other attached rigidly to the rear of the indicator dial. An operating lever 2 fulcruming about X raises or lowers the shaft 3 by the means of the pin 2. This raises or lowers the indicator dial 1, and as the indicator pin 5 is stationary on the fixture frame the correct reading will be given on the dial face. In operation the ball pointed shaft drops between each pair of teeth and produces the reading on the dial. A gear having a variation of more than .003 around the entire face is rejected.

Fast work in the boring of the gearset housing is accomplished by the third machine, which was built in the shops of the Warner Company, the jig and tool work being also a Warner product. Boring is the second step, the first being to mill the face.

The boring bars are numbered 1, 2, 3 and 4, respectively for the main countershaft, idler pin and shifter rod holes. The time to bore one of these cases complete is 11 minutes.



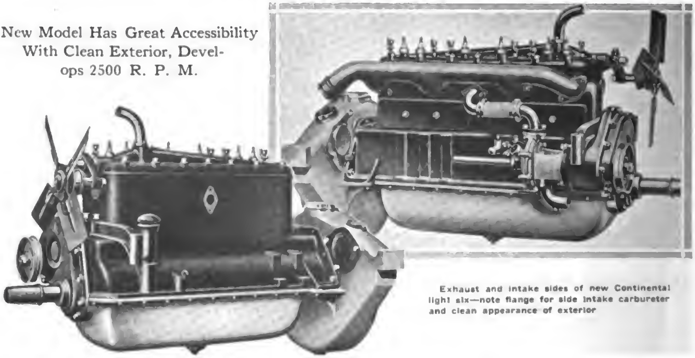
Specially built fixture for indicating spiral bevel gears on the pitch line



Special machine for fast work in boring the gearset housing

Continental Light Six Motor Announced

New Model Has Great Accessibility With Clean Exterior, Develops 2500 R. P. M.



Exhaust and intake sides of new Continental light six—note flange for side intake carbureter and clean appearance of exterior

THE first of the several new Continental motors to be announced by the Continental Motor Co., Detroit, Mich., is a light six 3.25-inch bore by 4.5-inch stroke. As a performer the engine is a fairly high-speed type since it develops 35 horsepower at about 1,600 r.p.m. and will run up to 2,500 r.p.m. the peak of the power curve being well up towards the maximum speed.

Apart from the neat appearance perhaps the most remarkable feature of the motor is the very large size of the crankshaft which is no less than 2 1-4 inches in diameter. This, it is claimed, completely overcomes torsional vibrations which is an advantage from the point of view of comfort and also because it tends greatly to reduce noise in the timing gears at the front end. This highly desirable quietness is increased by the use of a new compressed cloth material for the camshaft gear, and an engine which we were able to examine on the test block proved that the gearing is almost absolutely quiet at moderate crankshaft speeds.

There is but little aluminum in the motor as the cylinders and upper part of the crankcase are integral, but the flywheel housing is aluminum. This saves weight and, as the bottom portion of the crankcase is pressed steel the whole motor is quite reasonably light.

Valves are accessible by the removal of a cast iron detachable cylinder head which is in one piece, and the valve springs and tappets are located on the right behind the usual inclosing plates. On the right side also is the magneto when this form of ignition is employed, or the generator and ignition unit. Drive for these attachments is obtained by a shaft passing through the water pump and there are openings on either side of the aluminum flywheel housing so that almost any sort of cranking motor can be attached on right or left.

On the left side there is nothing but the carbureter which bolts directly to the cylinder block, all intake passages being internal but the exhaust manifold is, as usual, separate.

Lubrication is the combination force feed with dip troughs for the crankpins generally associated with Continental motor practice. Oil under pressure goes to the three main crankshaft bearings and to the helical timing gearing. Overflow thence fills the dip troughs and splashers on the connecting-rod bearing caps distribute the oil to all other parts.

As instancing the convenience of this motor to car manufacturers it should be observed that the practice of making the flywheel housing in aluminum, bolted to the iron of the crankcase, enables the housing to be varied a little to suit individual maker's requirements. The standard housing is one of the S. A. E. sizes which the society expects to standardize shortly, but it is possible to alter this cheaply.

For setting the motor in the frame a three-point suspension is arranged in such a way that there are four points of attachment to the chassis, and this is easier to provide than three points with a swivel bracket on one of the cross rails. At the rear end are the usual aluminum arms integral with the flywheel housing, and to the front end is attached a drop-forged beam. The two ends of this beam can be bolted to the car frame and the front end of the motor hangs from the middle of the beam.

We understand that the price to manufacturers of this new engine is distinctly lower than that of any previous Continental models, either four or six cylinder, of equivalent total piston displacement, this being made possible by a design that is a trifle more simple as a manufacturing proposition. Certainly the Continental company has never made a neater looking job, nor one that runs more smoothly.

Great developments are in progress at the Muskegon plant of the company where a new three-story building 60 by 150 feet is being erected. Two lines of test blocks to accommodate a hundred more motors are being added to the test room at Detroit and sundry small building additions are also being made to this plant. While trade has never before been so brisk the company expects it to be still better during the year and have had to refuse consideration of some substantial foreign orders owing to its inability to do more than satisfy the most pressing part of the home demand. It is said that the aim for the immediate future is an output of 500 motors daily.

The Automobile

PUBLISHED WEEKLY
Copyright 1915 by The Class Journal Co.

Vol. XXXII Thursday, June 24, 1915 No. 25

THE CLASS JOURNAL COMPANY
Horace M. Swetland, President
W. I. Ralph, Vice-President E. M. Corey, Treasurer
A. B. Swetland, Secretary
T. B. Van Alstyne, Advertising Manager

231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden
J. Edward Schipper Sydney Oxberry
L. V. Spencer, Special Representative, Detroit

BRANCH OFFICES
Chicago—910 South Michigan Ave., Phone Harrison 7707
Detroit—95 Fort Street, West, Phone Main 1351
Cleveland—516-517 Swetland Bldg., Phone Prospect 167

Cable Address - - - - - - - - - - Autoland, New York
Long Distance Telephone - - - - - - - - - - 2046 Bryant, New York

SUBSCRIPTION RATES
United States and Mexico - - - - - - - - - - One Year, $3.00
Canada - - - - - - - - - - One Year, 5.00
Foreign Countries - - - - - - - - - - One Year, 6.00

To Subscribers—Do not send money by ordinary mail. Remit by Draft, Post-Office or Express Money Order, or Register your letter.

Entered at New York, N. Y., as second-class matter.
Member of the Audit Bureau of Circulations.
The Automobile is a consolidation of The Automobile (monthly) and the Motor Review (weekly), May, 1902, Dealer and Repairman (monthly), October, 1903, and the Automobile Magazine (monthly), July, 1907.

S. A. E. Sets High Standard

THE quality of the papers read at the Society of Automobile Engineers' summer meeting and of the discussions thereon reflects great credit upon the authors, the speakers and the society. Discussions were hurried a little by pressure of number of papers on the program, but this seemed to serve merely to persuade speakers to come rapidly to the point.

The paper on the fundamentals of motor design was, of course, the most topical of all, and served as opportunity for obtaining the opinions of several prominent engineers on the situation created by the coming of multi-cylinder motors. These opinions were given in a frank, direct way and it was very impressive how most of the speakers refrained from giving their ideas as convictions. It may be doubted if such leaders of thought have ever before expressed themselves as quite so indefinite as to the future.

Another paper of unusual merit was that dealing with the spiral-type bevel and it was obviously appreciated by many as being a successful attempt to explain the detail of this type of gearing. In the discussion on this paper a very healthy condition was indicated in the absence of axe grinding by the sponsors of worm and bevel gearing, and throughout the whole meeting there could be no mistake as to the genuine nature of the opinions given.

The S. A. E. stands for the interest of the industry at large, and the interchange of ideas is one of the greatest reasons for the existence of the S. A. E. Thus it is more than encouraging to hear discussions of so high an order of frankness. Too often in the past, after hearing the expressed ideas of some leading engineer there has remained a doubt as to whether the things he said were the things that he believed fully and truly. At the 1915 summer meeting there was hardly an instance where the man who spoke did not create with his words an atmosphere which assured their complete sincerity.

Tire Economy

TIRE manufacturers and car manufacturers both agree that many of the cars of today are undertired, but instead of solving the problem, now that the solution is offered, both parties seem to hold aloof from action in this much needed reform. Last week before the Society of Automobile Engineers, the representative of one of the largest tire manufacturers stated that fully 33 per cent. of all automobiles are undertired.

This is a serious situation, and the short-sighted policy of clipping a few dollars from the sales price of a car for the sake of a sales talking point will react when owners begin to realize, as they are already beginning, that this few dollars saving in first cost will mean many dollars loss in tire replacements.

The amount of money wasted in tires is inconceivable under present conditions. When an expert who is in the tire business estimates that 30 per cent more tires are worn out annually than should be the case, it is time to call a halt. The car users are the first sufferers because it is they who have to foot the tire bills, but the car manufacturers themselves are the ones who will suffer in the long run in many ways. In the first place, many are kept from owning cars by the thoughts of large tire bills. In the second place, cars which would be easy on tires, were the proper size used, soon get the reputation of being hard on tires, merely because, for the sake of a few dollars on each car, they have cut the tire size to the limit.

Something must be done, and the solution is logical. Let car manufacturers and tire makers get together and decide, on a weight basis, what tire size should be used and let the car manufacturer send out his cars equipped with the correct even size, leaving the owner to put on the odd or oversize if desired, for particularly arduous service.

Frank Discussions

NOTHING can be gained by a man keeping his knowledge to himself in an industry where the necessity for progress is so marked as that concerned with the manufacture of automobiles and related articles. Each one must contribute his share in the up-building of knowledge, and for this reason frank discussions at engineering meetings are highly desirable. Such discussions were had at the summer meeting of the S. A. E.

S. G. V. Cars Will Be Continued

Manufacture Will Be Started in Met. District—Plans Yearly Production of 400

NEW YORK CITY, June 19—The manufacture of the S. G. V. car will be continued. R. J. Metzler, who bought the plant at Reading at the receiver's sale on May 27, has bought outright the name, good will, patterns, drawings, jigs, dies and the right to continue the business.

Mr. Metzler is now perfecting a new organization to go into active manufacturing of the car and expects to start active work in about a month with a production of about 400 cars a year. At present the New Jersey Machinery Exchange, 23 Mechanic street, Newark, N. J., of which Mr. Metzler is a member, is giving S. G. V. service in that city.

The plant has not been decided on, but Mr. Metzler states that it will be either in Newark or Long Island City. The thirty-two complete chassis offered for sale at the auction on June 9 were bought by Mr. Metzler.

Knox Motors Associates Take Care of Sales and Advertising

SPRINGFIELD, MASS., June 17—With a view toward reaching the highest possible degree of efficiency in its selling organization, the Knox Motors Co., Springfield, Mass., has transferred its sales and advertising work to a trust association known as the Knox Motors Associates. This association will act as sole distributors for all Knox products. The officers of the Knox Motors Associates are: President, H. G. Fisk; clerk, C. H. Beckwith; treasurer and general manager, E. O. Sutton.

The Knox company has recently put on the market a highly efficient four-wheel tractor designed for all kinds of heavy highway hauling and especially adapted to the hauling of such heavy materials as lumber, coal, structural steel, ore, contractors materials, etc.

Wuchter and Werner Head $2,000,000 Tire Co.

NEW YORK CITY, June 19—The Kansas City Tire & Rubber Co., recently incorporated in New York State by P. E. Werner, of Akron, O., and W. W. Wuchter and Philip Freshwater, has purchased the Chester Rubber Tire and Tube Co. plant in Chester, W. Va., as part of the above $2,000,000 incorporation. The Chester plant will be enlarged and its capacity doubled by the new management, and will supply the eastern tire and rubber products trade, while another plant, recently purchased by the company in Kansas City, will supply the central district.

Mr. Wuchter has been very prominent in the tire field, having been connected with the Firestone Tire & Rubber Co. as superintendent, and later as president and general manager of the Swinehart Tire & Rubber Co. Mr. Freshwater is general manager of the Chester plant.

Canadian Plant for Chevrolet

NEW YORK CITY, June 22—The Chevrolet Motor Co. of New York, is about to establish a plant in the Dominion of Canada, probably in Toronto, Ont., though the location has not been definitely decided upon. Thomas Houghton, formerly with the Dominion Carriage Co. has been appointed Canadian representative. It is planned first to build the "Four-Ninety" model and later to produce the complete Chevrolet line for Canadian consumption. It is expected the plant will have a capacity of 15,000 cars per year.

Warner Now Oakland's General Mgr.—Other Officers Promoted

PONTIAC, MICH., June 18—Several important promotions have been made among the officers of the Oakland Motor Co., by president Charles H. Nash, of the General Motors Co., of which the Oakland company is a subsidiary. Fred W. Warner, who has been general sales manager is now general manager; C. B. Voorheis, who was assistant sales manager, becomes general sales manager and Thomas H. McDearmon, of the department is made assistant general sales manager.

Mr. Warner was formerly manager of the Buick Motor Co.'s branch in Chicago; Mr. Voorheis was general manager of the Kingman Plow Co., Peoria, Ill.; Mr. McDearmon was general sales manager and assistant general manager of the John Deere Plow Co., Kansas City.

Co-operative Grocery Delivery

CHAMPAIGN, ILL., June 19—A co-operative delivery system for groceries, meat markets and similar lines has been started in this city and by means of which it is claimed 50 per cent. in the cost of delivery will be saved. A sufficient number of motor delivery wagons to care for the work have been purchased. The forty delivery men who heretofore have been employed by as many firms in these lines will be displaced by the new system. Half of these will enter the employ of the company caring for the co-operative system and the other half will take positions as clerks, etc. This plan of co-operative delivery is working successfully in Galesburg and other Illinois towns.

Reduced Studebaker Car Prices

Sixes Cut $400—Fours Reduced $100—Many Chassis Refinements—Delivery Prices

DETROIT, MICH., June 21—For 1916 the Studebaker Corp. has reduced the prices in its six-cylinder and four-cylinder models notwithstanding body refinements and numerous chassis improvements included. The price on the six-cylinder, seven-passenger car has been cut $400. The price on the four-cylinder touring car is cut $100. The six-cylinder roadster is now priced at $1,000, and the seven-passenger touring car is $1,050. Last season's five-passenger six was $1,385 and the seven-passenger $1,450. The four-cylinder touring car in the new series is to sell for $885, as compared with $985 this year. The roadster is $850, compared with $985.

There has been much standardization of the two chassis, and this is probably influential in the lowering of prices. The motors are both increased in bore from 3 1-2 inches to 3 7-8 inches, with the stroke remaining at 5 inches. Most noticeable in the engine changes is the removal of the cross shaft at the front, and the new mounting of the generator vertically with spiral drive.

Greater Accessibility

The whole chassis has been gone over with the main idea of attaining greater accessibility. Greater quietness has been striven for. The bodies have better lines, and there is no suggestion of break between body and the hood.

The new Studebakers use a modified form of Wagner electrical system in connection with a Remy ignition distributer. A special and advantageous feature of the electrical system is the placing of the wiring junction box on the right rear of the motor. Removal of its cover plate makes all connections accessible, and the wiring on the body is eliminated.

The wheelbase of both cars has been increased, being 1 inch longer on the six, 122 inches. The four is lengthened from 108 to 112 inches. Due to modifications in the suspension, the cars are lower, and the frame has been strengthened. Both cars are fitted with 33 by 4 tires.

On a modified four-cylinder chassis, the delivery car is fitted. This uses the same engine, and the chassis differences are only such as needed for such service. The springs are heavier and frame longer. With panel body, it is to sell for $875; express type, $850; combination express and passenger-carrying design, $875. Formerly the delivery types sold for $1,050.

Goodyear's $400,000 Addition

Adds 5 Acres Floor Space and Raises Daily Output from 12,000 to 15,000

AKRON, O., June 19—Five acres of additional working floor space are included in plans approved this week by the directors of the Goodyear Tire & Rubber Co., which will begin at once an extension of the Akron factory made necessary by the continued growth of the business. This will give the plant a total floor area of nearly 50 acres.

The new buildings will be ready, with machinery installed, by the beginning of the fiscal year, November 1, and will require for their use 2,000 additional men, bringing the Goodyear working force to a total of 10,000.

Goodyear's present capacity in automobile tire production is over 12,000 a day. The new buildings will enlarge the capacity to well over 15,000 tires a day. The cost of the plant enlargement will be $400,000. All the buildings are to be of brick and steel, to harmonize with the present plant, and room will be found in them to extend the manufacture of mechanical goods.

Bell Factory Starts Production in New Plant

YORK, PA., June 19—Operations at the plant of the Bell Motor Car Co., York's latest addition to the automobile industry, was started this week. The company expects to build a number of cars this month and material for their manufacture is arriving. The company expects to have its plant in full operation by the middle of July. W. F. Grove, for the past several years connected with the sales department of the Pullman Motor Car Co., has been appointed as sales manager. Workmen have been busy at the plant during the past several weeks in making the necessary improvements and installing the machinery and other equipment. The Bailey Mfg. Co., engaged in the manufacture of commercial automobile bodies, which occupied the plant, has moved to North Wales, near Philadelphia, where a large plant has been erected and the company will engage in the manufacture of bodies for Vim cars.

Studebaker's Annual Convention

SOUTH BEND, IND., June 21—The annual convention of the automobile branch managers of the Studebaker Corp. was held here Friday and Saturday in the administration building of the corporation. About twenty automobile dealers of the larger cities and the Detroit and South Bend officials were also in attendance. The annual conventions have heretofore been held in Detroit, but this year a change was made to South Bend in order to permit the managers and dealers to become more familiar with the South Bend plants which are now making the automobile bodies, castings, springs and stampings. Those attending were: J. M. Studebaker, sr.; F. S. Fish, E. R. Erskine, G. M. Studebaker, C. C. Hanch, H. E. Dalton and W. F. Shillington. Detroit officials: E. R. Benson, L. J. Ollier, R. T. Hodgkins, H. T. Myers, G. L. Willman, H. A. Biggs, James G. Heaslet, M. S. Wollering.

3,800 White Men Get Wage Increase

CLEVELAND, O., June 16—About 3,800 employees of the White Co., will receive increases in wages amounting totally to about $1,786 a day.

The move is an effort of the company to keep the good men it has in its employ. The demand for war material, according to the president of the company, Windsor T. White, has created a scarcity of skilled labor in mechanical fields.

Under the new schedule all men on day work will receive the same pay for 8 hours that they have been receiving for 9 hours' work. Time and a half will be paid for the 9th hour and all other hours of overtime.

The factory is to run 9 or more hours daily as long as the work holds out. A man who has been earning 25 cents an hour during a 9-hour day will now receive $2.25 for 8 hours' work and an additional 42 cents for the 9th hour.

Overland's 1916 Shipments 12,000 Up to June 12

TOLEDO, O., June 19—Up to June 12 the Willys-Overland Co. had shipped 12,000 of the new 1916 cars, and the company is now over 21,000 immediate shipping orders behind.

The present shipping schedule calls for the shipment of about 380 cars a day. May was the largest month in the history of the company, and sales were 54 per cent. ahead of those for the same month last year.

De Kalb Car on Street

ST. LOUIS, MO., June 17—The De Kalb Motor Car Co., this city, has one of its first De Kalb delivery cars on the street. It is a 45-horsepower, six-cylinder car, selling for $2,250 with choice of body at option of the purchaser. The same chassis will also be used for touring car bodies. The new car's motor is a Beaver and carries the Apple starting and lighting system, Stromberg carbureter and Remy magneto. The rear axle is floating Timken; semi-elliptic springs are used. The wheelbase is 130 inches.

1916 Briscoe Has Larger Motor

Uses Ferro Motor in Eight—Drops Single Headlight—Cantilever Springs

JACKSON, MICH., June 24—Nineteen-sixteen plans for the Briscoe Motor Co., of this city as intimated a week ago are now complete, and the company will manufacture a chassis in which either a four-cylinder or eight-cylinder motor may be used. The price of the four-cylinder job has been cut $35.

The four-cylinder engine is entirely remodeled over that used in the previous model, and though the car is an improved design throughout, the price has been reduced from $785 to $750.

The eight-cylinder model lists at $950, and being on the same chassis, either engine will go in either car. The Briscoe company will sell the eight engine for $225 additional. The eight-cylinder motor is of the Ferro design, with overhead valves already described in these columns.

The new four-cylinder motor has the same stroke as formerly, 5 1-8 inches. The bore is larger, 3 7-16 inches as compared with 3 1-8 inches. The cylinders are cast in a block, and a very smooth outward appearance has been given the power plant. The gearset is not in unit with it, but is suspended independently amidships.

The chassis has been lengthened from 107 to 114 inches, giving more room in the back seat. Cantilever rear springs are a departure from the semi-elliptics used previously. A noticeable change is in the using of two headlights in conventional manner instead of the single headlight in the middle of the radiator as previously.

Tires are increased from 30 by 3 1-2 to 32 by 3 1-2. The brakes have been changed from the double-internal-expanding variety to the internal-expanding and external-contracting form. The rear axle has been changed to a floating design. Three body types—roadster of the clover-leaf seating form, touring car and coupé—are to be had at the prices given.

To Sell Pope's Westfield Plant

BOSTON, MASS., June 19—Judge Aldrich of the United States district court has issued a decree ordering the sale of the Pope bicycle plant at Westfield, Mass., on July 20. George Pope, Chas. A. Morse and Chas. A. Parsons receivers for the Pope Mfg. Co., in their report stated that H. Preston Cousens of New York had offered to bid not less than $725,000 for the property if a sale was arranged not later than July 20. As this time was but a month away the receivers agreed that it would be wise to have immediate action taken upon the matter. In their report they stated that no reorganization plan had been presented to them by the creditors, and that they can continue to administer the plant at Westfield economically and successfully for an extended period only by losing considerable free cash now on hand.

Thomson of Thomas Drive Here

NEW YORK CITY, June 23—Hedley J. Thomson, managing director of the Thomas Foreign Patents Co. Ltd., holders of the patents on the Thomas gasoline-electric transmission is in this city for a short time on his way back to England after an extensive trip in the interests of the Thomas drive.

Mr. Thomson left England in July, 1914, for Australia together with a party of other members of the British Association, an organization for the general advance of science, and before a meeting in Melbourne in August, read a paper on the Thomas drive. He spent 3 months in Australia and 6 months in New Zealand, his home. Mr. Thomson's company holds extensive patents in this country on his drive and he expects to return here shortly, if his plans permit, to interest American manufacturers.

Dodge Now Making Roadster

DETROIT, MICH., June 21—Thus far Dodge Bros. have been building only touring cars, although they announced quite a while ago that they would also supply a roadster at the same price as the five-passenger car. Orders for this model came, however, in such quantity that for months all attention was given to the building of this style. Now, however, production has progressed to the extent of making it possible to also take care of the demand for roadsters and the first of these models are now being shipped to dealers and distributors.

The Dodge roadster differs from the Dodge touring car only as far as the body is concerned. It seats two passengers but is otherwise identical in construction to the larger car. It sells at the same price, $785.

50,000 Plugs a Day

FLINT, MICH., June 21—The Champion Ignition Co., manufacturers of spark plugs will increase its production capacity to 50,000 spark plugs a day when the addition to the plant is completed.

This new building, two stories high, 146 by 60 feet, will increase the floor space 20,000 square feet. It will be used by the engineering, tool and porcelain departments and the present factory building will be used for finishing the product.

Truck Shipments Unsatisfactory

McCulla Back from Europe Exposes Faults in American Trucks

NEW YORK, June 22—Wm. R. McCulla, assistant chief engineer of the Knox Motors Co., Springfield, Mass., who has been abroad investigating the truck situation in the war zone, returned last Saturday and has many startling confessions of the American truck situation in connection with the war. Mr. McCulla believes that one of the greatest evils in the present exporting of American trucks is that they are poorly crated, many of them being badly rusted when they reach the other side and some of them almost unable to run because of this condition. Some of the concerns have picked out very poor types of men to represent them in Europe.

Mr. McCulla says that where an error is being made is in not having the very best factory organization to handle the trucks when they arrive in Europe. Some organizations are leaving all the work to soldiers, which includes the unpacking and setting up of machines with the result that because of this unskilled help some of the machines operate very badly. Fatal accidents have happened before some of the trucks have gotten 10 miles from the seaport because of this.

Mr. McCulla mentions personally seeing three or four machines in which the magneto was set exactly half way around on the driving dog so that it was not firing at the right periods. On others the wiring was wrong, and valve tappets were not adjusted on others.

One American company has made a very enviable reputation for itself by careful business-like work in connection with shipping its trucks abroad and tuning them up over there. The trucks are well crated and the company has exceptionally good men at the landing stage. These men in turn employ four or five good French mechanics who thoroughly understand their business and who are not carried away with the sensation of working in a strange country and so go about their work in a business-like manner. The company representative at the landing port simply walks around and sees that each truck is positively O. K. before it leaves the port.

Concerning tractors Mr. McCulla believes the Panhard to be the best used in the war. The Renault is well designed but due to lack of time has apparently not been so well worked out. Some tractors in operation have not sufficient cooling facilities and have to carry additional water tanks.

Mr. McCulla officially demonstrated the Knox tractora to the engineers of the motor transports and made two trips to the firing line, thereby having an opportunity to observe the entire transportation methods at work. He reports that to date the French have had rather poor success hauling their big guns with tractors. He says that the new French gun will be hauled by tractors and that the lightest unit of it will weigh 40.5 tons, all the weight carried on four wheels.

Apperson Eight and Six

NEW YORK CITY, June 19—The Apperson Bros. Automobile Co. will drop the four-cylinder car in 1916 and will manufacture only sixes and eights. The six will be the same as the 1915 model. The body types will include a roadster with four seats, of which the two front seats are individual chairs. The new roadster body will be mounted on either the six or the eight chassis.

The eight motor 3 1-2 by 5, develops 55 horsepower, and is of the V-type mounted at a 90-degree angle, the cylinders being cast in fours. The car has a wheelbase of 128 inches and a tread of 56. Other features are: left drive, center control; gasoline tank in rear, and Stewart vacuum feed.

Adopts Automatic Spring Machine

RACINE, WIS., June 19—The Harvey Spring Co., Racine, Wis., car and truck springs and axles, has developed and installed in its plant a new device for automatically forming spring leaves and quenching the spring in oil. While the old method of forming and quenching springs by hands required an expert spring maker and a helper, the new device makes it possible for a single expert to attend single-handed to a battery of machines. The output of one machine alone is at least four times that obtained by hand work. With the new machines the Harvey plant is able to turn out daily twenty-five sets of twelve-leaf 2 1-2-inch springs, 50 inches long.

DETROIT, MICH., June 21—The Packard Motor Car Co., has placed a contract with the Burd High-Compression Ring Co., to use their patented piston ring for 1916.

To Conclude Detroit Electric Run This Week

DETROIT, MICH., June 21—The Anderson Electric Car Co. will conclude this week a series of 20 daily interurban runs which it has been conducting since June 1 for the purpose of demonstrating the possibilities of the electric in runs of one battery charge. The company maintains that the car is sufficient for 98 per cent. of the motorist's demands. The model of cars used is a fifty-two brougham, equipped with Detroit lead batteries, Goodrich Silvertown cord tires and Houk wire wheels. Guests are invited to take the trips, the cars stopping at their residences for them and the company furnishing a basket lunch.

Automobiles for China

New York City, June 19—A representative of interests in China, Gallant Goo has made inquiries at the Bureau of Foreign and Domestic Commerce in regard to automobiles. Mr. Goo wants to take back to China catalogues of manufacturers of automobiles, motor supplies, and vehicles. Upon his return home he will form a company capitalized at $100,000 to handle foreign cars and vehicles generally. According to Mr. Goo the prospects are good for an excellent business in American cars in that country as soon as the people are educated up to their use. Those interested may communicate with him by addressing S. H. Rose, Acting Agent in charge of the bureau, Room 409, Custom House.

A. O. Smith Pioneer Dead

Milwaukee, Wis., June 19—T. M. Custer, general purchasing agent of the A. O. Smith Co., Milwaukee, frames, parts and trucks, and a well known steel man in the country, died at Milwaukee June 17 of peritonitis, following an operation for appendicitis on May 21. Mr. Custer was born in South Ronaldshay, Orkney Islands, Scotland, in 1872 and came to America in 1891. He sailed the Great Lakes for a number of years and just as he was eligible for a master's or captain's license, he turned his attention to metallurgy, being employed by important steel and iron concerns in Elyria, O., Chicago and Cleveland until 1909, when he became associated with A. O. Smith Co. as a steel expert, shortly afterward being named chief purchasing agent.

Stanton Sails for London

New York City, June 19—A. T. Stanton, Dodge Bros.' newly appointed district representative for the British Isles sailed today on the steamer St. Paul. Mr. Stanton will have his headquarters in London, and will be in charge of Dodge Bros.' affairs in the British Isles.

Velie Manager Resigns

Moline, Ill., June 19—Ray R. Bush, general manager of the Velie Motor Vehicle Co., has resigned to engage in business in Kansas City.

Kelly-Springfield Tire May Add

Akron, O., June 19—The Kelly-Springfield Tire Co. is seriously considering a further enlargement of the plant here. The works are now running on a 24-hour schedule and are rushing orders. The output this week has run up as high as 1,100 tires a day.

Gasoline Price War Rages

Colorado Price Lowest in 20 Years—Cut 6 Cents in Ohio in Week

Denver, Col., June 22—*Special Telegram*—The price of gasoline in the Rocky Mountain region has reached the lowest mark in the last 20 years. Filling stations are selling at 13 cents per gallon, and garages are charging from 13 to 17 cents. The oil companies are selling direct to consumers at 12 and 13 cents in 25-gallon lots. The price to the trade is 11 cents per gallon. These lower prices have been brought about by an additional cut of 1 cent per gallon which is the second in 6 weeks. Small independent operators blame the Standard company for starting both cuts and predict still lower prices. Contrasting to-day's prices with those in vogue 18 months ago, when garages bought at 18 cents and sold at 22 cents per gallon, the advantage to the consumer can be seen.

Ohio Price Cut

Cincinnati, O., June 22—*Special Telegram*—Gasoline prices have been reduced in general throughout the state of Ohio. The latest cities to be affected by the reductions are Cincinnati, Lorain and Cleveland. In most cases the Standard Oil Co. has started the reductions and the independents have met them.

The price of gasoline in Cincinnati has been reduced from 12 to 11 cents per gallon to consumers by the Standard and the independents have met the reduction. A drop to 10 cents in the near future is promised. The independents state that the reduction is due to the immense accumulation of gasoline on the hands of the Standard company, owing to the inability to ship abroad on account of the war.

A dispatch from Lorain states that the price of gasoline has been dropped by the Standard company to 9 cents a gallon, thus renewing the gasoline war on its northern Ohio competitor, the Lake Erie Oil Co., Cleveland, which has established service stations for motorists at every cross-road. The Lake Erie Co. is meeting the reduction. The extent of the present war can be realized by the fact that gasoline at Lorain has declined 6 cents per gallon since last Thursday.

Long Can't Contest Interference

New York, June 23—On June 8, 1915, the Commissioner of Patents, head of the United States Patent Office, Washington, D. C., sustained the decision of the examiners in chief, who in turn had affirmed the decision of the law examiner, holding that G. F. Long has no right to contest the interference with E. Aufiero and the Auto Supply Mfg. Co. of Brooklyn on mechanical horn patents.

Toback Gets New York King

New York City, June 21—An important change in the New York field is the appointment of Samuel S. Toback, president of the A. Elliott Ranney Co., formerly distributer of Hudson cars who will handle the King line. The A. Elliott Ranney Co. has moved into the building occupied by the King, Broadway at Fifty-second street. Mr. Toback takes with him the same organization that has surrounded him during his 5 years in the Metropolitan district, with C. G. Taylor as sales manager.

Haynes Co. Makes Changes

Kokomo, Ind., June 17—The Haynes Automobile Co., this city, has made several important changes in its organization, the new appointments to go into effect immediately.

R. Crawford, for the past 18 months directing the sales of the company, has been appointed general sales and advertising manager. D. L. Watson graduates from assistant sales manager to sales manager. J. L. Larkin, previously sales promotion manager, has been appointed assistant sales manager.

S. A. Merinbaum, during the past year advertising manager of the company, has been appointed sales promotion manager. H. A. Minturn succeeds Mr. Merinbaum as advertising manager, he having previously occupied the position of manager of the technical bureau. Mr. Minturn's successor has not yet been named but negotiations are already under way with several Purdue University graduates in mechanical engineering.

Duffield Qualityre Sales Manager

Chicago, Ill., June 21—J. E. Duffield, formerly manager of the Chicago branch of the Thermoid Rubber Co., has resigned to take a position as sales manager of the Qualityre Rubber Co., Chicago.

Liston Promoted

Chicago, Ill., June 19—J. H. Liston, manager of the Detroit branch office of the Thermoid Rubber Co., has been promoted to western district manager of the Thermoid Rubber Co., with sales offices located at 2009 South Michigan avenue, Chicago.

Cunningham 1916 Out

Rochester, N. Y., June 18—The 1916 Cunningham has been announced. Changes include new body with divided front seat, new top and curtains, Westinghouse generator, dry-plate clutch, Westinghouse starter, drawn steel tank, new speedometer drive from universal and simplified brake linkage.

Truck Exports Gain Seventy Fold

Britain Greatest Buyer—Italy Drops—None to Germany—Canada Decreases

WASHINGTON, D. C., June 21—Supplementing figures previously published in THE AUTOMOBILE showing the gross figures of exports of motor cars during April, the Department of Commerce today issued the detailed figures and they are of decided interest to the motor car industry. As previously set forth the exports of commercial cars increased from fifty-two, valued at $72,676, in April, 1914, to 2,267, valued at $5,240,481, in April, 1915, an increase of over seventy-fold; while during the 10 months, ended April, these exports increased from 595 commercial cars, valued at $934,330, in 1914, to 8,580, valued at $23,977,968.

On the other hand, the exports of passenger cars dropped from 3,239, valued at $2,760,478, in April, 1914, to 3,078, valued at $2,804,741, in April, 1915, while the exports for the 10 months' period dropped from 23,167, valued at $20,664,480, in 1914, to 14,641, valued at $12,356,472, in 1915.

Exports of parts, not including engines and tires, increased in value from $626,132 in April, 1914, to $1,807,567, in April last, and from $5,549,471 to $5,924,175 during the 10 months' period.

Europe Gains

Naturally the bulk of our motor car exports are going to the warring European nations. The United Kingdom was a big buyer of American cars and trucks during April, 1915, the total being 1,455, valued at $1,925,280, as against 587 cars, valued at $514,977, in April, 1914. During the 10 months' period these exports rose from 6,319, valued at $5,057,100, in 1914, to 7,652, valued at $10,840,309, in 1915.

France likewise is becoming a big buyer of our motor trucks and cars, the purchases having increased from 311, valued at $179,230, in April, 1914, to 1,055, valued at $1,710,702, in April, 1915, and from 1,011, valued at $688,471, in 1914, to 3,951, valued at $10,035,842 during the 10 months' period of this year.

Under the heading of "other Europe," which includes all of the European countries with the exception of United Kingdom, Germany, France and Italy, surprising gains are shown, the exports having increased from 500, valued at $372,857, in April, 1914, to 855, valued at $2,535,169, in April, 1915, and from 2,241, valued at $1,777,826, to 2,118, valued at $6,129,392 during the 10 months' period. The natural inference is that trucks figured largely in the exports, as the value of the exports increased in value almost five-fold during the 10 months' period.

Italy is a poor customer, that country's imports from this country having fallen from fifty-nine, valued at $39,240, in April, 1914, to twenty-three, valued at $9,983, in April, 1915, while during the 10 months' period the exports to that country declined from 293, valued at $203,048, to 88, valued at $58,368.

Germany's contribution to American motor car makers was 234, valued at $163,101, in April, 1914, while in April last there were none of these exports to that country. During the 10 months' period the exports decreased from 1,185, valued at $840,448, in 1914, to 20, valued at $20,164 during 1915.

Canada likewise is not taking many American-built motor cars at this time,

(*Continued on page 1139*)

Automobile Exports and Imports for March and Preceding Nine Months

EXPORTS

	April 1914 Number	April 1914 Value	April 1915 Number	April 1915 Value	Ten months ending April 1914 Number	Ten months ending April 1914 Value	Ten months ending April 1915 Number	Ten months ending April 1915 Value
Automobiles								
Commercial	52	$72,676	2,267	$5,240,481	595	$934,330	8,580	$23,977,968
Passenger	3,239	2,760,478	3,078	2,804,741	23,167	20,664,480	14,641	12,356,472
Total	3,291	$2,833,154	5,345	$8,045,222	23,762	$21,598,810	23,221	$36,334,440
Parts of (not including engines and tires)	.....	$626,132	......	$1,807,567	......	$5,549,471	......	$5,924,175
EXPORTS BY COUNTRIES								
Automobiles								
France	311	$179,230	1,055	$1,710,702	1,011	$688,471	3,951	$10,035,842
Germany	234	163,101	......	....	1,185	840,448	20	20,164
Italy	59	39,240	23	9,983	293	203,048	88	58,368
United Kingdom	587	514,977	1,455	1,925,280	6,319	5,057,100	7,652	10,840,309
Other Europe	500	372,857	855	2,535,169	2,241	1,777,826	2,118	6,129,392
Canada	792	662,321	696	611,797	3,347	4,336,407	2,768	3,165,739
Mexico	6	6,848	6	4,025	160	268,497	64	63,600
West Indies and Bermuda	49	53,812	247	319,893	457	437,093	1,121	696,210
South America	137	104,567	98	68,637	1,729	1,219,422	906	494,488
British Oceania	276	251,012	307	270,230	3,351	2,909,643	2,471	2,059,011
Asia and other Oceania	211	184,277	394	560,945	1,879	1,802,247	1,340	2,116,888
Other countries	129	97,928	239	236,961	1,792	1,578,606	722	651,347
Total	3,291	$2,833,154	5,345	$8,045,222	23,362	$21,598,810	23,221	$36,334,440
Tires for Automobiles								
Belgium		......	......	......	.....	$15,429	......	......
France		......	......	......	.....	......	......	$6,090
Germany		$16,524	......	......	.....	108,254	......	......
England		131,101	......	$328,738	.....	1,362,418	......	1,000,430
Canada		92,104	......	22,000	.....	680,596	......	541,400
Cuba		......	......	21,033	.....	......	......	138,859
Mexico		5,639	......	7,381	.....	105,868	......	81,050
Australia		......	......	26,421	.....	......	......	160,736
Philippine Islands		10,554	......	28,660	.....	121,397	......	200,430
Other countries		43,283	......	105,344	.....	492,402	......	505,644
Total		$304,385	......	$665,043	.....	$2,683,344	......	$3,552,851
IMPORTS								
Automobiles .....dut.	15	$24,609	33	$37,795	260	$569,835	277	$442,816
Parts of (except tires) .....dut.	....	94,838	......	85,754	......	583,568	...	725,969
Total automobiles and parts of	......	$119,447	......	$123,549	......	$1,153,403	......	$1,168,785
BY COUNTRIES								
Automobiles								
France	7	$12,78[illegible]	7	17,956	117	$277,380	47	$100,377
Germany	2	3,5[illegible]	......	......	17	65,828	6	13,616
Italy	3	[illegible]	16	20,161	47	70,068	107	117,061
United Kingdom	1	1,815	4	7,536	38	133,557	64	150,918
Other countries	2	730	6	1,732	41	68,002	53	33,644
Total	15	$24,609	33	$37,795	260	$569,835	277	$442,816

Ford to Build Tractor Plant

Buys 2,000 Acres for Industrial City—500,000 Farm Tractors Annually

DETROIT, MICH., June 19—The first active step in the manufacture of the $200 Ford tractor described some time ago in THE AUTOMOBILE was taken last week when the Ford Motor Co. secured between 1,000 and 2,000 acres of land just beyond the city limits near Dearborn and Oakland where it is planned to erect for the manufacture of these tractors and where blast furnaces and other steel shops will be erected for the production of Ford parts. The plans have in mind the eventual employment of 20,000 men and the manufacture of approximately 500,000 tractors for farm work annually. A large amount of the ground will be reserved for the erection of working men's homes in this new industrial city.

No Delay on Plants

Work will be started with the least possible delay as it is expected that many years will be required before the new industrial city is entirely completed. The main plants, such as the tractor factory, the blast furnace, are expected to be ready for operation within a year or two.

When these new plants are completed, and possibly even before, it is the intention of the Ford company to operate the present plant in Detroit exclusively for the manufacturing of the bodies, tops and parts to be used for the Ford cars, the latter to be all assembled in the assembling plants.

Ready Materials

In speaking about his new plans Henry Ford made many interesting statements and comments: "Materials which we need for making our cars are not available or are received in such small quantities that it has and is causing much disturbance in our manufacturing plans. Were it not for the war these needed materials would be here, they would be received as before the war started, in sufficient quantity, but for some reasons, it seems that first attention is being given to those concerns making war material.

"It is my intention to be able in the future to avoid such a state of conditions. We will get the ore on our own ships and bring it to our new works where we will make our own steel, at our mills, and thus not only avoid the middleman to get the steel but we will have it cheaper and this will have quite naturally its effect upon the price of the finished products from our factories.

"To produce an automobile farm tractor at such a low cost or price that every farmer could purchase one, has been one of my ambitions.

"For years I have worked quietly upon the problem, and while some were made and tested long before the ones now in operation upon my farm in Dearborn, I was not satisfied until I had the tractor actually brought up to perfection.

"Months ago we could have announced that we were going to have a Ford tractor, but, just as in the case of the first Ford passenger car, we wanted to be sure of our ground, of our product. Now we are. Now we know that we have the tractor which will do the work, do it well and at such a low cost that it will be only a question of a few years when farmers will be faced with a new problem, that of the disposition of the horse. The tractor will do what five horses have been doing, so you can readily understand that the poor horse will have to look out for itself."

Washington State Derives $37,500 from New Law

SPOKANE, WASH., June 18—The new motor law in the State of Washington which went into effect on June 10 will bring at least $37,500 into the state coffers, which was not paid in last year, to say nothing of the large proportion which, operating in the jitney or "for rent" trade, must pay 50 cents per horsepower. As an illustration the Ford machine, with an insurable 23 horsepower, will cost the owner $11.50 if used for passenger carrying, as against $2.60 as at present. Of the 15,000 machines in the state which are being operated illegally, fully 6,000 are in the Seattle district but with the new law in effect revenue will be derived from cars which have been running without license of any kind.

The Pacific Coast Casualty Co. has completed its check of the jitney situation and finds a commendable intention on the part of the majority to aid in keeping within the law. Of the 466 jitneys actually in operation in Seattle, but nineteen have been intentional violators of the traffic ordinances and of the bonding agreement. These have been retired as bond risks. Spokane now has forty-one jitneys; Tacoma, seventy-seven; Everett, eighteen, and Bellingham, four.

24,400 Register in Maryland

BALTIMORE, MD., June 19—During the first 5 1-2 months of this year 24,400 automobiles have been registered and it is estimated that by the end of the year there will be more than 30,000 cars registered in this state. In 1914 20,200 cars were registered and $295,000 taken in registration fees. One of the reasons advanced for the great increase in registration is the improvement in Baltimore streets as well as in state roads.

105 Automobiles for Rural Delivery

Post Office Survey 105 Routes—Delivery in August—May Standardize Vehicles

WASHINGTON, D. C., June 22—One hundred and five routes for automobile delivery have been authorized, delivery to start on same August 2 and there is a strong possibility that in the near future the postoffice department will standardize motor vehicles for delivery. At the beginning the carrier may use any machine with not less than 800 pounds carrying capacity and a cubic load space not less than 80 cubic feet. To date no standards have been issued as to design or postoffice insignia. According to the postoffice department, motor delivery of mails will start on a large scale August 2, when 5,500 miles of rural post roads will be covered daily. This service will be extended as rapidly as possible.

The first dispatch of rural mails by motor car will be made July 1, radiating from Quarryville, Pa. Preparing for the introduction of this service wherever it will be advantageous, surveys of special needs and conditions in every State are being made and the postoffice department says that rapid increase in motor car mileage may be expected during the coming fiscal year.

The routes to be operated include distances of between 50 and 60 miles, and the schedules vary from 6 to 8 hours. In the same or less time than is now required to do 25-mile wagon route the motor car will serve the largely extended territory.

In the revision of the rural service and the inauguration of motor delivery there has been a reduction in operating expenses from April to June 19 of $744,300. This sum has been utilized to establish 732 new routes to serve 85,472 additional families or nearly half a million people.

Pocket Edition of National Used Car Report

CHICAGO, ILL., June 19—The first number of the pocket edition of the National Used Car Market Report has just been issued by the Chicago Automobile Trade Assn. It is a handy little volume, 3 by 4 3-4, bound in red leather and containing in concise form statistics on 131 gasoline and steam cars and fourteen electrics. As is shown in illustrations on this page, the book covers only one zone; that illustrated is Zone 7, centering in Chicago.

The tables shown give for each car the year, type, list price, number of cylinders, horsepower, appraised value in the zone, appraised average value for the whole United States and "as is" sales average for the United States. Following the tables are additional data in run-in form, giving the year, model style and list price. The entire data for even such a long-established car as the Pierce-Arrow occupy but one page.

An index at the front enables the user to turn readily to the data desired. Opposite the index is a table explaining the abbreviations used. There is also an explanatory page, telling how to get best results from the book.

The association is gratified at the reception accorded the book; following the deliveries to subscribers to the larger and national report, numerous additional requests were received. If the book is issued to a salesman through a dealer both the dealer and salesman must sign an agreement. The condition attaching to a subscription is that when the next number is received the present number shall be returned, the same rule applying to the national report. This is to restrict service to subscribers.

The books are issued quarterly for $5 a year. The leather cover is detachable, following numbers being inserted. Each book is numbered and a record kept by Assistant Secretary T. D. Beard at the association offices, 2422 Michigan avenue.

Berry Is Advertising Head

TOLEDO, O., June 21—G. M. Berry has been promoted to the position of advertising manager of the Willys-Overland Co. Mr. Berry was formerly connected with the Thos. B. Jeffery Co. as second vice-president and treasurer and connected himself with the Overland organization 18 months ago.

Tire Issues Continue Rise

Goodyear and Kelly-Springfield Cos. Feature the Security Market

NEW YORK CITY, June 21—Except for the large gains of the tire issues, the security markets were dull and uninteresting during most of last week. Within the last month tire stocks have shown a much higher tendency, in fact, sometimes reaching a record mark.

Last week, though most all of the tire issues made substantial gains, the most prominent were those of Goodyear and Kelly-Springfield. Goodyear common rose 17 points while that of the Kelly-Springfield company rose 13 points. The first and second preferred stocks of the latter company rose 1 1-2 and 20 points respectively, a record gain for the latter stock. Firestone common rose 6 points and Goodrich common 4 points.

The volume of business in the automobile stock market was small, thus reflecting little activity and few gains.

The Detroit quotations were in sympathy with the local prices, the prices there hovering around the opening prices with few important changes.

S. A. Exports Better in May

NEW YORK CITY, June 19—Exports to South America in the last 3 months show a gratifying improvement when compared with the earlier part of the war period. Exports in March were about $2,000,000 more than in the same month of last year, and April showed another gain of about $2,000,000 over April, 1914.

May exports to Argentina from the port of New York included $163,000 worth of gasoline, $20,000 in automobiles, and $68,000 in lubricating oil.

A steamer leaving for Buenos Aires on June 8 carried $20,000 worth of automobiles.

Franklin Dividend on Common Increased to 40%

SYRACUSE, N. Y., June 19—The H. H. Franklin Mfg. Co. has increased the dividend rate on its common stock from a 6 per cent. to a 10 per cent. quarterly basis, the dividend payable July 1, being at the rate of 40 per cent. per annum.

In addition, the directors have voted to retire as of July 1 the small issue of preferred stock, amounting to $130,450.

A production of 3,800 cars is being planned for, in addition to 1,000 cars to the 1915 ouput. To take care of the increase, three new buildings, with 75,000 feet of floor space, are being erected.

Dividends Declared

The Electric Storage Battery Co., Philadelphia, Pa.; 1 per cent. common and preferred.

Willys-Overland Co., Toledo, O.; quarterly 1 3-4 per cent. preferred.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; quarterly of 1 3-4 per cent. preferred and 1 per cent. common.

Yale & Towne Mfg. Co., New York City; quarterly 1 3-4 per cent.

Linde Air Products Co., New York City; quarterly dividends 1 1-2 per cent. preferred and 2 per cent. common.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
Ajax-Grieb Rubber Co. com.	220	..	300	..	..
Ajax-Grieb Rubber Co. pfd.	99	..	101	..	..
Aluminum Castings pfd.	98	100	98	100	..
J. I. Case pfd.	81	90	70	79½	..
Chalmers Motor Co. com.	99	103	92½	95	—2½
Chalmers Motor Co. pfd.	96½	99	95	98½	+4
Electric Storage Battery Co.	51	51½	54	55	+2
Firestone Tire & Rubber Co. com.	300	305	490	495	+6
Firestone Tire & Rubber Co. pfd.	108	109½	110	..	—1
General Motors Co. com.	92	93½	151	153	—1
General Motors Co. pfd.	93	94	101	102½	+1
B. F. Goodrich Co. com.	24½	24⅞	51	53	+4
B. F. Goodrich Co. pfd.	88¼	90	100	103	—1½
Goodyear Tire & Rubber Co. com.	170	175	263	268	+17
Goodyear Tire & Rubber Co. pfd.	97	99	106	107½	+1
Gray & Davis, Inc., pfd.	95	102½	..	..	..
International Motor Co. com.	..	5	13	15	—1½
International Motor Co. pfd.	3	10	34	36	—3
Kelly Springfield Tire Co. com.	..	..	158	162	+13
Kelly Springfield Tire Co. 1st pfd.	..	..	86	87	+1½
Kelly-Springfield Tire Co. 2d pfd.	..	..	160	165	+20
Maxwell Motor Co. com.	14½	14⅞	43	44	—3
Maxwell Motor Co. 1st pfd.	44	46	86	88	..
Maxwell Motor Co. 2d pfd.	18	19	37	38	—1
Miller Rubber Co. com.	..	..	185	187	..
Miller Rubber Co. pfd.	..	..	104	106	..
New Departure Mfg. Co. com.	126	128	..	..	..
New Departure Mfg. Co. pfd.	106½	..	..	..	..
Packard Motor Car Co. com.	103	..	103½	..	+3½
Packard Motor Car Co. pfd.	97	100	96½	99	+ ¼
Peerless Motor Car Co. com.	18	25	67	70	..
Peerless Motor Car Co. pfd.	..	62½	94	96	..
Portage Rubber Co. com.	..	40	35	39	..
Portage Rubber Co. pfd.	..	90	92	93	..
*Reo Motor Truck Co.	10½	12	14½	15½	+ ⅛
*Reo Motor Car Co.	20	22	32	33	..
Splitdorf Electric Co. pfd.	40	50	..	..	..
Stewart-Warner Speed. Corp. com.	48½	49	68½	69½	+1
Stewart-Warner Speed. Corp. pfd.	98½	99½	105	..	+1
Studebaker Corporation com.	30½	31	75½	77	+ ½
Studebaker Corporation pfd.	86½	88½	99	101	..
Swinehart Tire & Rubber Co.	85	87	79	82	..
Texas Co.	143½	144½	124	128	—4
U. S. Rubber Co. com.	58¼	59	64	66	—2
U. S. Rubber Co. pfd.	102⅞	103⅛	106½	108	—1
Vacuum Oil Co.	222	225	198	202	—3
White Co. pfd.	107	110	103	108	..
Willys-Overland Co. com.	78	79	129	130	—2
Willys-Overland Co. pfd.	93	95	103	105	+1½

*Par value $10.00; all others $100.00 par value.

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

	1914		1915		Wk's
	Bid	Asked	Bid	Asked	Ch'ge
ACTIVE STOCKS					
Chalmers Motor Co. com.	101	..	92	96	+1
Chalmers Motor Co. pfd.	95	98	95½	98½	+1
Continental Motor Co. com.	..	180	175	190	—7½
Continental Motor Co. pfd.	..	75	..	86	..
General Motors Co. com.	92½	95	151	155	+1
General Motors Co. pfd.	92	94	101	103	+1½
Maxwell Motor Co. com.	14½	15	43	45	—2
Maxwell Motor Co. 1st pfd.	44	45	86½	88½	+ ½
Maxwell Motor Co. 2d pfd.	18	19	37	39	—1½
Packard Motor Car Co. com.	103	..	103	..	..
Packard Motor Car Co. pfd.	97	100	96½	99	..
*Reo Motor Car Co.	18	19	..	32½	— ¼
*Reo Motor Truck Co.	10½	11⅛	14½	15⅛	..
Studebaker Corporation com.	..	..	76	77½	+ ½
Studebaker Corporation pfd.	..	..	100	102	+1
INACTIVE STOCKS					
*Atlas Drop Forge Co.	..	21	..	26	..
Ford Motor Co. of Canada	..	550	1000	..	+50
Kelsey Wheel Co.	185	..	200	..	..
*W. K. Prudden Co.	..	20½	19½	21	..
Regal Motor Car Co. pfd.	20	..	..	25	..
BONDS					
General Motors, notes, 6s, 1915	101	102	..	..	..
Packard Motor Co. 5s, 1916	95	98½	98¼	..	..

*Par value $10.00; all others $100.00 par value

Three New Regals for 1916

Two Fours and an Eight—Latter Sells for $1,200—Small Four, $650

DETROIT, MICH., June 22—The Regal Motor Car Co. of this city will have for 1916 a small four selling at $650, a large four at $985 and an eight at $1,200. The latter has a Port Huron motor which is neat in appearance, provides good valve accessibility and fits the same chassis as the big four. The cheapest car has a 3 3-8 by 3 3-4 motor, the big four 3 3-4 by 5-inch and the eight 3 by 4 1-2-inch. As to the chassis the two larger are very much like the last year model Regal with rear axle transmission and drive through radius rods, while the small car has a unit powerplant and a full floating axle provided with ample ball bearings.

Special attention has been given to the bodies, which have a family likeness and give a low appearance to the cars. The cheap car has plenty of room for four passengers and the large four and eight accommodation for five. Electrical equipment on all models consists of the Dyneto single unit machine with an adjustable chain drive, the chain being enclosed with the front end gearing. Cantilever rear springs are used for the little car and long, underhung three-quarter springs for the other two, while the underhung front spring with castor axle continues to be a Regal feature.

Dark blue will be the standard finish, with black upholstery and black fenders, but the little car has a black bonnet also. Stewart carbureters are used and Stewart speedometers, the eight and big four also having the Stewart Vacuum feed.

Truck Exports Gain

(*Continued from page* 1136)

the figures showing that the exports to that country declined from 792, valued at $865,321, in April, 1914, to 696, valued at $611,797, in 1915, while during the 10 months' period the exports fell from 3,347, valued at $4,336,407, in 1914, to 2,768, valued at $3,165,739, in 1915.

Six cars represented our exports to Mexico in April a year ago, the value being $6,830, and strangely enough six was the number exported in April last, but the value was only $4,025. During the 10 months' period the exports fell from 160, valued at $248,497, in 1914, to sixty-four, valued at $63,660, in 1915.

West Indies Gain

West Indies and Bermuda show an increase in the importation of American cars from forty-nine, valued at $53,812, in April, 1914, to 247, valued at $119,893, in April, 1915, while during the 10 months' period the exports increased from 457, valued at $437,093, in 1914, to 1,121, valued at $696,210, in 1915.

South America does not rank high on the motor car buying schedule from this country, only ninety-eight cars, valued at $60,437, being shipped there in April, as against 137 cars, valued at $104,562, in April a year ago. During the 10 months' period these exports fell from 1,729 cars, valued at $1,719,422, in 1914, to 906 cars, valued at $494,488, in 1915.

Two hundred and seventy-six cars, valued at $251,022 were shipped to British Oceania in April a year ago, while in April last the figures had risen to 307 cars, valued at $270,230. During the 10 months' period the exports fell from 3,535, valued at $2,909,643, to 2,471, valued at $2,059,033.

Slight gains are indicated in the figures for Asia and other Oceania, the exports being 211 cars in April a year ago, the value of which was $184,277, while in April last the number exported was 394 and the value $560,845. During the 10 months' period the figures show exports to other countries imported 129 cars in April, 1914, the value being $97,925, while in April, 1915, the number increased to 209 and the value to $236,861. During the 10 months' period the number exported was 1,792, valued at $1,578,608, in 1914, and 722, valued at $651,347, in 1915.

The detailed figures follow:

Market Prices Steady

NEW YORK CITY, June 22—Market quotations last week were steady with few important changes. Metals held firm throughout the week. Tin had a sharp break at the beginning of the week but picked up at the close with a drop of $1.50. Copper held strong throughout the week, both electrolytic and Lake quoting at above 20 cents. Aluminum went up 1 cent on Thursday and held strong at the increase until the closing on Monday, the price being 29 cents.

Twenty-Three Start at Chicago

Resta Makes 110.1 M.P.H. in Eliminations—Stutz Team Fast—Sunbeams Speedy

CHICAGO, ILL., June 22—*Special Telegram*—The stage is set for Chicago's first speed spectacle and 4 days hence an epoch-making race of 500 miles will be run on the new board track 10 1-2 miles west of the commercial zone of the Windy City.

Twenty-three cars will accept the issue in the international feud of Saturday. This was determined this afternoon when the final elimination trials were held and four additional entries joined the exclusive ranks of the twenty space destroyers that qualified in the laps against time run on Tuesday and Wednesday of last week.

The Order of Start

The cars will be sent away by Starter Fred J. Wagner in the following rows of four each:

First row—Resta's Peugeot; Wilcox's Stutz; Anderson's Stutz, and Cooper's Stutz.

Second row—Carlson's Maxwell; Rickenbacher's Maxwell; Burman's Peugeot, and Von Raalte's Sunbeam.

Third row—Porporato's Sunbeam; Chevrolet's Delage; Keene's F. R. P., and O'Donnell's Duesenberg.

Fourth row—Grant's Sunbeam; Alley's Duesenberg; Henning's Mercer Special, and Haupt's Duesenberg.

Fifth row—Babcock's Peugeot; Joe Cooper's Sebring; Rawling's Ogren, and Hughes' Porter-Knight.

Sixth row—Orr's Maxwell; Devore's Porter-Knight, and Mulford's Mulford Special.

The order of start was determined by the time made in the elimination trials, the four fastest cars starting in the first row, the second speediest quartet in the second tier, etc. This allows the positions of desirability to the faster cars.

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Aluminum	.28	.28	.29	.29	.29	.29	+.01
Antimony	.37	.37	.36½	.36½	.36½	.36½	—.00½
Beams & Channels, 100 lbs.	1.31	1.31	1.31	1.31	1.31	1.31	......
Bessemer Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	......
Copper, Elec., lb.	.20⅛	.20⅛	.20	.20	.20	.20	—.00⅛
Copper, Lake, lb.	.20¼	.20¼	.20¼	.20¼	.20¼	.20¼	......
Cottonseed Oil, bbl	6.12	6.12	6.05	6.10	6.08	6.00	—.12
Cyanide Potash, lb.	.24	.24	.24	.24	.24	.24	......
Fish Oil, Menhaden, Brown	.40	.40	.40	.40	.40	.40	......
Gasoline, Auto, bbl.	.12	.12	.12	.12	.12	.12	......
Lard Oil, prime	.90	.90	.90	.90	.90	.90	......
Lead, 100 lbs.	6.75	6.50	6.00	5.75	5.75	5.75	—1.00
Linseed Oil	.64	.64	.62	.62	.62	.62	—.02
Open-Hearth Steel, ton	19.50	19.50	19.50	19.50	19.50	19.50	......
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	......
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	......
Rapeseed Oil, refined	.85	.85	.85	.85	.85	.85	......
Rubber, Fine Up-River, Para	.63	.63	.63	.63	.63	.63½	+.00½
Silk, raw, Ital.	3.85	..	3.75	..	..	3.75	—.10
Silk, raw, Japan	3.35	..	3.27½	..	..	3.22½	—.12½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	......
Tin, 100 lb.	42.25	41.00	40.75	41.00	40.75	40.75	—1.50
Tire Scrap	.04¼	.04¼	.04¼	.04¼	.04¼	.04¼	......

The four cars that qualified today were Henning's Mercer Special; Mulford's Mulford Special; Hughes' Porter-Knight and Rawling's Ogren, a post entry that was accepted only after all the drivers consented to the eleventh-hour nomination.

Limberg's Sunbeam, which qualified at a speed of 90.8 miles an hour last week, will not be allowed to start. There are three other Sunbeams in the race, all of which made faster time in the eliminations, and consequently Limberg's amount is automatically barred by the three-car rule of the American Automobile Association.

In addition to Limberg's Sunbeam, the following original entries will not start: Ralph DePalma's Mercedes; Barney Oldfield's Bugatti; Brown's Du Chesneau; Vail's Mulford Special; Zucher's Berwyn Baby, and Mais' Mais Special. The Mercedes and Bugatti were scratched last week because of mechanical trouble, the Du Chesneau and the Mulford Special failed to make their appearance; the Berwyn Baby was hopelessly slow and the Mais Special is suffering from lubrication troubles.

In an effort to better their starting positions, several of the drivers qualified their cars for a second and third time today and eight succeeded in making faster time than they did in their first laps in the eliminations. The surprise of the day was the showing of the two Maxwells by Rickenbacher and Carlson. Neither appeared exceptionally speedy when it qualified last week but this afternoon they averaged 103 miles an hour or better and earned a place in the second row of starters.

Sunbeams Gain Speed

The two English Sunbeams, entered by the British maker, also had greater speed today than they showed last week, Von Raalte raising his average speed from 93 to 100.8 miles per hour and Porporato hitting 98.66 miles per hour in his third trial. Harry Grant drove some of the bugs out of his six-cylinder motor since last week when his best time was 91 miles per hour and covered a lap at a 96-mile an hour clip this afternoon.

Haupt's Duesenberg has more speed than it had last week and Joe Cooper's Sebring raised its average from 89 to 92.3 miles an hour.

The drivers will have 2 more days of practice before the race. The track will be closed on Friday in order to prepare it for the inaugural contest. The drivers' meeting will be held Thursday night.

Peugeot Fastest

Resta with his Peugeot stands first in the list of the twenty-three to qualify, his average for the two laps being 110.1 miles an hour, and almost 6 miles an hour faster than any of the other cars to qualify.

The most consistent team qualification was that of the three Stutzes, all of which will line up side by side with Resta in the front row Saturday. Naturally the Stutz team is the favorite one as it was at Indianapolis a month ago, and it is expected that considerable race strategy will be exercised by this team in wearing down its speedier rival, Resta. Resta will have to meet the Stutz stamina single-handed Saturday, in that his speed-mate DePalma, who was his fighting rival at Indianapolis, has not been able to get his Mercedes ready. It will not be surprising to see one of the Stutz entries start out setting the pace and as they all qualified at a speed slightly over 104 miles an hour, some fast traveling will be looked for in the early stages of the race. It will only be a question of motor and chassis stamina that will determine the average speed, because drivers are agreed that the 2-mile board track scientifically banked as it is, is much easier to drive than the Indianapolis track with its not so well banked turns. The three Stutz cars have been completely overhauled since the Indianapolis race, and this, backed by the Stutz factory organization, should form a strong combination.

The opinion is common that Porporato and the English Sunbeam will be a factor in the race and much more dangerous than at Indianapolis when the British entry was eliminated near the close of the contest with a faulty carbureter while running well inside the money. The Sunbeam is built for a banked track such as the Chicago one and both Porporato's car and that of Von Raalte have been fitted with the same gears as were used at Brooklands for successful time trials. Porporato is a masterful driver and fearless. Like the majority of foreigners he shows his car no mercy and if the Sunbeam stands up under him he should be a serious contender all the way.

Barney Oldfield established Sunday a new lap record for the wooden bowl. At the wheel of his Christie the veteran covered the 2 miles in 1 minute 4 2/5 seconds, an average of 115.5 miles an hour.

Chicago's Speedway Field

Car	Driver	Time	M.P.H.
Peugeot	Resta	1:05.4	110.1
Stutz	Wilcox	1:08.7	104.75
Stutz	Anderson.	1:08.8	104.6
Stutz	Cooper	1:08.8	104.6
Maxwell	Carlson	1:09.78	103.1
Maxwell	Rickenbacher	1:09.9	103
Peugeot	Burman	1:11.3	101.0
Sunbeam	Von Raalte	1:11.45	100.6
Sunbeam	Porporato	1:12.96	98.6
Delage	Chevrolet	1:14.3	97
Porter-Knight	Keene	1:14.2	96.9
Duesenberg	O'Donnell.	1:14.7	96.4
Sunbeam	Grant.	1:14.8	96.2
Duesenberg	Alley	1:15.9	95
Mercer Special	Henning.	1:16	94.7
Duesenberg	Haupt	1:16.7	93.8
Peugeot	Babcock	1:17	93.2
Sebring	J. Cooper	1:18	92.3
Ogren	Rawling	1:18.30	92
Porter-Knight	Hughes	1:18.98	91.1
Maxwell	Orr	1:20.3	89.6
Porter-Knight	Devore	1:21.3	87.3
Mulford Special	Mulford.	1:23.75	85.9

Association to Insure Race Drivers

New Drivers' Assn. Offers 25% of All Revenues for Benefit of Drivers

CHICAGO, ILL., June 19—A movement which is hoped will benefit drivers and mechanics who are injured in races has been started by the Automobile Drivers' Protective Association, organized at Indianapolis during the recent race meet. This association contemplates an insurance fund for the benefit of injured drivers and mechanics.

Twenty-five per cent. of all revenue paid into the treasury of the protective association will be set aside as an insurance fund and held in trust. A nucleus for this fund was created by the management of the Chicago speedway, which is sharing the receipts from practice with the drivers. The local promoters already have turned over $1,800, which is 40 per cent. of the money taken in at the gate Sunday, to the drivers' association, and $450 has been deducted from this sum for risk benefits. The remaining $1,350 will be divided among the teams who warmed up their mounts in order to thrill the Sabbath throng. In addition to money received for participating in practice, 25 per cent. of the initiation fees and annual dues will be put into the insurance fund.

Fifteen Charter Members

The drivers held their first meeting since they organized at Indianapolis here today and adopted a constitution and by-laws. The fifteen charter members of the organization are representative drivers and the board of directors is composed of such stars as Ralph de Palma, Harry Grant, Barney Oldfield, Earl Cooper and Bob Burman. Fifty applications for membership have been received.

The following men have been chosen to guide the destinies of the organization during its first year:

President, L. C. Erbes of St. Paul; first vice-president, E. J. Schroeder of Jersey City, N. J.; second vice-president, Charles Erbstein of Chicago; and secretary-treasurer, E. C. Patterson.

The drivers' association is heartily in sympathy with the American Automobile Association in its efforts to put racing on a high plane in this country and the by-laws stipulate that no driver or mechanician can become a member of the organization unless he is in good standing with the A. A. A. and willing to live up to the rules of the A. A. A. contest board. In addition, each member must post a bond of $1,000 to abide by the A. A. A. rules.

Five-Car Entries Allowed

A. A. A. Will Register All Racing Cars to Avoid Certain Abuses

NEW YORK, June 22—At a meeting of the Contest Board of the American Automobile Assn. changes in the contest rules were made which will permit of starting five cars of one make in a contest instead of three as formerly. Where five cars are entered, three may be entered as a factory or team entry and the two additional cars may be entered by individuals.

A plan has been adopted to register all racing cars so as to avoid certain abuses now existing and each racing car will be designated as a special model.

Messrs. Sloan & Moross were disqualified for running outlaw meets, the disqualification being for 3 years from date of last unsanctioned contest. Drivers connected with them were disqualified for a period of 1 year from date of their last offense. Drivers re-instated by the board included Hughie Hughes, Arthur Chevrolet, Omar Toft, Herb Alderson, Harry N. Agerter, C. O. Norman, and Charles W. Johnson. Further changes in rules limit the length of a handicap on a 1-mile track to 10 miles.

Sioux City Has 17 Entries

SIOUX CITY, IA., June 19—Everything pertaining to the speedway races here on the 2-mile dirt speedway July 3 are moving along satisfactorily and a record attendance is looked for. To date 17 entries have been received.

Car	Driver
Maxwell	Rickenbacher
Maxwell	Carson
Duesenberg	Alley
Duesenberg	O'Donnell
Duesenberg	
Erwin Special	G. C. Bergdoll
Erwin Special	
Du Chesneau	W. W. Brown
Mais Special	J. A. Max
Sebring	J. T. Cooper
White 6	W. J. Shrunk
Emden	Grant Donaldson
Peugeot	Resta
Mulford Special	Mulford
National	Buller
Orgen	
Chalmers	H. A. Wetmore

Tacoma Has Big Field

TACOMA, WASH., June 19—Seventeen starters are to date assured for the Tacoma race meet Sunday and Monday July 4 and 5. On the first day will be held one race for 250 miles on the new 2-mile board speedway and on Monday there will be two races one at 100 miles and the other at 200 miles.

Car	Driver
Barney Oldfield	Peugeot
G. E. Ruckstell	Mercer
Harry Reynolds	Marmon
Eddie Pullen	Mercer
Frank Elliott	Gordon
Bob Burman	Peugeot
Earl Cooper	Stutz
Dave Lewis	Stutz
George Hill	Stutz
Jim Parsons	Parsons
Ernest Schneider	Schneider
Hen Hendriks	Stutz
Billy Carlson	Maxwell
Joe Thomas	Mercer
H. D. Stratton	Mercer
Ray Lentz	Romano
T. F. Barsby	Velie

Oldfield will probably drive the Peugeot with which Resta won the Vanderbilt and Grand Prize races. Earl Cooper has entered the third Stutz which will probably be driven by George Hill.

Board Speedway for Coast

CHICAGO, ILL., June 24—Los Angeles, Cal., is to have an automobile speedway and expects to have it completed for opening on Thanksgiving day. L. W. Wickes, engineer in charge, was in this city last week making a study of the 2-mile Chicago track. A. M. Young, prominent in the promotion of southern California racing is the chief backer of the project and claims that options are already held on three sites all within 15 minutes ride by trolley from the center of the city. This enterprise should mark the home-coming of speedway racing for the coast so far as board tracks are concerned as the original board track speedway of America was built on the coast.

Sixteen Entrants for Omaha

OMAHA, NEB., June 21—Arrangements are nearing completion for the 300-mile race on July 5 on the new 1 1-4 mile board speedway in this city. The track was completed a week ago and now a force of workmen is completing the grandstand and other necessary buildings. Entries to date follow:

Car	Driver
Mercedes	De Palma
Duesenberg	O'Donnell
Duesenberg	Alley
Maxwell	Bruske
Sunbeam	Porporato
Sunbeam	VonRaalte
Peugeot	Resta
Stutz	Anderson
Stutz	Wilcox
Baby Peugeot	LeCain
DeLage	John DePalma
Maxwell	Rickenbacher
Maxwell	Moore
Du Chesneau	Brown
Mais Special	Mais
F. R. P	Hughes

Robertson Joins Houk

NEW YORK CITY, June 18—George H. Robertson, prominent in the automobile industry as a race driver, and later connected with the Auto Supply Co., New York City, for years, has become the eastern district manager for the Houk Mfg. Co., Buffalo, N. Y. His headquarters will be at the company's branch at Fifty-eighth street and Broadway.

Chicago-Seattle Record Established

CHICAGO, ILL., June 19—A record of 2,439 miles in elapsed time of 97 hours and 10 minutes, was made recently over the Yellowstone Trail from Chicago to Seattle. The run was made by a series of relays.

West Reduces Fuel Prices

Twin Cities Cut Prices—Milwaukee and Cincinnati Prices Reduced

MINNEAPOLIS, MINN., June 19—Quiet marks the gasoline market in the Twin Cities. After the Standard Oil Co. had reduced gasoline 1 cent and the independents had met the price at 10 1-2 cents per gallon no change has been noted. The leading independent dealers scout the idea of any price fight with the Standard, and they deny any knowledge of a business combination to be effected between the independents. A leading dealer lays the cut in price to over production of gasoline. He said also that the wet weather has had some effect in reducing general motoring and also that the war had reduced export, thus tending to an overplus of stock in the American market. The Standard people said that discovery of new fields was one phase which brought the reduction. W. C. Stohr of the Independent Oil Co., St. Paul, and John Hancock of the Pure Oil Co. in both cities, are authority for the statements as to the reason for the price cut.

Wisconsin Has Lien Law

MADISON, WIS., June 19—A Wisconsin garage lien law has been passed which gives every keeper of a garage a lien upon and power to retain the possession of automobiles for the amount which may be due for care of same until such amount is paid. The law requires that the garagemen shall not exercise his power upon any automobile unless there shall be posted a card stating the charges for storing, such to be easily read a distance of 15 feet by any person entering the garage through the proper entrance.

2-Mile Speedway for Pittsburgh

PITTSBURGH, PA., June 21—The Pittsburgh Speedway Assn. has been formed to build a 2 1-2-mile speedway in this city. It is expected that within a short time the roster of officials will be announced. The capital is $1,100,000 and the incorporators are: W. J. Phillips, Gen. F. J. Kress, R. D. Ward, N. S. Grubbs, J. F. Lent, J. H. Johnston, W. C. Atkinson, G. A. MacGregor, J. B. Callanan, F. B. Ninness, T. F. Walter, R. Briney, F. F. Jamison, E. N. Hagerling, C. H. Bunting, J. R. Robinson and others.

Three sites are under consideration, all of which are within a radius of 15 miles of Pittsburgh.

$35,000,000 for Cars This Year

Southern California to Spend This Amount—68,200 Cars Now Registered

By A. G. WADDELL

LOS ANGELES, CAL., June 19—Southern California, with an approximate area equal to that af the state of Pennsylvania, finds ready means of continuing her lead in per capita purchases of motor vehicles throughout the summer and fall months. It is estimated that out of the $244,583,311, total products of the eight southermost counties of California this year, at least $25,000,000 will be turned into the automobile industry, for new cars. Many experts claim that southern California will invest $35,000,000 in new machines this season.

Exceptional grain crops are assured by a large and unusually favorable rainfall; improved conditions cause greater demands in the petroleum industry; mining interests are extending; modern highways are giving increased mileage; manufactures are growing in variety and extent; shipping and ship building have attained new proportions and, among many miscellaneous interests, motion picture producing companies are maintaining motor plants of immense importance to the automobile trade of southern California.

$2,000,000 in Pictures

Moving picture concerns in and around Los Angeles, are using automobiles and motor trucks to the amount of $2,000,000. One company is represented by 300 machines, owned by the company and the players personally to the value of $500,000. Many cars are rented by the day or week for the players, but those required for general services are owned and operated by the producing companies. Machines bought by these concerns for wrecking purposes in scenes, afford used-card dealers of Los Angeles a regular line of business, at prices ranging from $200 to $300 per car.

Orange growers, ranchmen and farmers generally are now buying cars and trucks as essential adjuncts of their business, each year's crop bringing in new files of purchasers. Each mile of laterals added to the good roads system of the Southland provides new motor vehicle users. And these ranchers and orange growers seek quality in all lines, their cars averaging $1,250 each.

The state of California as a whole keeps something like $150,000,000 invested in machines, of which 134,970 are registered on this date. Averaging each car as valued at $1,000, the investment represented by machines at this time is approximately $135,000,000 and according to state and county officials, $1,000 per car in California is a low estimate.

There are 68,200 machines registered from the southern California counties alone. The southern California branch of the state motor vehicle department records shows a total registration from the eight southern California counties at this time last year amounting to 51,369 cars, an increase in 1915 of 16,831 cars, practically all new machines. At this time last year Los Angeles county had 35,132 registrations; Imperial, 1,270; Orange, 3,138; Riverside, 1,743; San Bernardino, 2,686; San Diego, 4,713; Santa Barbara, 1,486, and Ventura, 1,201.

The Products of Southern California

The eight southermost counties of California, all of which are tributary to the port of Los Angeles will produce approximately $250,000,000 this year, of which at least 10 per cent. will go direct to the coffers of the automobile industry, according to authoritative and conservative figures.

Product	Quantity	Value.
*Asphaltum	200,000 tons.	$1,600,000
*Beans	1,665,000 bags	6,573,750
*Beef	300,000 bbls.	2,400,000
Berries	125,000 crts.	425,000
*Borax	....	500,000
*Brick	....	1,459,500
Butter	8,525,200 lbs.	2,477,716
Cabbage	500 c. l.	175,000
Canned goods	1,750,000 cases	8,300,000
Cauliflower	600 c. l.	150,000
Celery	1,200 c. l.	275,000
*Cement	4,000,000 bbls	5,750,000
Cheese	250,650 lbs.	39,377
Clay	....	137,000
Copper	....	120,000
*Cotton	50,000 bales	3,000,000
Eggs	200,000 cases	2,700,000
Fertilizer	....	1,500,000
*Fish, canned	900,000 cases	2,900,000
Fish, fresh	34,000,000 lbs.	2,059,200
*Flour and flour mill products	2,000,000 bbls	5,000,000
*Fruits, citrus	41,978 cars.	33,000,000
*Fruit, dried	9,000 tons.	1,810,000
Gems	....	13,000
Gold	....	374,000
*Grain	5,500,000 bu.	8,700,000
Gypsum	....	65,000
*Hay	350,000 tons.	4,000,000
Hides	....	2,500,000
*Honey	5,000,000 lbs.	350,000
Lettuce	300 c. l.	90,000
Lime	1,000 bbls.	125,000
Limestone	....	287,000
*Lumber and timber imp't'd rough and milled	186,000,000 ft.	5,760,000
*Meats, dressed	....	20,000,000
Melons	5,000 cars	1,500,000
Mineral waters	....	10,000
*Nuts	4,200 tons	2,000,000
Olive oil	105,000 gals	225,000
*Olives, pickled	....	3,000,000
Onions	250 c. l.	75,000
*Petroleum	100,501,000 bbls.	46,283,568
*Peppers and pimentos	....	550,000
Potatoes	300 c. l.	240,000
Potatoes, sweet	101 c. l.	60,000
Poultry	....	1,400,000
*Salt	25,000 tons.	117,500
Stone, crushed and gravel	....	2,450,000
*Sugar (beet)	160,000 tons.	16,000,000
Tomatoes	200 c. l.	90,000
Vegetables, asstd.	1,500 c. l.	525,000
*Wines and brandy	6,500,000 gals.	2,750,000
Wool	....	500,000
*Manufact'd products not mentioned herein	....	54,000,000
		$244,583,311

*Suited for export.

A year ago the total car registration in the state amounted to 102,148 machines over which the total 1915 registrations to date show an increase of 32,822 cars. This increase represents new cars almost entirely and represents not less than $30,000,000 spent for machines in California already this season, according to the most conservative figures of bankers and state officials.

There were 949 new machines sold out of Los Angeles territory during the month of May exclusive of Fords, and the machines shipped into Arizona, which territory is controlled almost exclusively by Los Angeles dealers. On an average of 200 Fords a month are sold in southern California and from 50 to 100 go into Arizona, which do not show on the California registration reports.

Money is abundant in the banks of this region, though conservatively handled. On May 18, the date of the last call, the banks of Los Angeles city carried total deposits of $171,257,628 with $47,085,583 cash on hand. The Los Angeles clearing house reports that these sums are not decreasing as the season advances, but increasing.

Eight counties of southern California produce this year approximately $250,000,000 in crops and staple manufactures. Petroleum alone yields $46,000,000 of which $5,000,000 is estimated as the current investment due for motor cars. Trucks and cars for use of owners and operators, as well as private machines for the well paid workers in the oil fields, swell this demand from the oil centers.

Some Leaders

Citrus fruit, second in importance as an item of revenue, amounts this year to 41,978 cars, of $33,000,000 in value. Dressed meats come to $20,000,000 and rank third with beet sugar amounting to 160,000 tons estimated at $16,000,000 in value. Beans are yielding 1,665,000 bags, bringing a further $6,573,750 at the lowest estimate. The acreage is greatly increased over all former years by planting throughout orchards in some localities. Walnuts are developing a magnificent crop and melons are apparently due to break all records. The 7,650 acres of cantaloupes in Imperial Valley alone are estimated at 1,500,000 crates worth $1,500,000.

The ports along the west coast of Mexico are stocked with hides and Mexican products and the traders of that section are anxious to do business with the shippers of the Pacific Coast, San Diego and Los Angeles, in particular. This is a new field and Los Angeles harbor has already been taxed with the Mexican export and import business.

Against these advantages must be considered the general depression felt more or less throughout the country, the unfavorable effects of the present tariff on citrus fruit and other commodities, and the loss of European buyers because of war—particularly the cutting off of Germany as a buyer of apricots. Apricots of the finest quality, in large quantities, are expected to bring less than 5 cents per pound, by reason of the decreased foreign markets.

As the birthplace of the jitney bus, Los Angeles furnishes records effecting the tremendous issues involved in this new factor of municipal and commercial life which are worthy of especial attention. The jitney cars, lately used so freely in passenger transportation, have reduced the street car traffic to such a point that the state of California is losing $200,000 annually on its share of the gross revenue of the car companies. This serious loss induced the Legislature to enact a law taxing each vehicle engaged in motor transportation of passengers at the rate of $7.50 per annum for each passenger seat. This bill, now in the hands of the governor, will doubtless become effective, if for no other reason than the necessity of maintaining the state revenues.

1,000 Jitney Buses

Los Angeles at one time supported 1,800 licensed jitney busses, with 1,000 in daily operation. At the present time less than 1,000 licenses are effective, with 500 in constant operation. This level has been maintained for the past 6 months and seems fairly indicative of an established market for such vehicles, if the same conditions continue.

But the increase of motor accidents, as well as the opposition to this traffic developed from various sources, and the necessity of controlling the business in some measure, impelled the city to establish regulations in the shape of a license tax of $2.50 per seat per month, bonds of $5,000 for each vehicle, adherence to routes specified, licensed chauffeurs, etc. Such an ordinance was passed in February, but was held up by the jitney owners, who secured an initiative petition under which a much less burdensome ordinance, requiring no bond whatever, was submitted to the voters. The substitute ordinance having just been defeated at the polls by 11,000 majority, the council's ordinance now becomes law; and the new council, elected at the same time, even shows a disposition to increase the bond required to $10,000 or $15,000.

The Accident List

Fifty per cent. increase in motor accidents with the advent of the jitney, as shown by the records of the Los Angeles police department, induces the requirement of bonds adequate to the protection of the public. From 400 accidents per month involving motor vehicles prior to the advent of the jitney service, 600 has become the regular average.

During the four months from December 1 to April 1, Los Angeles recorded 2,300 accidents to motors, of which 1,473 were private machines, and 827 jitneys. This was while 28,000 private machines were in use, and 500 jitneys on the streets.

To Reduce Number

These accidents naturally furnish some consumption of machines, besides the wear of the unusually heavy traffic on the light cars commonly used in the service. The municipal and state legislation mentioned will doubtless tend to reduce the number of cars used for this purpose, but on the whole, the jitney service may be looked upon as a new, large and lasting addition to the automobile trade of southern California.

Ore refineries and mills in process of erection near Los Angeles harbor are planning employment for many additional workers within the year and their combined enterprises should introduce an appreciable element into local automobile distribution.

Discovers Rubber Substitute

Dr. Noble of Cleveland, Discoverer—Coal Tar Chief Ingredient of Product

CLEVELAND, O., June 18—Dr. Lyman A. Noble, electro-therapist, of 610 Schofield Bldg., this city, claims to have discovered a substitute, combining all the qualities of natural rubber. He states that the chief ingredient of his product is coal tar.

Mr. Noble has been experimenting for nearly a year. His first experiments failed because the resulting product was greatly lacking in resiliency. This he found was solely a matter of process, and the use of a high frequency, high voltage electric current has eliminated the difficulties. By evaporating the liquid combination of ingredients and submitting them to a high frequency current for an extended time, 6 hours, the result was attained.

From 200,000 to 500,000 volts of electricity of high frequency was necessary to produce the rubber. The various ingredients are mixed, by secret formula, into a liquid which, under heat, is evaporated down to one-quarter of its original mass. When it has reached a consistency of a thick syrup, the mass is placed in a metal retort and connected with a high frequency electrical machine. The retort forms one pole and the other pole is suspended in the liquid. The current is turned on and after 6 hours, the retort contains a black, spongy substance with all the qualities, Dr. Noble claims, of natural rubber.

The inventor claims that with the artificial rubber the cost of a 37 by 5-inch tire will not cost more than $15 a tire, or $60 for a set of four.

He stated that a company is being organized to manufacture his product on a large scale, and a plant will be built in Cleveland.

Wayne Tank Gets Extension

CHICAGO, ILL., June 19—The Wayne Oil and Tank Co., Fort Wayne, Ind., defendant in a suit brought against it in the United States district court of the northern district of Illinois, eastern division, by S. F. Bowser & Co., of Fort Wayne, charging three infringements of patents now held by the latter concern relating to improvements in filling and vent-filling devices used in gasoline storage and dispensing systems, has been granted a further extension of 30 days for filing answer to the complaint. This is the second extension, the first being by stipulation April 27, last, when the Wayne company was given 45 days extension beyond the time fixed by the rules of the court.

Jitneys in San Antonio

SAN ANTONIO, TEXAS, June 19—The Jitney Transportation Co. has been organized here with a capital stock of $150,000 for the purpose of operating jitney buses over regular routes and on regular schedules in this city. Twelve trunk bus lines will be maintained. The incorporators are: L. M. Emlet, W. T. Crow, John Neidert, C. M. Dewey and William Haensler.

Detroit S. A. E. Gets $2,200

DETROIT, MICH., June 19—The maintenance fund of the Detroit section, Society of Automobile Engineers, was increased by $350 during the month starting May 15 to June 15. The new contributors were the Timken-Detroit Axle Co., $200; Saxon Motor Co., $100; and the Russel Motor Axle Co., $50. The total amount thus far contributed is $2,200. The maximum budget for the next 12 months calls for $2,500.

King Manager Goes West

DETROIT, MICH., June 21—W. L. Daly, sales manager of the King Motor Car Co., has started on a trip through the West, visiting King dealers and distributors.

75,000 Buicks for 1916

DETROIT, MICH., June 18—Instead of 60,000 Buick cars it is reported that the Buick Motor Co. has decided to make at least 75,000 cars for next season.

Factory Miscellany

Galion to Add—The Galion Motor Car Co., Galion, O., is contemplating the erection of a large addition to its factory.

Toledo Ford Tire Adds—The Toledo Ford Tire Co., Findlay, O., will build a two-story factory addition, 50 by 150 feet.

To Make Engines—The Pirate Motor Mfg. Co., 834 Muskego avenue, Milwaukee, Wis., will shortly engage in the manufacture of gasoline engines.

To Make Sheet-Iron Bodies—Frank Doering, Temple, Tex., is erecting a plant and car shop for the manufacture of sheet-iron bodies for automobiles.

Continental Adds—The Continental Motor Mfg. Co., Muskegon, Mich., is erecting a three-story addition to be used for a crating and packing room.

Mercer To Add—A contract for the erection of a one-story, 60 by 400-foot addition to the plant of the Mercer Automobile Co., Trenton, N. J., has been awarded.

Auto Specialty Builds—The Auto Specialty & Equipment Co., 5966 Jackson avenue, Long Island City, N. Y., is erecting a five-story plant, 50 by 96 feet, to cost $50,000.

Aurora Spark Plug's Plant—The Aurora Non-Fouling Spark Plug Co., Lynn, Mass., has started the construction of a one-story, 50 by 78 feet factory on Chestnut avenue.

Saurer Plant Addition—The International Motor Co., Plainfield, N. J., will enlarge its Saurer plant by building a one-story, 120 by 120-foot machine shop and a one-story, 40 by 60-foot power house.

Russell Axle Commences Addition—The Russell Motor Axle Co., Detroit, Mich., has commenced the construction of a building, 120 by 120 feet, adjoining its present plant.

Tire Inflater Co.'s Plant—The D. L. Davis Co., Ft. Madison, Ia., manufacturer of tire inflaters, has acquired a site in that city on which a factory will be erected. The plant site includes 8 acres of land.

Aluminum Cos. Consolidate—The Aluminum Specialties Co., Manitowoc, Wis., has purchased the business, equipment, stock and materials of the Mauston Aluminum Co., Mauston, Wis., and will consolidate the works at Manitowoc.

To Add Tire Manufacture.—The Alliance Rubber Co., of Alliance, O., which has been making automobile tires on contract for some time, will soon start the tire manufacturing business in earnest. It is planned to employ three shifts of men after June 1. New equipment will be installed at once to take care of the work.

To Manufacture Fire Apparatus—The Thomas Automatic Fire Engine Co. has been incorporated with a capital of $100,000 to operate a plant in Columbus, O., for the manufacture of a motor-driven fire engine, the invention of J. A. Thomas, formerly of Zanesville. The engine mixes soda with water, which is claimed to speedily blanket a fire.

To Make Brass Articles—The Klipper Mfg. Co. has been organized at Beaver Dam, Wis., by R. P. Scholz and N. Schweiger to take over the business of the E. O. Siedschlag Co., manufacturing various articles in brass, bronze and aluminum. E. O. Siedschlag has sold his entire interest to Messrs, Scholz and Schweiger and will retire.

McGraw Tire's Big Generator—The McGraw Tire & Rubber Co., East Palestine, O., has added a new steam turbine and a generator. The latter is built to provide 500 kilowatts an hour, with a 250-volt current and 750 horsepower. The generator will be used to run nine new motors, which will in turn drive several mills and a refiner.

New Era Makes Change—The New Era Spring & Specialty Co., Detroit, Mich., states that all mail matter pertaining to its shock absorbers should now be addressed to the Detroit office, from which point all shipments of shock absorbers are being made, instead of from Hempstead, L. I. Arrangement for their manufacture at that point has been ordered forwarded on to the Detroit office.

To Make Mechanical Starter—The Eureka Mechanical Starter Co., Columbus, O., which was incorporated some time ago with an authorized capital of $30,000 will soon open a factory in Columbus for the manufacture of a starter, which has been patented. W. A. Ross is in charge of the project. The other incorporators are J. W. Matthews, C. E. Bonebrake, A. Bunford and C. E. Ross.

Milwaukee Parts Co. Moves—The Auto Parts Mfg. Co., Milwaukee, Wis., manufacturer of windshields, bumpers, shock absorbers and other accessories, has moved from the Stroh industrial building to the Milwaukee branch house of the Mitchell Automobile Co., at 528-532 Broadway.

The Automobile Calendar

June 26	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Utica, N. Y., Hill Climb, Automobile Club of Utica.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
July 5	Visalia, Cal., Road Race, Tulare Co. Auto. Assn.
July 7-8	Taylor, Texas, Track Race, Taylor Automobile Club.
July 9	Burlington, Ia., 100-Mile Track Race; Tri-State Fair.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Races.
Sept	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 8-11	Hamline, Minn., 2-Day Meet at State Fair Grounds between Minneapolis and St. Paul, State Fair.
Sept. 13	Oakland, Cal., Pan-American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct	St. Louis, Mo., Show, Forest Park Highlands, St. Louis Automobile Manufacturers and Dealers' Assn.
Oct. 1	Minneapolis, Minn., Track Race, Twin City Motor Speedway Co.
Oct. 1-2	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 2	New York City, Sheepshead Bay Motor Speedway Track Meet.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Oct. 11-12	Dayton, O., National Paving Brick Manufacturers' Assn., Annual Meeting.
Nov. 18	Arizona 150-mile Grand Prix.
Dec. 31	New York City, Show; Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.
March 4-11	Boston, Mass., Truck Show, Mechanics Bldg.

The Week in the Industry

Norwalk Resigns.—A. B. Norwalk, formerly the president and a director of the Thirty-five Per Cent. Automobile Supply Co., New York City, is no longer connected with this company in any capacity.

Parrish Heads New Packard Branch—W. J. Parrish is the head of the new Packard branch in St. Louis, Mo., under the name of the Packard Motor Sales Co., which bought out the Halsey Automobile Co. and which will control all Packard business in the State of Missouri. The St. Louis firm will be known as the Packard Missouri Motor Co.

Recent Changes in Taximeter Co.—Eben Luther has been put in charge of the Boston, Mass., sales department of the American Taximeter Co., New York City. E. E. Smith is in charge of the Philadelphia branch with headquarters at 1209 Vine street. F. C. Copeland is assistant manager of the sales of the Pacific Coast branch in San Francisco, Cal.

Motor Men in New Roles

Howard Houston Detroiter Mgr.—D. M. Howard is manager of the newly established Detroiter agency in Houston, Tex. The sales rooms are at 116 Main street.

Senour Goodyear's Salt Lake Mgr.—P. W. Senour has been appointed manager of the Salt Lake City branch of the Goodyear Tire & Rubber Co. Formerly he was manager of the El Paso branch.

Haydenfeldt Knox Rep.—Herman Haydenfeldt, formerly connected with the H. O. Harrison Co. as district representative, has been appointed factory representative of the reorganized Knox Motors Co.

Rhodes Joins New Era Spring—H. P. Rhodes, formerly manager of the Cleveland Spring Co., Cleveland, O., has become Southern general traveling representative for the New Era Spring & Specialty Co., Detroit, Mich., and in charge of its spring business.

Arthur Heads Minneapolis Branch—The Tri-State Auto Co., 18 University avenue, S. E., has opened a West Side branch on automobile row, at Hennepin avenue and Thirteenth street, Minneapolis, Minn. It is in charge of B. D. Arthur, the company's manager. The Moon and Inter-State cars are displayed.

Henshaw Increases Force—The Henshaw Motor Co. has recently leased additional space in the Motor Mart Bldg., Park Square, Boston, as part of its service station, and has added several well-known men in the trade to its organization. These include Dearborn Bailey, who joins the sales force. He was formerly with the General Vehicle Co. for 4 years. L. E. Owen, who takes charge of the stock department, after 9 years in a similar position with The White Co. L. C. Hale, with the Maxwell factory for 5 years, becomes chief accountant, while F. P. Kent, who managed a garage in Ipswich, Mass., looks after the testing department.

40-50 Cubic Inch Cylinders

(Continued from page 1109)

and 5 by 7 inches; the weights of these cars he gave respectively 4,200, 5,100 and 5,600 pounds and the miles per gallon as respectively 11, 9 and 8, these figures being reached after a trip of 1000 miles on rough roads. According to Mr. Fergusson recent statements should lead him to believe that the largest is the sweetest running motor of the three.

Mr. Fergusson mentioned a test where a standard 1-ton truck equipped with a 7 to 1 reduction averaged 7.25 miles per gallon and another truck of the same capacity was run over the same roads, equipped with a high-speed type motor geared 14 to 1 and only made 6.6 miles per gallon. Mr. Fergusson concluded by asking why the eight is not used for trucks since economy is so much to be desired.

A. L. Clayden, engineering editor of THE AUTOMOBILE, pointed out that Mr. Fergusson was not quite correct as to gear ratios. He said that the small French and British engines are now geared between 3.5 and 3.7 to 1 and even so low as the 4 to 1, but never 5 to 1, used on American cars. "Driving with these cars," he said, "is of the same effect as driving on the third and not the fourth speed of the European car, but the European car does a large proportion of its running on its lower speeds, whereas the American car runs on the high gear practically all the time, which influences the average motor speed."

D. McCall White, engineer of the Cadillac company, said, "We are all engineers and if we work with principles which cannot go wrong we will be sure to obtain the proper results. In the Cadillac eight-cylinder engine, we have a speed range of from 100 to 3,400 r.p.m. I would like to answer the question as to what is a high-speed engine and believe this is answered by referring to the comparative standard speeds. I have attained 4,000 r.p.m. with an L-head type of motor.

"Although our car, Cadillac eight, has shown good power, we have not gone after power, the primary attention being placed upon evenness of torque and smoothness."

Mr. White remarked that increasing the number of cylinders increases the wall area and the small four should be developed. An eight must be of the highest type of construction to be a success. In manufacture great attention must be given to minute details, and hence the eight to be correct is expensive to manufacture. He expressed himself as deprecating the rush towards cheaper eights and also stated that the maximum efficiency was not to be secured from the six or twelve. As regards quietness, he said that this quality would be best found in the L-head motor.

F. E. Moscovics referred to Mr. Brush's paper, asking regarding the horizontal vibrating stresses as mentioned in the paper where the author states:

"In this connection it has been interesting to observe that a properly constructed chassis seems much better able to absorb this horizontal vibratory tendency than the vertical vibratory tendency of the vertical four."

He stated that he believed the horizontal stresses to be the most difficult to handle because in the vertical they can be absorbed by the front springs.

Mr. Clayden added that much could be determined by locating the center of gravity and then laying out the points of support of the motor.

William Stout, engineer of the Scripps-Booth Company, remarked that Newton's law, which states that the area of surfaces increases with two dimensions and the volumes or weights with three, could be applied throughout the entire chassis design. A 6-inch piston, he cited, "will weigh a certain amount, while a 3-inch piston will only weigh 1-8 of that. This law applies throughout the whole question of design in laying out a chassis."

Howard Coffin, engineer of the Hudson company, said: "One of my jobs around the Hudson plant is to sit upon the theoretical lid. As one man says, an engineer is all right so long as he does not get into the way of the production and sales departments. The company will vote thousands of dollars for expensive sales campaigns and when the experimental department timidly asks for a few hundred dollars more from the annual appropriation there is immediately a clamor protesting against the wasteful expenditure. The public, however, will not be long misled. Some of the large concerns who advertised themselves as being against the recent developments in motors have reversed themselves completely. Why the eight came is common knowledge.

Multi-Cylinder Work Requires Care

"Behind the cylinder question there are several fundamentals to be taken into consideration. Does a concern expect to charge the public for the work on the multi-cylinder car or give the best value for the money?"

Mr. Coffin then went on to mention how certain exhibits at recent shows were so hurriedly put together that the pistons were not even in the cylinders. He then cited an article which recently appeared in THE AUTOMOBILE, where it was stated that the question is not so much how many cylinders as what should be the size of the individual cylinder. He stated it as his belief that the best size per cylinder would be from 45 to 50 cubic inches. From this premise he drew the conclusion that if the piston displacement of the motor were 300 cubic inches or greater it would be better to break it up into a larger number of cylinders. "But we believe that if the piston displacement is less than 300 cubic inches it should not be broken up into more than six cylinders. Mr. White spoke a true word when he deprecated the building of the cheap eight. We believe, however, that the Cadillac eight is carefully made. Some one must pay for the carelessly assembled cars, and it is sure to be the consumer. The Hudson company has built everything up to a twelve and all performed well and each had individualities of its own. So would the repair bills and upkeep expense of each have an individuality of its own.

"The manufacturer must decide the class of people to whom he wishes to cater and must also consider the cost of maintenance. I think Mr. Brush's 2.5-inch limit is too small, as this would only have a 20 or 25 inch piston displacement per cylinder and therefore could not be economical.

Do Not Be Stampeded

"I simply want to go on record with a warning not to be stampeded by the action of individual engineers. The consumers or prospective consumers have not asked us for the eight-cylinder engine. They would have thought you crazy if you had suggested a year ago that you could supply them with such a power plant for practical use. All this development has been cooked up within our own ranks. There has been no outside demand. You have heard a great many statements regarding the advantages of more than six cylinders as compared to fewer cylinders, but the real result will be that the motors with four and six cylinders will be perfected. The six will be made to perform as well as the eight or twelve. Whenever you say 3,000 r.p.m. is not practical on the six it is merely because we have not learned to build six-cylinder crankshafts. It was the advent of the six that caused so many of the improvements in the four."

Mr. Coffin then remarked that statements have been made that with high-speed engines of equal piston displacement vibration is avoided in the eight and twelve. "I think," he continued, "that if large engines are to be built, because of the weight of reciprocating parts, the bore will have to be limited due to the vibrations set up. Below 3.5 inches this does not hold. It is with these practical limitations that we as engineers, who must market the cars and secure the maximum results, are concerned."

Howard Marmon, of the Marmon company, believed the higher bore limit could be 4 inches without difficulty, stating as a near example the six-cylinder 3.75 by 4 inches as what he considered good practice.

"Regarding the motors with a greater number of cylinders," said Mr. Marmon, "after going at any speed the purchaser will not know if the motor is a six, eight or twelve. Muffler vibrations are set up even in a six and this is one of the difficulties which may confront the twelve.

"The valve-in-head motor is easier to cool than the L-head or the T-head—the valve location gives a smoother flow to the inlet gases. Our experience also teaches us that the cross vibrations are more pronounced with the eight than they are with the four."

George Dunham, consulting engineer, said: "Mr. White has upset my calculations on what is the right car. I believe that the best car is the one from which the ultimate consumer will secure the best results. The things which sell a car are, first, appearance which attracts the interest of the intending purchaser and, second, performance which makes him decide. Assuming this contention, the motor which gives the best performance would be the best. This condition will react back to fewer cylinder cars. We are apt to think of the four as a heavy motor which is larger and is troubled by vibration. Progress has been made during the last few months due to the multi-cylinder motors, and on these the greatest argument in their favor is the greater number of impulses or, in other words, smoother torque. Smoothness of operation resolves itself down to a question of impulses per unit of travel."

Packard Favors 35 to 40 Inches

Russell Huff, consulting engineer of the Packard company, asked: Why are we all studying the multi-cylinder type of engine and discussing its merits? Asking myself this, it came to me that the problem should be studied by first making the car and then studying its performance. Packard has studied cars for fast cross-country running. We cannot make that type of car under 4,500 pounds even with the best of materials and with this weight a good-sized motor must be used. We have come to the conclusion that 35 to 40 cubic inches piston displacement to a cylinder is the most practical limit. You need 410 to 425 cubic inches to handle the type of car that I have described.

"The public has demanded smoothness. People do not like to shift gears, and this has driven us to study the multi-cylinder type and we have learned many things. The question of reducing the weights of the reciprocating parts should be given great attention. By using a light-weight piston we have made a big cut in the weight on this new Packard twelve and in the connecting rods a similar reduction has taken place. This has enabled us to make vibration practically nothing, while on the six cylinder car at certain speeds there is a vibration. We are now using gear reductions of 4.375 to 1 for fairly level country and 4.75 to 1 for more hilly country and with the new type of car find that we can get 99 per cent. travel without gear chugging.

"The valve weight with the new design has been cut from 15.5 to 9.5 ounces and it is our experience that the twelve runs much cooler than the four or six and hence the valve trouble is cut down. Therefore, there will be small necessity for grinding the valves.

"Another feature is the great increase in horsepower output, allowing us to dispense with more models and with this single model do the work of the larger designs. The twin-six performs better than our 48. The magnalium pistons reduce friction, there is better cooling and less power loss, giving better economy than the 38, which is a smaller six. This refutes Mr. Fergusson's statement on the efficiency. The twelve is the easiest motor ever built for carburetion."

Give your car this luxurious look

Write for this catalog

Every dealer, every car owner should get a copy of our new catalog, describing and illustrating many other accessories, all sold under the Campbell guarantee. We have an especially attractive proposition for progressive dealers.

With every efficient mechanical accessory included as regular equipment on the car, the eyes of the automobile world are turned toward greater luxury.

Luxury—with all the added beauty, comfort and pride of ownership that go with it—is the aim of every motorist.

Campbell Detachable Upholstery gives you this luxury in a way no other single accessory can. It transforms the interior of your car into a drawingroom. It is the last word in refinement.

Campbell Detachable Upholstery goes on over your regular upholstery, and is held in place by special snap fastenings, so that it can be instantly removed for cleaning.

It can be obtained for all standard makes and models of cars in a wide range of fabrics and shades at surprisingly moderate prices. Every set is custom tailored to a permanent glove-fit. Its durability is greater than that of cheap leather coverings. See that you get it on your new car or, better still, put it on your old car and make it look like new.

Write today for samples and prices

of Campbell Detachable Upholstery. Whether you are a manufacturer, a dealer or an owner, you owe it to yourself to investigate this accessory. Write today to

The Perkins Campbell Co.
633 Broadway, Cincinnati, O.
New York Office, 89 Chambers St.

CAMPBELL

The name Campbell on the fastenings guarantees the genuineness of Campbell Detachable Upholstery. Look for it.

CAMPBELL GUARANTEED MOTOR CAR ACCESSORIES

— 1916 —
CROW ELK-HART

"Made to Make Good" **$725** Fully Equipped

Startling Announcement

New Model CE-30

More Car—Lighter Weight—Greater Power

The 1916 CROW ELK-HART contains all the high-grade features of our previous thirty-five horsepower model—our famous E-45 which sold for $1150. But the price is $425 less. It has the same style streamline body, the same high-grade blue-black finish, more horsepower per pound with efficient long five-inch stroke motor—but **this car weighs 650 pounds less.** Increased production and greater factory efficiency make this wonderful motor-car value possible.

In detail finish, mechanical fineness, comforts and conveniences this 1916 CROW ELK-HART gives you **ALL** there was in our highest-priced models—**And it sells for but $725, completely equipped.**

SPECIFICATIONS:

Wheelbase, 112 inches.
Motor, 3½"x5".
FULL Floating Rear Axle.
Improved Multiple Disc Clutch.
Full 5-passenger Body.
Latest Streamline Design.
Oval-Shaped Radiator.
Underslung Three-Quarter Elliptic Springs on Rear.
Left-Hand Drive; Center Control.
Built-In Double Ventilating Rain-Vision Windshield.
Instrument Board on Cowl Dash.
Thermo-Syphon Cooling.
Headlight Dimmers.
Stewart Speedometer.
32" Wheels—Demountable Rims.
Disco Starter and Lighting System.

And **Note the Weight—1950 Pounds**

The Triumph of our Seven Years in Motor-Car Building!
Get our Proposition Quick!

Dealers!

Don't judge this car by its price. Investigate for yourself. Write or wire NOW for our proposition.

More than 200 dealers are selling the CROW ELK-HART.

With this car you can get your share of the 1916 business.

CROW MOTOR CAR CO. 1500 NO. MAIN ST. **Elkhart, Ind.**

ONE WEEK BOOK

RETURN TO→ CIRCULATION DEPARTMENT
202 Main Library 642-3403

LOAN PERIOD 1 | 2 | 3
4 | 5 | 6

LIBRARY USE

This book is due before closing time on the last date stamped below

DUE AS STAMPED BELOW

REC. CIR. DEC 1 1978

UNIVERSITY OF CALIFORNIA, BERKELEY
BERKELEY, CA

Google

YE 16807

LIBRARY USE
RETURN TO DESK FROM WHICH BORROWED
LOAN DEPT.
THIS BOOK IS DUE BEFORE CLOSING TIM
ON LAST DATE STAMPED BELOW

LIBRARY USE
OCT 30 1963

REC'D LD
OCT 30'63 -2 PM

LIBRARY USE FEB 16 1975 9 9

REC. CIR. FEB 1 5 '75

LIBRARY USE OCT 26 '77

REC. CIR. OCT 26 '77

LD 62A-20m-9,'68
(E709s10)9412A

General Library
University of California
Berkeley